MEETING NOTICE AND AGENDA

JOINT WORKSHOP OF THE REGIONAL PLANNING TECHNICAL WORKING GROUP (TWG) AND THE CITIES/COUNTY TRANSPORTATION ADVISORY COMMITTEE (CTAC)

The TWG and CTAC may take action on any item appearing on this agenda.

Thursday, May 9, 2013
12:30 to 3 p.m.

SANDAG, Conference Room 7
401 B Street, Suite 800
San Diego, CA 92101-4231

Staff Contacts: TWG     CTAC
Carolina Gregor       Alex Estrella
(619) 699-1989       (619) 699-1928
carolina.gregor@sandag.org alex.estrella@sandag.org

*PLEASE RSVP TO SANDAG STAFF*

WORKSHOP HIGHLIGHTS

- BRAINSTORMING SESSION ON ALTERNATIVE LAND USE AND TRANSPORTATION SCENARIOS TO FURTHER REDUCE GREENHOUSE GAS EMISSIONS

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In compliance with the Americans with Disabilities Act (ADA), SANDAG will accommodate persons who require assistance in order to participate in SANDAG meetings. If such assistance is required, please contact SANDAG at (619) 699-1900 at least 72 hours in advance of the meeting.

To request this document or related reports in an alternative format, please call (619) 699-1900, (619) 699-1904 (TTY), or fax (619) 699-1905.
A. WELCOME AND INTRODUCTIONS

The Regional Planning Technical Working Group (TWG) and the Cities/County Transportation Advisory Committee (CTAC) members should conduct self-introductions.

B. PUBLIC COMMENTS AND COMMUNICATIONS

Members of the public shall have the opportunity to address TWG and CTAC on any issue within the jurisdiction of SANDAG that is not on this agenda. Anyone desiring to speak shall reserve time by completing a “Request to Speak” form and giving it to the staff coordinators prior to speaking. Public speakers should notify the coordinators if they have a handout for distribution to working group members. Public speakers are limited to three minutes or less per person.

WORKSHOP

+C. BRAINSTORMING SESSION ON ALTERNATIVE LAND USE AND TRANSPORTATION SCENARIOS TO FURTHER REDUCE GREENHOUSE GAS EMISSIONS

1. Project Background and Performance Indicators (Carolina Gregor and Clint Daniels)

As part of the 2050 Regional Transportation Plan and Sustainable Communities Strategy (2050 RTP/SCS) adopted in 2011, the SANDAG Board of Directors committed to preparing alternative land use and transportation scenarios to explore a range of options that could further reduce greenhouse gas (GHG) emissions. The scenarios will help inform various components of San Diego Forward: The Regional Plan. The TWG and CTAC are serving as the primary working groups providing input to the Regional Planning and Transportation Committees on this effort. Staff will provide background information on the scenario planning effort and describe the UrbanFootprint performance indicators.

2. Break-Out Discussions (TWG and CTAC Members)

TWG and CTAC members will break out into small groups to begin brainstorming on the range of land use and transportation scenarios that could help further reduce GHG emissions. Initial scenario planning efforts will focus primarily on land use assumptions, and input on transportation, parking, pricing, and emerging technologies will be sought. A draft “menu of options” will be provided at the workshop to help guide the break-out discussions.
3. **Tables Report back to the Group (Table Leaders/Facilitators)**

A leader or facilitator from each table will report their table’s results back to the larger group. Each facilitator should limit their reporting time to five minutes.

4. **Brief Comparison of Ideas Generated from Each Table to Lessons Learned from Other Regions (Jamey Dempster, Cambridge Systematics)**

The consultant team will listen to the ideas generated from each table and comment on the proposed concepts in comparison to efforts undertaken in other regions across the state and the nation. (Attached as background information is a Lessons Learned report prepared by the consultant team.)

5. **Group Discussion (All)**

TWG and CTAC members will participate in a group discussion to refine proposed ideas and organize the proposed concepts into a continuum of alternative approaches.

6. **Next Steps (Carolina Gregor)**

Next steps include writing a report summarizing the TWG and CTAC’s initial scenario ideas, presenting the ideas to the SANDAG policy advisory committees and Board of Directors, soliciting input from stakeholders, and asking the public for their thoughts at the San Diego Forward workshops. Refined concepts would then be presented in July to the SANDAG Policy Committees and Board of Directors for guidance on which land use scenarios should be tested in Urban Footprint over the summer and into the fall. In the fall, TWG and CTAC will be asked to provide additional input on transportation, parking and pricing assumptions, and emerging technologies. The highest-performing land use scenarios would then be tested using the full suite of SANDAG modeling tools with variations to the transportation network, parking and pricing assumptions, and emerging technologies.

D. **ADJOURNMENT OF THE JOINT CTAC/TWG WORKSHOP AND NEXT INFORMATION MEETINGS**

The next CTAC meeting will be held on Thursday, June 6, 2013. The next TWG meeting will be held on Thursday, June 13, 2013.

+ next to an agenda item indicates an attachment
Memorandum

TO: Carolina Gregor, SANDAG
FROM: Cambridge Systematics, Inc.
DATE: May 2, 2013
RE: Scenario Planning Lessons Learned

Cambridge Systematics (CS) is assisting San Diego Association of Governments (SANDAG) as it explores land use and transportation scenarios for San Diego Forward: the Regional Plan. SANDAG will use the scenarios to identify strategies that could reduce the region’s greenhouse gas (GHG) emissions beyond those projected in the 2050 Regional Transportation Plan and Sustainable Communities Strategy (RTP/SCS). In particular the scenario results will inform:

- the Sustainable Communities Strategy land use pattern;
- the transportation network scenarios;
- the land use, transportation, parking, and roadway pricing policies; and
- assist with the GHG target-setting process.

CS reviewed results and lessons learned from a subset of other regions that have used scenario planning to inform regional transportation planning efforts. In particular, we sought out organizations that have developed scenarios that will meet regional performance measure targets. This memorandum summarizes the information, with a focus on the following topics:

- how the organizations developed the scenarios;
- how the agencies evaluated GHG emissions and other performance measures; and
- how the agencies tied their scenario planning activities to the overall regional transportation planning process.

Federal Highway Administration Guidelines

The Federal Highway Administration’s (FHWA) Transportation for Communities: Advancing Projects Through Partnerships (TCAPP) program\(^1\) provides resources for scenario planning and evaluation. The resources apply to both visioning exercises leading to long-range plan goals,

and development of strategies to achieve those goals. The guidelines presented on this website and in related documents serve as a useful reminder of the scenario development process, which may help SANDAG guide the process. The FHWA stresses that scenario planning processes are not necessarily consecutive, and that organizations often return to earlier phases to incorporate new data, targets, and refine procedures.

The FHWA report outlines eight key scenario planning phases:

1. Scope the effort and engage partners;
2. Establish a baseline analysis. Identify factors and trends that affect the state, region, community, or study area;
3. Establish goals and aspirations based on values of the state, region, community, or study area;
4. Set financial assumptions;
5. Develop strategies;
6. Create alternative scenarios;
7. Assess scenario impacts, influences, and effects; and
8. Select a preferred scenario. Craft the comprehensive vision, identify strategic actions.

The guidelines are related to the scenario planning framework developed under the Strategic Highway Research Program (SHRP), and in particular the Transportation for Communities: Advancing Projects Through Partnerships (TCAPP) program. The SHRP includes a report on integrating GHG emissions data and performance measures into the scenario planning process (SHRP 2 Project C09). The recommendations highlight specific points in TCAPP framework where GHG targets and analysis are most relevant in the decision-making process, and outline the types of data and analysis required for each step. SANDAG’s previous efforts are similar to the guidelines presented in the report.

Regional Scenario Planning Efforts for Meeting Environmental Targets

Through research of public documents and direct experience, Cambridge Systematics examined scenario planning activities at several organizations. The planning efforts described below are intended to inform the SANDAG scenario planning process and tailor the planning scenarios to identify strategies specifically related to reducing GHG emissions. Table 1 illustrates the types of planning tools and methods the selected organizations used to develop and evaluate land use and transportation scenarios. The key elements are explained by the following definitions.

- GHG target: Indicates whether the scenario evaluation included a performance measure for GHG emissions, and if the organization intended to meet a regional GHG emissions target.
- Scenario tool: indicates if the scenario development and evaluation process included the use of a software-based land use visioning tool or model.
Table 1. Key elements of scenario planning steps for select regions

<table>
<thead>
<tr>
<th>Region</th>
<th>GHG target</th>
<th>Scenario tool</th>
<th>Travel model(^2)</th>
<th>Iterative</th>
<th>Transportation</th>
<th>SE forecast</th>
<th>Land use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern California</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Bay Area</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Sacramento</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>Denver</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Washington DC Regional Plan</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Washington DC Transportatio n Analysis</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>North Texas</td>
<td></td>
<td>✓</td>
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<td>✓</td>
<td></td>
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<td>✓</td>
</tr>
<tr>
<td>Salt Lake City</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
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<tr>
<td>San Diego Foundation</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

- **Travel model**: indicates if the scenario development and evaluation process included the use of a regional travel demand model.

- **Iterative**: indicates if planners developed scenarios by adding elements in discrete phases, in order to identify which changes were most relevant to achieving targets, or to creating scenarios that would best illustrate key issues. This was typically done internally.

- **Transportation**: indicates if planners changed the transportation network or service levels to create a scenario.

- **Socio-economic (SE) forecast**: indicates if planners adjusted the overall regional population and employment totals between scenarios. Typically, regional growth is used as a “control total” at some geographic scale.

- **Land use**: indicates if the geographic allocation of land uses (population, employment and resulting development densities) changed between the scenarios.

\(^2\) Land use models in these examples include assumptions regarding travel behavior that can be modified by the user to change development suitability. Examples include mode share, travel pricing schemes, and vehicle operating cost.
Southern California Association of Governments

The Southern California Association of Governments (SCAG) evaluated four land use and transportation scenarios for its RTP/SCS. SCAG developed a sketch planning tool using a geographic information system (GIS), which allowed users to simultaneously create and analyze land use scenarios. Planners at SCAG and local municipalities created and compared a variety of land use scenarios. The key input was the geographic distribution of growth, including development type, and development density. The tool provided outputs such as developed land area, vehicle miles traveled by mode, and GHG emissions from transportation and land development.

Each scenario assumed the same population, housing, and jobs forecasts in each traffic analysis zone (TAZ), and planners allocated new growth within those zones. All scenarios included a $0.02 vehicle miles traveled (VMT) charge, and started with the cost-constrained transportation network. The first scenario represented a business-as-usual approach that included land use policies from adopted General Plans and a continuation of existing trends (for time periods beyond the General Plan horizon years). The three successive scenarios included varying levels of increased development density near targeted development areas near transit, more transit service, transportation operations improvements (reducing bottlenecks, transportation demand management, etc.), and more non-motorized transportation facilities. Some scenarios included pricing strategies such as cordon pricing, expanded high occupancy toll (HOT) lane network. SCAG scenarios met the future SB-375 GHG emissions targets. Table 2 presents key elements of the SCAG scenario evaluation process.

Table 2. Summary of SCAG scenarios

<table>
<thead>
<tr>
<th>Scenario planning element</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of scenarios</td>
<td>4</td>
</tr>
<tr>
<td>Names of scenarios</td>
<td>Scenarios 1 through 4</td>
</tr>
<tr>
<td>Land Use forecasts</td>
<td>Constant at regional and TAZ level</td>
</tr>
<tr>
<td>Focused development</td>
<td>High quality transit areas, growth areas; other areas assume no growth</td>
</tr>
<tr>
<td>Innovative transportation strategies</td>
<td>Cordon Pricing, HOT network, VMT fee</td>
</tr>
<tr>
<td>GHG target</td>
<td>Yes, achieved</td>
</tr>
</tbody>
</table>
**Metropolitan Transportation Commission and Association of Bay Area Governments - Plan Bay Area**

The Metropolitan Transportation Commission (MTC) and the Association of Bay Area Governments (ABAG) used land use and transportation scenarios for their RTP/SCS to illustrate future growth patterns and performance across a range of social, economic and environmental measures. There were three iterations of the scenario planning process, including five scenarios each. The scenarios were adjusted iteratively by MTC and ABAG between the phases to ensure that the scenarios would reflect participants’ needs, and meet regional performance measure targets.

In the second and third phases, one scenario included a change in the regional control totals for population and employment. The other scenarios used a constant regional population and employment totals. The scenarios differed by the geographic distribution of development, with some scenarios more or less focused on Priority Development Areas (PDA), Growth Opportunity Areas (GOA), and Transit Priority Project (TPP) areas. Each scenario had a different set of transportation investments, the estimated cost of which was controlled for all scenarios based on available discretionary funds.

Table 3 presents key elements of the MTC scenario planning process. Table 4 illustrates the elements of each scenario in the third evaluation phase. ABAG created the land use scenarios first using a variety of sketch planning tools in the first two evaluation phases. In the third phase, ABAG used the land use model UrbanSim, which incorporates detailed functions related to market feasibility and other constraints. Once finished, MTC would pair the land use scenario with one of two transportation scenarios, and ensure that the transportation network supported the PDAs and GOAs targeted for future development.

### Table 3. Summary of MTC scenarios

<table>
<thead>
<tr>
<th>Scenario planning element</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of scenarios</td>
<td>15 in three phases</td>
</tr>
</tbody>
</table>
| Names of scenarios (EIR phase) | 1. No Project  
2. Jobs Housing Connection  
3. Transit Priority  
4. Enhanced Network of Communities (Business group lead)  
5. Environment, Equity and Jobs (Environment group lead) |
| Land use forecasts          | Constant in 4 scenarios for population, housing, jobs  
Scenario 4 added in-commute households to regional total;  
Share of job types not constant by subregion |
| Focused land development    | Priority Development Areas and Growth Opportunity Areas receive greatest growth in scenarios 3, 5. |
| Innovative transportation strategies | Three scenarios w/ higher Bay Bridge toll; VMT tax |
| GHG target                  | Yes, achieved                                                          |

3 Includes initial visioning, Draft RTP/SCS scenarios, and Draft environmental impact report scenarios. The RTP/SCS process also included a project-level performance measure evaluation that informed the selection of individual projects in the RTP.
The Bay Area initiated the Regional Prosperity Plan in 2012, supported by a grant from the US Department of Housing and Urban Development’s Sustainable Communities Partnership grant program. The Regional Prosperity plan results will build on Plan Bay Area, and inform future RTP/SCS efforts. The outreach process is expected to include land use scenario evaluation to inform regional visioning exercises. The Regional Prosperity Plan will include local-area plans to envision the neighborhood effects of regional land use plans.

In earlier efforts, the Silicon Valley Community Foundation created the “Envision Bay Area” plan. Their work informed the Plan Bay Area efforts. The Foundation worked with a consultant team to manage proprietary modeling tools that created regional scenarios to represent and illustrate the consequences of different growth patterns. The scenarios explored how variations in jobs-housing balance, development patterns, and transportation investments impacted land consumption, energy, water use, greenhouse gas emissions, fiscal impacts, and household costs.
Table 4. Specific elements of the MTC environmental impact report scenarios

<table>
<thead>
<tr>
<th>Zoning</th>
<th>Alt 1 No Project</th>
<th>Alt 2 Proposed Plan</th>
<th>Alt 3 Transit Priority</th>
<th>Alt 4 Enhanced Net</th>
<th>Alt 5 Env Equity Jobs</th>
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<td>Existing general plans</td>
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<tr>
<td>PDA-focused growth</td>
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<tr>
<td>TPP-focused growth</td>
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<td></td>
<td>✓</td>
</tr>
<tr>
<td>Growth Boundaries</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current trends continue</td>
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<td>Strict boundaries</td>
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<td>Fees and subsidies</td>
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</tr>
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<td>No new fees</td>
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<td>Subsidies for PDA growth</td>
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<td>✓</td>
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<tr>
<td>Subsidies for urban core</td>
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<td></td>
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<tr>
<td>Subsidies for PDA/TPP opp. Areas</td>
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<td></td>
<td></td>
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<tr>
<td>Fee on high VMT areas</td>
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<td>Incentives</td>
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<td>Committed projects only</td>
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<td></td>
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<tr>
<td>Preferred</td>
<td></td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Preferred w/ reduced express lanes</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
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<tr>
<td>Preferred w/o highway expansion or operations projects</td>
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<td>✓</td>
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<tr>
<td>Transit network</td>
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<tr>
<td>Committed projects only</td>
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<tr>
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<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
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<tr>
<td>Increased funding for BART, AC Transit</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Increased funding for all but BART, Muni, Caltrain</td>
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<td>✓</td>
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<tr>
<td>Road pricing</td>
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<td>None</td>
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<tr>
<td>Higher peak toll on Bay Bridge</td>
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<td>VMT tax</td>
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<td>Status quo</td>
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<tr>
<td>Reduced minimums</td>
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<td>✓</td>
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</table>

Sacramento Area Council of Governments – Regional Transportation Plan

The Sacramento Area Council of Governments (SACOG) created and evaluated three transportation and land use scenarios as part of the planning process for the Sacramento Region’s Metropolitan Transportation Plan (MTP)/SCS. SACOG evaluated each scenario using a range of performance measures and presented the findings to participants in discussions of the trade-offs in regional policy and investment. The discussions informed work by SACOG planners to create a preferred scenario.

Each scenario used the same overall regional growth projections and financially constrained transportation budget that restricted the modeled transportation investments. The land use projections included variations of land development types and densities, and transportation investments that SACOG expected to realistically occur over the MTP/SCS planning period. The scenarios included one with high-density development and supporting transit investments, a more geographically dispersed scenario reliant on automobile travel, and a hybrid scenario of the two. Targeted development areas included Transit Priority Areas (TPAs), which are areas near high-frequency transit service. According to planning documents, additional scenarios were evaluated internally to ensure the modeling results met GHG emissions targets. The preferred SACOG scenario met the region’s GHG target.

Table 5 presents key elements of SACOG’s scenario planning process. Table 6 presents additional detail about the transportation and land use assumptions for the three scenarios.

Table 5. Summary of SACOG scenarios

<table>
<thead>
<tr>
<th>Scenario planning element</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of scenarios</td>
<td>3</td>
</tr>
<tr>
<td>Names of scenarios</td>
<td>Scenarios 1-3</td>
</tr>
<tr>
<td>Land use forecasts</td>
<td>Constant for population, housing, jobs</td>
</tr>
</tbody>
</table>
| Focused land development  | Focus development in Transit Priority Areas  
                           | Vary by development density, housing type, and mix of uses |
| Innovative transportation strategies | Combine roadway pricing with transit and transportation demand management strategies |
| GHG target                | Yes, achieved |
### Table 6. Specific elements of SACOG planning scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Land Use</th>
<th>Transportation</th>
</tr>
</thead>
</table>
| **Scenario 1** | • Smallest share of new compact housing\(^1\) (61%, same as 2008 MTP)  
• Smallest share of growth in Transit Priority Areas\(^2\) (20% of new homes, 26% of new jobs)  
• Most dispersed development pattern/highest amount of developed acres | • Least amount of transit service, mostly in the form of shuttles, commuter bus, fixed route bus  
• Least amount of bus rapid transit (BRT), streetcar and light rail transit (LRT)  
• Highest amount of new roads and road expansions  
• Least amount of road maintenance and rehabilitation  
• Least amount of bicycle and pedestrian street and trail projects |
| **Scenario 2** | • Higher share of new compact housing\(^1\) (68%, as Blueprint)  
• More growth in TPAs\(^2\)  
• Less dispersed development pattern than Scenario\(^1\)/ fewer developed acres | • More transit service than Scenario\(^1\)  
• More BRT, streetcar, and LRT than Scenario\(^1\)  
• Less new road capacity and road expansion than Scenario\(^1\)  
• More road maintenance and rehabilitation than Scenario\(^1\)  
• More bicycle and pedestrian street and trail projects |
| **Scenario 3** | • Highest share of new compact housing\(^1\) (75%)  
• Highest share of growth in TPAs\(^2\)  
• Least dispersed development pattern/fewest developed acres | • Highest amount of transit service  
• Highest amount of BRT, streetcar and rail  
• Least amount of new roads and road expansions  
• Same road maintenance and rehabilitation as Scenario\(^2\)  
• Most bicycle and pedestrian street and trail projects |

\(^1\) Compact housing is defined as small-lot single-family (8 to 25 dwelling units per acre) and attached residential (attached single-family or multifamily homes ranging from duplexes, triplexes, lofts, apartments, condominiums, townhomes, row houses, halfplexes, etc., built at densities from eight to over 50 dwelling units per acre.)

\(^2\) Transit Priority Areas (TPAs) are defined as areas within one-half mile of a rail station stop or a high-quality transit corridor. A high-quality transit corridor has fixed-route bus service with service intervals of 15 minutes or less during peak commute hours.

The Denver Regional Council of Governments (DRCOG) is currently updating Metro Vision, the regional long-range transportation plan. Initial outreach materials suggested that exploratory scenarios will compliment the planning process by providing iteratively developed scenarios to illustrate environmental and transportation performance results. DRCOG expects to use UrbanSim, a software-based land use and transportation simulation model, to test how land uses will change given assumptions about development and travel costs. The UrbanSim results will also be used to inform the regional travel model analysis.

The previous regional transportation plan, Metro Vision 2035, included an evaluation of seven scenarios. DRCOG created three scenarios using the same land use assumptions, combined with bundles of transportation investments that iteratively add transit and pricing elements. The three other build scenarios use a dispersed land use pattern and vary by incrementally adding road and highway miles. DRCOG evaluated the scenarios using 12 performance measures related to developed area and open spaces, and transportation measures such as congestion and vehicle hours traveled. Scenario F, which combined compact development with increased transit service and roadway pricing, was selected as the preferred scenario based on its overall performance in the evaluation. This scenario resulted in reduced congestion, less driving, and reduced air pollution. DRCOG used the computer-assisted sketch planning tool MetroQuest to create and analyze scenarios during public workshops.

DRCOG is participating in the Sustainable Communities Initiative (SCI), a federally-funded consortium of cities, counties, state agencies, housing authorities, nonprofits, corporate interests, and philanthropic and academic organizations. The SCI will support Metro Vision 2040 and enhance the scenario planning effort.

Table 7 summarizes key elements of the DRCOG scenario planning process. Table 8 provides additional detail on the scenario building process.

**Table 7. Summary of DRCOG Metro Vision 2035 scenarios**

<table>
<thead>
<tr>
<th>Scenario planning element</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of scenarios</td>
<td>6 build</td>
</tr>
<tr>
<td>Names of scenarios</td>
<td>Scenarios A-F*</td>
</tr>
<tr>
<td>Land use forecasts</td>
<td>Constant population, households, and employment</td>
</tr>
<tr>
<td>Focused land development</td>
<td>Scenarios A, E and F use same compact land use pattern, and iteratively change transportation. Scenarios B, C, and D use a dispersed land use pattern and iteratively expand roadways.</td>
</tr>
<tr>
<td>Innovative transportation</td>
<td>Double auto operating cost (e.g. gas price), and assume free transit</td>
</tr>
<tr>
<td>strategies</td>
<td>GHG target None</td>
</tr>
</tbody>
</table>

* Metro Vision 2020 used four scenarios named Dispersed, Compact, Corridor, and Satellite Development
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Expansion of UGB</th>
<th>Density increase</th>
<th>Change to fiscally constrained roadway network</th>
<th>Change to fiscally constrained transit network</th>
<th>Pricing Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>None</td>
<td>23%</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>B</td>
<td>+70 square miles</td>
<td>12%</td>
<td>+300 miles minor arterials and collectors</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>C</td>
<td>+150 square miles</td>
<td>0%</td>
<td>+600 miles minor arterials and collectors</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>D</td>
<td>+70 square miles</td>
<td>12%</td>
<td>+300 miles minor arterials and collectors</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>E</td>
<td>None</td>
<td>23%</td>
<td>-100 miles highway capacity</td>
<td>Additional rail and bus rapid transit</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>None</td>
<td>23%</td>
<td>-100 miles highway capacity</td>
<td>Additional rail and bus rapid transit</td>
<td>Transit free; auto op. cost doubled</td>
</tr>
</tbody>
</table>

Metropolitan Washington Council of Governments - Greater Washington 2050 (qualitative) and “What Would It Take” (quantitative) Scenarios

The Metropolitan Washington Council of Governments (MWCOG) led Greater Washington 2050, the region’s long range transportation plan (LRTP). For a series of public workshops, MWCOG created four very different qualitative land use and transportation scenarios. The scenarios represented “tectonic changes” in assumptions related to energy, global climate change, the economy, emerging technologies, demographics, and the federal funding. The scenarios were not modeled, but were developed through public outreach to reflect the broad range of assumptions forming people’s visions of what the future might look like. The COG designed the scenarios to help regional leaders break away from conventional scenario planning process, to explore together the wide range of future circumstances for the region.

For example, one scenario description in the Greater Washington 2050 plan was:

*High Tech Green Scenario:* Investments in green infrastructure help end the Great Recession [2008] and create new mid-skill Green Collar jobs. High tech developments come together in a Green Industrial Revolution with a flowering of new entrepreneurial businesses. Growth is clustered in a dozen transit-oriented Activity Centers with pedestrian-friendly, mixed use designs. However, positive sustainable growth brings its own set of challenges, such as declining exurban areas and the lack of affordable housing in Activity Centers.

Participants clarified their priorities for the region’s future during workshops, heard from experts on key trends, and identified strategies likely to help the region achieve its goals under a broad range of future conditions. While this long range plan did not include quantitative scenarios or detailed analytical evaluation, it did incorporate a range of ideas without constraining input to quantifiable forecasts or project types. Table 9 presents key elements of MWCOG’s scenario planning process.

Table 9. Summary of MWCOG Greater Washington 2050 scenarios

<table>
<thead>
<tr>
<th>Scenario planning element</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of scenarios</td>
<td>4 (qualitative, not modeled)</td>
</tr>
<tr>
<td>Names of scenarios</td>
<td>High Tech Green, Hot and Gridlocked, Federal Government Dispersal, Cooperation in Hard Times</td>
</tr>
<tr>
<td>Land use forecasts, land use development,</td>
<td>Not modeled; scenarios represent storylines about the future, illustrating different trends in demographics, industry mix, land use densities; Used to elicit public feedback on priorities, which helped them create goals, targets, ongoing performance measures</td>
</tr>
<tr>
<td>transportation strategies</td>
<td></td>
</tr>
<tr>
<td>GHG target</td>
<td>None</td>
</tr>
</tbody>
</table>
Another useful scenario planning approach is MWCOG’s “What Would it Take” scenario evaluation, conducted in 2010. In this study, MWCOG first evaluated individual transportation strategies relative to their ability to reduce GHG emissions. In the second phase, planners bundled the transportation strategies based on how they would be most logically implemented. For example, the High Federal Role bundle includes increased fuel efficiency standard, and higher gasoline prices; long-term regional actions included value pricing, higher-density land use, and rail expansion. The scenarios were iterative in that they ranged from least to most aggressive measures. Cumulative GHG emissions reductions were estimated by adding benefits calculated in the first phase of detailed analysis, but did not include “synergistic” effects of bundling, such as the analysis used in Moving Cooler, a national study of transportation strategies to reduce GHG emissions. Only the High Federal Role scenario met the 2030 GHG target. Table 10, below, presents key elements of the scenario evaluation related to transportation strategies.

Table 10. Summary of MWCOG What Would It Take scenarios

<table>
<thead>
<tr>
<th>Scenario planning element</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of scenarios</td>
<td>4</td>
</tr>
</tbody>
</table>
| Names of scenarios        | No Further Federal or Local Action  
High Federal Role  
Short Term Regional Actions  
Long-Term Regional Actions |
| Land use forecasts        | None   |
| Focused land development  | For Long-Term Regional Actions, tested emission reductions from transit oriented development |
| Innovative transportation  | Value pricing (HOT lanes on highways, parkways, in DC) combined with enhanced transit; Eco driving |
| strategies                |        |
| GHG target                | Yes, nearly achieved with High Federal Role (CAFE 55 mpg and double heavy duty vehicle CAFE by 2030; $7/gallon gasoline) |

---


5 Technically, the scenario did not meet the emissions target in 2030. It met the target just before 2030 and failed to increase benefits at the same rate as the target.
Vision North Texas – North Texas 2050

North Texas 2050 was a regional planning effort led by Vision North Texas (VNT), a partnership of private, public, and academic organizations representing 16 counties. North Central Texas Council of Governments (NCTCOG) used the scenarios VNT developed and evaluated to inform modeling scenarios in the regional transportation plan. VNT operates independently of NCTCOG’s regional transportation planning process, and offers recommendations for regional planning documents. Key VNT members include NCTCOG, Urban Land Institute, and the University of Texas at Arlington. Table 11 presents key elements of NTCOG’s scenario planning process.

NCTCOG held regional population and employment totals constant in all scenarios, and adjusted local area housing and job density.\(^6\) The scenarios used variations of roadway and transit networks proposed in the previous LRTP. For example, the “Connected Centers” scenario assumes greater densities of development at specific commercial and residential centers, and a greater amount of transit and walking/biking facilities and programs. Performance measures included delay, pavement needs, emissions, and transit ridership. The measures did not include targets, but were compared to a no-project scenario. The final Preferred Future scenario blended the scenario variations into a hybrid concept that illustrated the future residents and leaders wanted to see.

In addition to regional measures, the study included 20 case studies of what future proposed development densities and transportation would look like at the neighborhood level. Each case study varied in scope, but generally included visualizations of streetscape improvements and development density, as well as qualitative assessments of residential and economic activity.

Table 11. Summary of NTCOG North Texas 2050 scenarios

<table>
<thead>
<tr>
<th>Scenario planning element</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of scenarios</td>
<td>5</td>
</tr>
<tr>
<td>Names of scenarios</td>
<td>Business as Usual &lt;br&gt;Connected Centers &lt;br&gt;Return on Investment &lt;br&gt;Diverse, Distinct Communities &lt;br&gt;Green Region</td>
</tr>
<tr>
<td>Land use forecasts</td>
<td>Regional population, job totals constant; each scenario varies population and job allocations</td>
</tr>
<tr>
<td>Focused land development</td>
<td>Greatest growth near transit stations in Connected, and Distinct Communities</td>
</tr>
<tr>
<td>Innovative transportation strategies</td>
<td>2030 RTP roadway and transit network for all scenarios</td>
</tr>
<tr>
<td>GHG target</td>
<td>None</td>
</tr>
</tbody>
</table>

\(^6\) While NCTCOG’s future year planning horizon was 2030, they created a 2050 forecast for use in the North Texas 2050 study.
**Envision Utah – Wasatch Choice 2040**

Envision Utah has implemented some of the best-known examples of scenario planning for a metropolitan region. Envision Utah’s work includes the local and regional planning efforts such as Wasatch 2040, Downtown Rising (Salt Lake City), the Bear Lake Valley Blueprint, and Wasatch Canyons Tomorrow. It is a non-profit organization started in 1997 to develop a long-range plan, which resulted in the Quality Growth Strategy.

Scenarios for these projects have focused on mapping demographic, economic and environmental data, in order to collect residents’ preferences for future land use and transportation visions. Scenarios have been evaluated using land use planning software that let planners set travel assumptions by land use type, then allocate land use types to different areas of the region. The software output included performance measures such as land consumption, and vehicle miles. Participants used the information to compare scenarios, but did not compare to regional targets.

Staff from Wasatch Front Regional Council and Envision Utah met with municipal staff and elected officials from over 60 communities between 2007 and 2009 to discuss implementation of the Wasatch Choices 2040 Growth Principles. To date, sixteen cities incorporated the Growth Principles into their general plans or passed resolutions of support of the Growth Principles. Wasatch Choice 2040 is a regional plan started in 2004 as collaboration between the two MPOs in Utah. The effort is supported by a federal Sustainable Communities Initiative grant, which will inform the update to the regional plan. Table 12 presents key elements of the Envision Utah scenario planning process.

**Table 12. Summary of Envision Utah Wasatch Choice 2050 scenarios**

<table>
<thead>
<tr>
<th>Scenario planning element</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of scenarios</strong></td>
<td>4</td>
</tr>
<tr>
<td><strong>Names of scenarios</strong></td>
<td>A. Business as Usual</td>
</tr>
<tr>
<td></td>
<td>B. Transit Station Villages</td>
</tr>
<tr>
<td></td>
<td>C. Interconnected Network of Complete Streets</td>
</tr>
<tr>
<td></td>
<td>D. Centers of Employment</td>
</tr>
<tr>
<td><strong>Land use forecasts</strong></td>
<td>Regional population, jobs constant</td>
</tr>
<tr>
<td><strong>Focused land development</strong></td>
<td>Scenario B focused development on rail transit</td>
</tr>
<tr>
<td></td>
<td>Scenario C focused development on arterial roads</td>
</tr>
<tr>
<td></td>
<td>Scenario D focused employment in suburban centers</td>
</tr>
<tr>
<td><strong>Innovative transportation strategies</strong></td>
<td>Increase commuter and light rail area beyond current plans</td>
</tr>
<tr>
<td><strong>GHG target</strong></td>
<td>None</td>
</tr>
</tbody>
</table>
**San Diego Foundation – Greater San Diego Vision**

The Greater San Diego Vision scenario planning process started in 2011 and resulted in a vision statement and goals to guide future development in the San Diego region. The Foundation used scenario evaluation to educate the public and record feedback from a wide array of the public, using meetings, workshops, surveys and direct engagement with key organizations.

The Foundation used sketch planning software to facilitate the land use visioning exercises. The software let users vary assumptions about where development would be located, how intense the development was, and what types of uses were included. The software also let users adjust transportation assumptions for land use type, such as how much driving was expected from people living in townhomes, as opposed to large-lot single family homes. However, the underlying transportation network was constant for all scenarios. The Foundation did not create scenarios to test performance against regional targets.

The Foundation presented four scenarios reflecting different patterns and types of development in the region. Development constraints included slopes, flood zones, and parks. Development scenarios then varied by the share of new development in six types of housing, from rural to multi-family high rise buildings. Scenario A represented a business as usual scenario based on existing local land use plans. Scenarios B and C represented more compact development patterns that would lead to greater use of public transit and non-motorized trips (medium and high density), and preserved open spaces. Scenario D assumed mix of concentrated multi-family housing and less mid-range housing than the previous two scenarios.

The Foundation used the same regional control totals as the SANDAG Series 12 Regional Growth Forecast. However, they assumed that only 20 percent of areas identified for development in the 2050 RTP/SCS would be redeveloped. Table 13 presents key elements of the Foundation’s scenario planning process.

**Table 13. Summary of San Diego Foundation Greater San Diego Vision scenarios**

<table>
<thead>
<tr>
<th>Scenario planning element</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of scenarios</strong></td>
<td>4</td>
</tr>
<tr>
<td><strong>Names of scenarios</strong></td>
<td>Scenarios A-D</td>
</tr>
<tr>
<td><strong>Land use forecasts</strong></td>
<td>Modified Series 12 2050 Growth Forecast</td>
</tr>
<tr>
<td></td>
<td>Allocation of jobs and households by TAZ held constant</td>
</tr>
<tr>
<td><strong>Focused land development</strong></td>
<td>Iterative increase in multifamily buildings (compact development); 20% (vs. SANDAG’s 100%) redevelopment rate in SANDAG targeted development areas</td>
</tr>
<tr>
<td><strong>Innovative transportation strategies</strong></td>
<td>None; focused on housing development patterns</td>
</tr>
<tr>
<td><strong>GHG target</strong></td>
<td>None</td>
</tr>
</tbody>
</table>
Conclusions

The regional summaries highlight lessons learned from some larger scenario planning efforts in California and peer regions around the country. These scenario planning experiences point to five common themes that are often found in “successful” exploratory phases of scenario development and evaluation.

1. **Focused on new growth and explored redevelopment assumptions.** Technical evaluation of land use scenarios typically included first distributing forecasted new housing growth across the region, with some areas assumed to redevelop at higher densities. This approach also helps explore the consequences of more or less areas available for redevelopment.

2. **Adjusted transportation costs to explore trends in technology and pricing.** As with population and employment forecasts, transportation modeling is based on assumptions about the future transportation network, technology, and available resources. DRCOG, for example, modeled free transit fares in one scenario. MWCOG modeled increases in fuel efficiency and gasoline prices. Moving Cooler, a national study of transportation-based strategies to reduce GHG emissions, assumed fuel efficiency would be three-times higher, and even greater in some scenarios.

3. **Developed scenarios iteratively to isolate key elements or strategies.** Scenarios incorporating land use and transportation changes should strive to provide clear connections between specific scenario components (or variables) and regional performance measures. DRCOG scenarios E and F are one example, which when compared, isolated the effect of greater vehicle operating costs and reduced transit fares. Given limited resources, however, transportation and land use strategies can’t always be isolated. Organizations such as SACOG and MTC created scenarios that combined different land use allocations and transportation projects, such as increasing land use densities near transit and increasing transit service to these areas. MWCOG grouped transportation strategies based on how they would be implemented (e.g. requiring Federal action vs. local, short-term vs. long-term strategies). As much as possible, these organizations grouped scenario components in a way that linked key issues to strategies and solutions.

4. **Engaged stakeholder groups early in scenario development and evaluation.** In each of the examples above, public outreach and close working relationships with stakeholders were key to building broad support for the regional plan. MTC engaged economic development, environmental, and social equity advocates to participate in the scenario development process. Groups of experts from local organizations worked closely with MTC planners to create and evaluate two scenarios developed for the environmental impact report evaluation phase. MWCOG focused resources on soliciting public feedback and crafted stories about possible futures that were broadly compelling, and incorporated the concerns of a large number of stakeholders. They continued to engage the public in order to identify investment and policy strategies that were most closely related to the key issues, and to develop a focused, action-oriented plan.
5. **Assessed changes in total regional population, household, and employment forecasts to explore trends in growth.** Exploring changes in regional socioeconomic and demographic growth (a.k.a. “control totals”) helped identify issues that posed the greatest challenges to meeting regional targets. MTC used this approach in one scenario by increasing regional population and decreasing household size to test the effect of “housing” current in-commuters in the Bay Area. MWCOG developed broad, qualitative scenarios that informed public discussions about future changes in industrial make-up of the region, job skill level, household income, and climate change. This analysis informed the development of land use forecasts, helped develop processes to monitor key trends, and identified strategies and policies to address a range of possible futures.
Where could the region’s future growth be placed to reduce GHG emissions? What is the range of opportunities?

Series 13 Growth Forecast Projections:

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2050</th>
<th>% Annual change between 2010 &amp; 2050</th>
<th>% Total change between 2010 &amp; 2050</th>
<th>Numeric change between 2010 &amp; 2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>3,095,313</td>
<td>4,068,759</td>
<td>.7%</td>
<td>31%</td>
<td>973,446</td>
</tr>
<tr>
<td>Jobs</td>
<td>1,328,755</td>
<td>1,807,460</td>
<td>.8%</td>
<td>36%</td>
<td>478,705</td>
</tr>
<tr>
<td>Housing Units</td>
<td>1,158,076</td>
<td>1,491,189</td>
<td>.6%</td>
<td>29%</td>
<td>333,113</td>
</tr>
</tbody>
</table>

Existing Population, Jobs, & Housing within County Water Authority Service Area & Smart Growth Opportunity Areas

<table>
<thead>
<tr>
<th></th>
<th>CWA Boundary</th>
<th>SGOAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>96%</td>
<td>18%</td>
</tr>
<tr>
<td>Jobs</td>
<td>92%</td>
<td>37%</td>
</tr>
<tr>
<td>Housing Units</td>
<td>96%</td>
<td>21%</td>
</tr>
</tbody>
</table>
Objectives:
1. Test alternative land use, transportation, pricing, and parking scenarios to further reduce GHG emissions beyond those in the 2050 RTP/SCS.
2. Incorporate emerging technologies/travel behavior trends into the scenario process and determine the extent to which the model can capture the GHG emission reductions of the individual technologies and trends.

Basic Assumptions:
- Baseline:
  - Series 13 Regional Growth Forecast
  - 2050 RTP/SCS Revenue Constrained Network
- Projecting Historical Trends: “Pre-RCP” Scenario
  - Series 9 or 10 Regional Growth Forecast
  - 2050 RTP/SCS Revenue Constrained Network

Phases:
- Phase 1: Land Use
  - Develop 5-7 land use scenarios to test in UrbanFootprint over the summer
  - Test those land use scenarios with the 2050 RTP/SCS Revenue Constrained Transportation Network
  - Narrow the land use scenarios to the top 3-4 performing scenarios
- Phase 2: Transportation, Parking, Pricing and Emerging Technologies/Trends
  - This fall, test the top 3-4 land use scenarios with various transportation/parking/pricing bundles using SANDAG’s full suite of modeling tools (ABM/PECAS)
  - Identify emerging technologies/travel behavior trends
  - Test, as possible, the effects of emerging technologies/trends
- Phase 3: Policy Discussions
  - Develop an alternatives report describing the results of the scenarios and initiate policy discussions for potential incorporation into San Diego Forward: The Regional Plan

Indicators:
- Greenhouse Gas Emissions: Transportation (liquid fuel and electricity) emissions, building energy emissions
- Transportation: Vehicle miles traveled (VMT), travel mode (walk, bike, auto, transit), congestion, GHG and criteria pollutant emissions
- Land Consumption: New land consumed, agricultural, sensitive lands consumed
- Household Costs: Transportation (driving and related) costs, residential energy and water costs
- Building Energy Use: Residential energy use, commercial energy use, building-related carbon dioxide emissions

Key Discussion Questions:
- a) What land use patterns should we test to further reduce greenhouse gas emissions?
- b) What transportation, parking, and pricing scenarios should we test with the top-performing land use scenarios?
- c) What emerging technology ideas/travel behavior trends should be considered?
- d) What policy choices should we consider to achieve further greenhouse gas reductions and related benefits?

Instructions:
Each group should brainstorm and develop two land use scenarios that are significantly different from one another. These scenario ideas should be illustrated on the two Smart Growth Concept Map base maps. Groups can consider and make notes on transportation, parking, pricing, and emerging technology concepts related to each land use scenario, which would be further explored in Phase 2. Each group should select a facilitator to lead their discussions and report their land use scenario ideas back to the group. Also, groups should try to name their scenarios in a creative way.

How far should we stretch? What is the range of opportunities?
Menu of Ideas: Examples to Generate Discussion ....Be Creative!....

1. **LAND USE IDEAS**
   a. **Variations to Smart Growth Concept Map:**
      o Density variations in SGOAs (e.g., apply 25% increase over maximum densities for existing/planned place types and 10% increase over maximum densities for potential place types; other variations)
      o Intensification of jobs in SGOAs (e.g., apply 15% increase over maximums in Special Use Centers and Mixed Use Transit Corridors; other variations)
      o Future development in urban areas (e.g., no development in back-country beyond 2020 and all future development at highest density allowed in incorporated areas plus intensification of Urban/Town Centers)
      o Other
   b. **Residential Intensification:** Intensification of residential capacity within one to four miles of existing and/or planned transit stations
   c. **Urban Area Transit Strategy Boundary:** Intensification options within UATS boundary
   d. **Housing in Major Employment Areas:** Increase multi-family housing in or around major employment areas
   e. **Redevelopment of Suburban Areas:** Increase residential and/or job capacity of existing suburban areas
   f. **Second Units:** Increase residential capacity through single family infill
   g. **Maximum Allowed Densities throughout the Region:** e.g., all future development occurs at highest density allowed by general / community plans instead of 50% greenfield or 75% redevelopment areas
   h. **Other**

   **Tools:** Subsidies (e.g., subsidize development in certain geographic areas); CEQA Streamlining (e.g., assume streamlining to reduce development costs in certain geographic areas; Infrastructure Investment (e.g., accelerate infrastructure and public amenities/facilities investment to promote SGOAs prioritized by readiness/propensity to change; Other

2. **TRANSPORTATION NETWORK IDEAS**
   Mix of: Transit routes, transit project phasing, transit frequencies, signal priority for buses, bike/pedestrian facilities, bike parking facilities at transit stations, bike-sharing and car-sharing programs at regional transit stations as first/last mile solutions, High Occupancy Vehicle (HOV) lanes, High Occupancy Toll (HOT) lanes, Park-n-Ride facilities at transit stations, Park-n-Ride facilities to support HOV/HOT lanes, bottleneck relief projects, freeway operational improvements, arterials and connectors, freight corridors, other.

3. **PARKING AND PRICING IDEAS**
   Mix of: Free or reduced-cost transit, free transit transfers, HOT lanes, parking management and pricing strategies such as unbundled parking, parking maximums, demand-based pricing, parking cash out, priority parking for HOVs, real-time parking information, parking taxes, parking fees at major employment centers, parking reductions for certain uses, etc., VMT user fee, cordon pricing, congestion pricing, pay-as-you-drive insurance, subsidies/incentives for HOV modes, more people per car to qualify for HOV lanes, other.

4. **TRANSPORTATION DEMAND MANAGEMENT / TRANSPORTATION SYSTEM MANAGEMENT (TDM/TSM) IDEAS**
   Mix of: Telecommuting/teleworking/enhanced virtual office, flexible work schedules, alternative work schedules, carpooling programs, vanpooling programs, programs that encourage walking and biking, safe routes to school programs through outreach, education, and incentives, employer-based trip reduction ordinances, support for employer trip reduction programs, electric scooters/foldable bikes as first/last mile solutions, active traffic management strategies to improve operations and access to travel information (speed harmonization, hard shoulder use, dynamic lane control, real-time travel information, comparative travel information, etc.), real-time multi-modal travel planning applications, carshare programs, bikeshare programs, other.

5. **EMERGING TECHNOLOGIES IDEAS**
   Mix of: Vehicle automation (driverless vehicles), electric vehicle technology, fleet mix/fleet tracking, intelligent transportation system, integrated Near Field Communication (NFC) payment systems for seamless mobility across modes, mobility hubs to support integrated vehicle sharing (Neighborhood Electric Vehicle (NEV) / Personal Electric Vehicle (PEV) / Bike / Car) for first/last mile and mid-day short trips; peer-2-peer sharing, wearable technology (trip monitoring/reporting), integration with Universal Transportation Account (UTA), other.
Climate Mandate on Regional Driving & 2 Needed VMT-Reduction Strategies

Mike Bullock
mike_bullock@earthlink.net
760-754-8025

The Climate Problem

Any Earth Science text book* contains the following facts:

• Atmospheric CO2 traps heat
  – CO2 Molecules absorb and then emit, in a random direction, infrared radiation, heat given off by the Earth's surface
  – This effect is significant
• Combustion of fossil fuels greatly increases our Earth’s levels of atmospheric CO2
  – The amount of CO2 in the atmosphere is well known
  – Our yearly emissions are well known

Governor’s Executive Order S-3-05

Slide 1 of 4

http://www.dot.ca.gov/hq/energy/ExecOrderS-3-05.htm

- Signed in 2005
- Greenhouse gas (GHG) Emission Trajectory
  - 2000 levels by 2010
  - 1990 levels by 2020*
  - 80% below 1990 levels by 2050
- Achieved by Plans & Status

* AB 32 law mandate. Prop 23 would have suspended this.

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Governor’s Executive Order S-3-05

Slide 2 of 4

California's S-3-05 C02_e Emissions, MMT Per Year

The world is currently above its trajectory. The world will need to get emissions below the trajectory to make up for this.

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How Bad Could it Get?

• *Scientific American* June 2008 issue
  – 550 PPM CO2 possible in several decades
  – This could (5% probability) lead to 8 Deg. Celsius of warming
  – 8 Deg. Celsius could lead to “a devastating collapse of the human population, perhaps even to extinction”

• December 24/31 2012 Issue of Nation magazine:

> A recent string of reports from impeccable mainstream institutions—the International Energy Agency, the World Bank, the accounting firm of PricewaterhouseCoopers—have warned that the Earth is on a trajectory to warm by at least 4 Degrees Celsius. [4 Degrees Celsius] would be incompatible with continued human survival.

Winter, *UU World* magazine (p. 57): “Lags in the replacement of fossil-fuel use by clean energy use have put the world on a pace for 6 degree Celsius by the end of this century. Such a large temperature rise occurred 250 million years ago and extinguished 90 percent of the life on Earth. The current rise is of the same magnitude but is occurring faster. We must reduce or eliminate all uses of fossil fuels.”

Climate Data

• Keeling Curve:
Our Climate Crisis

- From: http://en.wikipedia.org/wiki/An_Inconvenient_Truth#Scientific_basis

![Temperature and CO₂ Records](image)

- Current Level of CO₂ is 394 PPM
- S-3-05’s goal is to cap CO₂ at 450 PPM

- Mike Bullock, 2012; Engineers for a Sustainable World, National Conference; Workshop 2223

Our Climate Crisis

- Earth & Space Research (ESR) website:
  http://www.esr.org/outreach/climate_change/mans_impact/man1.html

![CO₂ Chart](image)

- Current level = 394 PPM
- S-3-05’s Goal is to cap CO₂ at 450 PPM, which is off this chart.

- Mike Bullock, 2012; Engineers for a Sustainable World, National Conference; Workshop 2223
SB 375, Passed in 2008


- Authored by Speaker Pro Tem Darrell Steinberg
- Only for cars and Light-duty trucks
- Key provision
  - California Air Resources Board (CARB) Provides vehicle-miles-travelled (VMT) reduction targets
    - For years 2020 and 2035
    - To Metropolitan Planning Organizations (MPO)
    - Computed in Regional Transportation Plans (RTP)
    - Local MPO, San Diego Association of Governments (SANDAG), produced the first post-SB375 RTP

How to Solve a Problem

- Define the solution: at least S-3-05
- Compute what is needed (driving reduction)
- List attainment strategies

We can’t just “do real good”.
The physical world doesn’t care about our problems.
It will kill us if we fail here.
### Trajectories to Support Calculations

Purple (Low carbon fuel), Green (C02/Mile), & Gold (S-3-05)

From Communities Tackle Global Warming, A Guide to SB 375 comes the words and plot shown as Figure 1.

In San Diego County, 41% of GHG emissions come from cars and light-duty trucks.

---

#### Figure 1: Increasing VMT Threatens to Overwhelm Greenhouse Gas Savings From Cleaner Fuels and Vehicles

- **VMT (CALTRANS)**
- **CO2**
- Low-Carbon Fuel Standard (LCFS): -10%
- GHG Target: 1990, 27% < 1990 in 2030

---

### SB 375’s Per-Capita VMT Reduction for 2035, to Support S-3-05

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Definition</th>
<th>Taken From</th>
</tr>
</thead>
<tbody>
<tr>
<td>f</td>
<td>net factor of the emissions of Greenhouse Gas</td>
<td>Gold Line¹</td>
</tr>
<tr>
<td>f_Pavley</td>
<td>factor of the average statewide mileage</td>
<td>Green Line¹</td>
</tr>
<tr>
<td>f_Fuel</td>
<td>factor of the reduction of GHG due to low-carbon fuels</td>
<td>Purple Line¹</td>
</tr>
<tr>
<td>f_Population</td>
<td>factor of the population in the region of interest</td>
<td>CARB²</td>
</tr>
<tr>
<td>f_PerCapitaVMT</td>
<td>factor of per capita driving</td>
<td>Computed</td>
</tr>
</tbody>
</table>

1. From the Chart constructed by Steve Winkleman, as shown in the “Guide to SB 375” report.

\[
f = f_{\text{PerCapitaVMT}} \times f_{\text{Population}} \times f_{\text{Pavley}} \times f_{\text{Fuel}}
\]

\[
f_{\text{PerCapitaVMT}} = \frac{f}{(f_{\text{Population}} \times f_{\text{Pavley}} \times f_{\text{Fuel}})}
\]
Per-Capita VMT Reduction for 2035, as Required by S-3-05

\[ f_{\text{PerCapitaVMT}} = \frac{f}{(f_{\text{Population}} \times f_{\text{Pavley}} \times f_{\text{Fuel}})} \]

\[ f_{\text{PerCapitaVMT}} = \frac{0.525}{(1.313 \times 0.685 \times 0.9)} \]

\[ f_{\text{PerCapitaVMT}} = 0.649 \]

This is a 35.1% decrease in per-capita VMT.

The population factor of 1.313 is specific to San Diego County.

Because .649 \times 1.313 = .8515, in 2035, the people in San Diego County must drive 15% less than they did in 2005, even with the 31.3% increase in population. Therefore, why add lanes?

Performance of Current Regional Transportation Plan Dictates Amount of Improvement Needed

• As shown, a 35.1% driving reduction is needed
• The current RTP, RTP2050, achieves 13%
• New policies needed to get an additional 22.1%

Note: Given the realities of climate, just achieving S-3-05 is still dangerous. We need GHG reductions to be As Much as Possible (AMAP) and As Soon As Possible (ASAP).

Let’s call the AMAP/ASAP principle. No good ideas to reduce driving should be overlooked. We should never delay good policies.
Strategies to Get 22% More

• Stop expanding freeways
  – No need; we must drive less
  – Eliminate congestion with following strategies

• Reallocate freeway-expansion funds to transit 2%

• Pricing, to increase fairness & choice
  – Parking demonstration projects to unbundle cost
  – Legislation
    • Unbundle the cost of all underpriced parking 7.5%
    – Equitable&environmentally-sound road-use fees* 7.5%

• Smart growth, complete streets, bike classes 3%

*The state must do this; it is infeasible and would go in the APS.

21st Century Transportation Solutions

• Redesigned rail or monorail systems
  – Electric, automated, 24/7, frequent service

• Commitment to clean-bus technology

• Equitable driving fees to reduce taxes

• Unbundled car parking cost
American drivers park “free*” at the end of 99% of their vehicle trips**.

*the cost is bundled, reducing wages and/or increasing other costs, such as rent
**http://bikesiliconvalley.org/content/1155

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Results of 3 Actions, Including Cashout
Case (#1), Reference Patrick Siegman’s article in Bicycle Pedestrian Federation

- Company: CH2M Hill
  - Location: Bellevue, Wa (Seattle suburb)
  - Engineering Firm with 430 employees
- Actions
  - $54/month (1995 $’s), 
    to not drive
  - Improved Transit
  - Improved Bike/Pedestrian facilities

<table>
<thead>
<tr>
<th>CH2M Hill Work Trips</th>
<th>Mode</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive Alone</td>
<td>89%</td>
<td>54%</td>
<td></td>
</tr>
<tr>
<td>Carpool</td>
<td>9%</td>
<td>12%</td>
<td></td>
</tr>
<tr>
<td>Bus</td>
<td>1%</td>
<td>17%</td>
<td></td>
</tr>
<tr>
<td>Bike, Walk</td>
<td>1%</td>
<td>17%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

This case is not used in the tabulation of pricing results (next chart)
It shows that double-digit reductions in driving can cause triple-digit increases in transit usage. (Quadruple digit here: 1,600%).

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Cashout Results
(11 Locations, 3 Groups, 1995 Dollars)


• 3 Largest Responses – 38%, 36%, 31%

• 3 Smallest Responses – 15%, 18%, 24%

*Patrick Siegman, of Nelson Nygaard

<table>
<thead>
<tr>
<th>Location</th>
<th>Scope</th>
<th>1995 dollars per mo.</th>
<th>Parking Use Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group A: Areas with little or no public transportation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cornell University, Ithaca, NY</td>
<td>9000 faculty &amp; staff</td>
<td>$34</td>
<td>20%</td>
</tr>
<tr>
<td>San Fernando Valley, Los Angeles</td>
<td>1 employer, 850 employees</td>
<td>$37</td>
<td>30%</td>
</tr>
<tr>
<td>Costa Mesa, CA</td>
<td></td>
<td>$37</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Average for Group</strong></td>
<td></td>
<td>$47</td>
<td>23%</td>
</tr>
</tbody>
</table>

| **Group B: Areas with fair public transportation** | | | |
| Los Angeles Civic Center | 10000+ employees, several firms | $125 | 30% |
| Mid-Wilshire Blvd., Los Angeles | 1 mid-size firm | $89 | 38% |
| Washington DC Suburb | 5500 employees at 3 worksites | $88 | 20% |
| Downtown Los Angeles | 5000 employees, 118 firms | $125 | 20% |
| **Average for Group** | | $152 | 31% |

| **Group C: Areas with good public transportation** | | | |
| University of Washington, Seattle WA | 50,000 faculty, staff & students | $16 | 24% |
| Downtown Ottawa, Canada | 3500+ government staff | $12 | 18% |
| Bellevue, WA | 1 firm with 430 employees | $94 | 40% |
| **Average for Group, but not Bellevue Washington** | | $45 | 21% |
| **Over All Average, Excluding Bellevue Washington** | | $45 | 21% |

Money Matters

Parking vacancy would be higher! Not used, since transit & walk/bike facilities also improved.

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Cashout Results References


• Above reference listed the following references:


Mike Bullock, 2012; Engineers for a Sustainable World, National Conference; Workshop 2223
A Plan to Efficiently and Conveniently Unbundle Car Parking Costs

- Motivation (1 slide)
- Goals (2 slides)
- Definitions and Methods (7 slides)
- Implementation (2 slides)

Note: I do not have time to present these 12 slides

This paper was peer-reviewed and published by the Air and Waste Management Association. I was a co-author. I presented the paper in their Sustainable Land Use and Transportation Session, in Calgary, in 2010.

Simple Example: 10 Employees and $5 Per Day to Park

- If all 10 drive: $50 per day collected
  - Each employee gets $50/(10 employees) = $5
  - Each employee pays $5 to park
  - Each employee breaks even
- If only 9 drive: $45 per day collected
  - Each employee gets $45/(10 employees) = $4.50
  - Each driver losses 50 cents
  - The non driver get $4.50 but also loses 50 cents because everyone lost $5 per day in wage
Simple Example: 10 Employees and $5 Per Day to Park

- If 9 drivers losing 50 cents bothers the employer
  - Employer could give all employees that need it, an “add in”
  - Earnings (here $4.50) plus “Add in” (here $.50) = Parking Charge ($5.00)
  - This is unfair to non-drivers (lose $.50, because the lost wage for everyone is $5 per day)
  - This is less unfair to the non driver than “free parking” which cost the non-driver $5 per day
  - Unbundling has cut the non-drivers loss 90%

Motivation

- Fairness to individuals
  - Costs no longer hidden
  - Costs mostly recovered, by not using parking
- Less driving, to reduce environmental harm
  - Motivates choosing alternative modes
  - Less driving to find parking
- More Efficient Development
  - Less parking needed reduces land and building costs
Comprehensive Road-Use Fee Pricing and Payout System

• “Comprehensive”
  – Pays for: Road costs, Health costs, Environmental costs, etc.
  – Equitable
    • Protects privacy
    • Protects low-income drivers
  – Environmentally sound
    • Rewards efficient cars, at least as much as gas tax
    • Congestion pricing, to defeat congestion

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Honorable TWG and CTAC Members:

Mike Bullock, retired systems engineer and Sierra Club Transportation Chair.

Climate Mandate on Regional Driving and 2 needed VMT-Reduction strategies.

These charts are available; please ask. [Chart 1]

We understand the problem. [2]

We know we must at least achieve S-3-05; we know its targets. [3]

We know the slope gets much steeper after 2020, after Cap and Trade ends. [4]

We know the urgency: [quote]“incompatible with continued human survival”[end quote], for example [5]

We’ve seen the plots, over decades, over eight hundred thousand years and over the last thousand years. [6-8]

We’ve read SB 375 and know the difference between an SCS and an APS. Its needed because clean cars will not be enough; we must also drive less. [9]

To solve a problem, define the solution, compute the shortfall, and erase the shortfall; we understand the necessity. [10]

Winkleman’s data supports the calculation. [11, 12]

We must reduce driving by 35.1% [13]

Currently, we only get 13%. We need 22.1% more. [14]

It’s time for feasible (SCS) and even infeasible (APS, road use fee) solutions. I am going to focus on unbundling the cost of parking. [15]

[Skip 16]

Unbundling the cost of parking is needed everywhere. [17]

Double-digit reductions in driving can produce triple-digit reductions in alternatives. Here, a 39% reduction in driving caused both transit and biking to increase by one-thousand-six-hundred percent, from 1% to 17% [18]

11 cases of introducing a price differential, like unbundling, averaged a 25% decrease in driving. The 2 worst cases had a 15% decrease in driving. I only assume 7.5% because there aren’t many cases [19]

The references, behind the cases. [20]

This is the presentation I gave to the Air and Waste Management Association’s Sustainable Land Use and Transportation Session, in Calgary. It must suffice here to say that the
parking earnings must go to those for whom the parking is built, such as students OR to those losing money because of the parking, like employees, who are getting a reduced wage. SANDAG staff disagrees. They want to use the earnings for transit. This is wrong. Consider: if you charge an employee for parking and keep his money, then that employee has paid twice: once hidden (by a reduced wage) and once not hidden. If you give that employee the earnings, the employee has paid twice, but one of the payments is mitigated by the received earnings. Remember, the employee got to use the parking. Consider the employee that does not drive. That employee paid once, hidden. If they get the earnings, they will still have lost money once (hidden). However, by getting the earnings, they lose less. To all, it will feel like an offer to get paid to not drive.

Transit will do well with unbundling and it can raise more money at its fare box. It is not fair to take money from motorists and non-motorists, that are already losing money due to bundled-cost parking.[21]

Here is a very simple example. 10 employees, losing $5 a day due to parking, so parking is priced at $5 per day. If all 10 drive, they all break even because the earnings equal the charge and they all use the parking.

If only 9 drive, each employee gets earnings of $4.50, so everyone loses 50 cents. [22]

If the employer wants, she could chose to give employees an “add in” so drivers break even. [23, 24]

A comprehensive road-use fee pricing and payout system. Put it in your APS and claim the credit. I will defend your right to do that. The state needs to do its part.

Thank you [25]