Development of performance measures for rural counties in California

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ABSTRACT

Transportation agencies at all levels are increasingly relying on performance measures to inform decisions on investment and transportation system management. The California Transportation Commission (CTC) recently adopted a set of performance measures that were based mainly on the needs of urban areas in the state. The California Rural Counties Task Force were concerned that these performance measures did not meet their specific needs. The Task Force therefore commissioned a study to develop performance measures applicable specifically to rural areas in the state. This paper describes the development of these performance measures, which were subsequently adopted by the CTC. The study consisted of reviewing existing performance measurement practices in rural counties, assessing available planning resources for data collection and analysis to produce performance measures, establishing criteria for assessing potential performance measures, recommending performance measures, and examining potential future performance measures. The recommended performance measures were adopted in toto by the CTC. What distinguishes this study from most previous efforts in this area is the development of a systematic framework for the selection of performance measures.
INTRODUCTION

Regional Transportation Planning Agencies (RTPA) in California have been developing metrics to inform and track implementation of regional plans well before previous efforts of rural Blueprint Plans and, more recently, Sustainable Communities Strategies (SCS) required by SB 375 for MPOs (1). The emphasis for performance measurement in the regional planning process has been confirmed through many Federal and State initiatives (e.g., MAP 21 and legacy bills SAFETY-LU, TEA-21 and ISTEA, Caltrans “new” Mission and Vision Statements) (2). The most recent rendition of performance monitoring guidance is in the 2010 California Regional Transportation Plan Guidelines (3) and the 2014 STIP Guidelines (4) from the California Transportation Commission (CTC). These guidelines provided latitude and flexibility for developing performance measures in recognition of the differences in environmental conditions, data availability, modeling capability and regional socio-economic characteristics among MPOs/RTPAs throughout the state. As such, individual areas have a history of adopting metrics that reflect their unique circumstances and that are appropriate to their resources and capacities. Caltrans has also provided guidance on performance measures for rural areas (5, 6).

The California Transportation Commission (CTC) recently adopted a set of performance measures that were developed by the San Diego Association of Governments (SANDAG) (7). These performance measures were developed mainly for urban areas, and rely heavily on data sources that are available mainly in urban areas.

California contains 26 rural counties, most of which have populations of less than 250,000 and no urbanized area greater than 50,000. Rural counties provide food and natural resources for California industry and residents; and recreation for urban residents and tourists. The Rural Counties Task Force (RCTF) was formed 1988 to provide a direct opportunity for the small counties to remain informed, have a voice, and become involved with changing statewide transportation policies and programs. This Task Force is an informal organization with no budget or staff and meets every other month. CTC and Caltrans staff usually attend these meetings to explain and discuss changing statewide transportation issues that may be of concern to the rural counties. (8)

The RCTF were concerned that the performance measures proposed by CTC had little relevance to rural areas and required extensive staff resources for data collection and analysis beyond the capability of the rural RTPAs. RCTF therefore commissioned a study to develop a set of performance measures that would be specifically applicable to rural areas (9). The objectives of the study were the following:

1. Evaluate the set of performance monitoring metrics documented in the SANDAG study of performance measures (7) for their applicability to rural and small urban areas.

2. Emulate the SANDAG study approach of the 18 MPOs in California to include the rural 26 RTPAs and 4 small MPOs that requested to participate in this study.

3. Identify metrics that are appropriate for rural and small urban areas for incorporation into the CTC 2016 State Transportation Improvement Program Guidelines.
PERFORMANCE MEASURES IN THE PLANNING PROCESS

The purpose of transportation performance measures is to monitor how well the transportation system is meeting the goals and objectives of the agency responsible for planning, programming, and funding the transportation system. This is illustrated in Figure 1 below. Goals and objectives establish benchmarks for the intended operation of the transportation system; performance measures and data are used to track progress in reaching these benchmarks.

- **Goals** define the overall transportation aims of the region: e.g., “provide a transportation system that is safe, reliable, and efficient.”

- **Objectives** are measurable embodiment of the goals: e.g., “reduce the total cost of accidents in the region.”

- **Performance measures** are the “yardsticks” by which an agency can determine how well the objectives are being met: e.g., “number of accidents by severity”, “total cost of accidents”.

- **Data collection** is determined by the performance measures, and provides the information for these measures.

The guiding premise for this study was that performance measures should be evaluated on how well they can inform planning decisions on transportation system investment, management, and operations.

FIGURE 1. PERFORMANCE MEASURES IN THE PLANNING PROCESS
STUDY APPROACH
The study identified seven performance measures that more closely address the transportation goals and objectives of rural RTPAs and that take into account the limited availability of resources for performance monitoring in these RTPAs. The RCTF worked with CTC to amend the rural performance measures identified in this report into the 2016 STIP Guidelines. These measures are applicable to the rural county RTPAs and are provided as an option to small Metropolitan Planning Agencies (MPOs). The 2016 STIP Guidelines were adopted on August 27, 2015.

This study was carried out in the following steps:

1. Review existing performance measures for their applicability to rural counties.
2. Review the current state of performance measures among rural counties in California by conducting an on-line survey of rural county transportation planning agencies and interviewing with staff of these agencies.
3. Develop criteria for performance monitoring measures appropriate to rural county transportation agencies.
4. Develop performance monitoring measures for rural county transportation agencies according to these criteria and determine the required resources to carry out these performance measures.
5. Examine potential future performance monitoring measures and assess their applicability to rural county transportation agencies.

CURRENT STATUS OF PERFORMANCE MEASURES
A study by the San Diego Association of Governments (SANDAG) (7) was the source for the performance measures submitted to the California Transportation Commission (CTC) in June 2013 for consideration and amendment to the 2016 State Transportation Improvement Program (STIP) Guidelines. The goal of the SANDAG Study was to develop a standardized set of performance indicators, using existing data sources, to be used by all MPOs and state agencies.

The SANDAG Study recommendations were based exclusively on examination and input from the state’s 18 MPOs. The predominantly rural Regional Transportation Planning Agencies (RTPAs) did not participate in the SANDAG study. Hence, some of the recommendations are less applicable to rural and small urban counties. For example:

- For several congestion relief and system reliability measures, the SANDAG Study proposed performance measures that rely primarily on accessibility to Caltrans Performance Measurement System (PeMS) data (10). PeMS data can be accessed directly online or through publications, such as the Caltrans Mobility Performance Reports and Texas Transportation Institute Urban Mobility Reports. As shown in Table 1, the percent of total freeway and principal arterial centerline miles with PeMS field deployment is 73% for the “Big Four” MPO regions (SANDAG, Southern California Association of Governments, Metropolitan Transportation Commission,
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and Sacramento Area Council of Governments); 52% for all urban regions (including
the “Big Four” regions); and just 12% for the state’s rural and small urban regions.
Across the entire state highway system, the percent of PeMS coverage falls to less
than 5% in rural and small urban regions. Although coverage is expected to gradually
increase over time with new field deployment, the degree of additional coverage
needed in rural and small urban regions suggests that PeMS will not be meaningful
for informing the recommended monitoring metrics in these areas for some time.

TABLE 1. PeMS STATEWIDE COVERAGE, 2013

<table>
<thead>
<tr>
<th>County Type</th>
<th>2013 PeMS Centerline mi.</th>
<th>HPMS 2013 Total FWY+PA mi.</th>
<th>PeMS % Coverage</th>
<th>2013 Total SHS mi.</th>
<th>PeMS % Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Counties</td>
<td>3,137</td>
<td>7,497</td>
<td>42%</td>
<td>15,147</td>
<td>21%</td>
</tr>
<tr>
<td>Urban Counties</td>
<td>2,918</td>
<td>5,621</td>
<td>52%</td>
<td>10,635</td>
<td>27%</td>
</tr>
<tr>
<td>Big Four MPO</td>
<td>2,419</td>
<td>3,327</td>
<td>73%</td>
<td>5,840</td>
<td>41%</td>
</tr>
<tr>
<td>Rural Counties*</td>
<td>219</td>
<td>1,876</td>
<td>12%</td>
<td>4,512</td>
<td>5%</td>
</tr>
</tbody>
</table>

- State and federal sample-based data collection efforts favor urban over rural areas.
  Data sources, such as Public Use Microdata Sample, American Community Survey,
  the California Statewide Household Travel Survey, the National Household
  Transportation Survey, employment data and HPMS estimates of vehicle miles of
  travel are available at much greater accuracy and level of detail in urban areas.

- Given differences in population densities, some measures are biased in favor of urban
  counties. For example, one measure from the SANDAG Study under the Congestion
  Relief category is mode share for work travel. Urbanized areas have the population,
  employment base, densities, and transit infrastructure to support transit and active
  transportation choices that can allow these areas to improve non-auto mode share by
  greater investments in transit and active transportation modes. Conversely, in rural
  and small urban regions the ability to significantly increase non-auto mode shares is
  severely limited given lower population and employment densities. Furthermore, the
  market for transit service in urban areas contains a significant proportion of choice
  riders (i.e., transit riders who could use auto) while in rural areas the transit market
  consists predominantly of transit-dependents.

- Transportation issues in rural and small urban regions are generally significantly
different from those in urban regions. Rural and small urban regions will likely be
  more interested in infrastructure condition and safety and perhaps less concerned with
  mode split and congestion. System reliability in rural and small urban regions is
  primarily concerned with non-recurrent events (e.g., peak weekend tourist events,
  construction activities, incidents, weather events, natural events such as floods,
  wildfires, landslides) and community isolation during disaster evacuation events.
  Reliability in urban areas is primarily concerned with normal AM/PM weekday
  recurrent congestion as well as non-recurrent congestion.
Collecting and analyzing data to measure performance of the transportation system is challenging in some categories for rural and small urban RTPAs. Data collection must be recognized as a valuable asset for small agencies that have limited staff resources.

The scale of the data values in the majority of existing performance metrics benefits quantity over the value of a project. Two programs that highlight this are the Highway Safety Improvement Program (HSIP) and the Active Transportation Program (ATP). For example:

- The HSIP benefit-cost requirement rewards projects that have high accident quantities. Rural areas have accidents per capita rates that warrant HSIP funding but have trouble competing in the cost benefit ratio outcome required by the HSIP program guidelines. And average crash severity is higher in rural areas (Table 2)

<table>
<thead>
<tr>
<th>Area type</th>
<th>Percentage of Total Collisions by Type</th>
<th>Average collision cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fatal</td>
<td>Injury</td>
</tr>
<tr>
<td></td>
<td>Severe</td>
<td>Moderate</td>
</tr>
<tr>
<td>Rural</td>
<td>1.11</td>
<td>3.86</td>
</tr>
<tr>
<td>Urban</td>
<td>0.66</td>
<td>2.25</td>
</tr>
<tr>
<td>Total</td>
<td>0.70</td>
<td>2.37</td>
</tr>
</tbody>
</table>

- The ATP program rewards projects that prove to have high quantities of existing bicycle and pedestrian users. On the surface, this makes sense, but no mechanism exists to account for smaller population centers that also have critical projects with the same ATP program goal intent. This is despite having a programmatic rural set aside.

The SANDAG Study noted that further discussion was needed to continue addressing variations among diverse California regions, the need for flexibility, and future performance monitoring, which could be both quantitative and qualitative assessments and data availability. This RCTF study continues this discussion by augmenting the SANDAG Study with a recommended approach to rural and small urban counties.

**CURRENT PRACTICE IN CALIFORNIA RURAL COUNTIES**

We conducted an online survey and staff interviews of 30 RTPAs and county transportation agencies in the 26 rural counties of California. These revealed the following:

- All rural county agencies have performance measures in place. These performance measures reflect the main transportation concerns of the agencies.
The main transportation issues in rural and small urban regions differ significantly from those in urban counties. Review of rural and small urban regions revealed that issues such as safety and pavement management consistently rank toward the top (Figure 2) whereas urban counties are primarily concerned with issues such as congestion, air quality, and travel time reliability.

**FIGURE 2. PRIORITIES FOR MANAGING TRANSPORTATION INFRASTRUCTURE (% OF AGENCIES)**

- **Practices vary widely among agencies.** Some agencies tie performance measures to specific goals or objectives, while for other agencies the goals and objectives appear to be implicit in the performance measures.

- **Goals, objectives, and performance measures are different among agencies.** Although some measures are common across most or all agencies – e.g., accident rates, required performance measures for TDA audits – some agencies go into great depth and detail in performance measures, particularly those related to environment and quality of life.

- **There are barriers to maintaining performance measures in rural and small urban regions. These inequities are exacerbated by current federal and state data collection practices, which favor urban counties.** As shown in Figure 3, data availability was the most frequently cited barrier to maintaining performance measures in rural counties. Many data sources that are available for urban areas in California are either not available or severely diminished for rural and small urban regions: e.g., PeMS, HPMS, ACS, employment data, and journey-to-work. Other barriers including identifying measures with local relevance and staff resources.
FIGURE 3. BARRIERS TO IMPLEMENTING PERFORMANCE MEASUREMENT (% OF AGENCIES)

- **Population-based performance measures can be biased against lower population counties.** Performance measures such as person-hours of delay or number of crashes will inherently favor areas with higher traffic volumes.

- **The current set of recommended performance measures does not account for significantly different definitions of user population between rural and urban counties.** Tourist population accounts for a much greater share of traffic in many rural and small urban regions than in urban counties. Hence, for rural and small urban regions the benefits of transportation investments accrue in much greater proportion to travelers who do not reside within these counties.

- **Current performance measures do not take into account the value provided by rural and small urban regions to the State of California as a whole.** Rural and small urban regions that are tourist attractions provide facilities and services that make the State of California more economically attractive to businesses. Similarly, agricultural counties provide agricultural products to the Californians at lower cost than to other states because of their proximity to markets. Current performance measures do not take these benefits into account.

- **Rural counties have limited staff availability for data collection.** While staff availability for data collection varies by type of county (Figure 4), most counties have less than 2 FTE staff availability for data collection and analysis.
CRITERIA FOR CHOOSING PERFORMANCE MEASURES

The purpose of this study was to develop performance measures for rural counties that were 1) relevant to their needs, and 2) could be produced without undue strain on existing staff and monetary resources.

Performance measures typically used by transportation agencies can be classified as monitoring-based or model-based.

- **Monitoring-based performance measures** are determined empirically by direct measurement in the field (e.g., traffic volumes, accidents by type) are monitoring-based measures. They allow agencies to track success in achieving goals and objectives based on real outcomes.

- **Model-based performance measures** are estimated by analytical tools or models (e.g., travel demand models). They are typically used to evaluate various alternatives under...
future year conditions (e.g., evaluate plan alternatives) and are not based on real outcomes.

This study exclusively addressed monitoring-based performance measures for the following reasons:

- Model-based performance measures depend on the capabilities of the model being used and the assumptions that go into building the model. Only partial validation is possible (e.g., comparing ground counts to model results at the screenline level), especially within the resources available to rural planning agencies.

- Monitoring-based performance measures provide “ground-truth” data for tracking the accuracy of measures that have been projected using models. They are used to answer, “Are we trending in the right direction to achieve our goals and objectives?”

- Monitoring-based performance measures can be directly traced to valid data sources that can be tracked and compared over time. They are used to answer, “What is actually happening as we implement our goals and objectives?”.

We developed the following principles for selecting among different possible performance measures:

1. **Performance measures must reflect the goals and objectives of the agency.** Performance measures are the yardsticks for measuring how well a particular transportation alternative meets the goals and objectives of the agency. Hence, any suggested performance measure must be capable of being tied to one or more agency goals or objectives.

2. **The purpose of performance measures is to inform decisions.** Performance measures are useful only to the extent that they can inform policy, planning, programming, budgeting, or management decisions.

3. **Performance measures should enable decision makers to identify tradeoffs between potentially conflicting goals or objectives.** Consider a hypothetical case of trying to “maximize mobility at the minimum cost.” It is impossible to simultaneously optimize over more than one measure. In this case, it would require performance measures for both cost and mobility to enable decision makers to identify the tradeoffs among alternatives between cost and mobility; i.e., answering the question “how much mobility are we buying at what cost?”

4. **Performance measures should ideally be as commensurate as possible.** Metrics that are measurable across all regions and/or applicable to differing scales of analysis allows for an "apples-to-apples" comparison and makes for better statewide or regional decision making (for funding or comparing progress). When a number of performance measures are used to evaluate transportation alternatives, decision makers should make tradeoffs between these measures in a consistent manner. This is the main rationale for benefit-cost
analysis, where market values are used to identify tradeoffs between measures such as
cost, travel time, reliability, safety, and environmental effects.

5. **Performance measures should be easily understood by decision makers and the
general public.** Concepts such as cost and accident totals are easily communicated to
decision makers and the general public, whereas technical concepts such as “buffer
index”, as a measure of travel time reliability, may require detailed explanation to be
fully understood.

6. **The number of performance measures should be as few in number as possible.**
Humans are able to keep 7 ± 2 items in memory at one time when making decision (14).
Too many performance measures will confuse rather than inform.

Based on the above principles and our findings on agency practice, we adopted the following
criteria to select performance monitoring measures for rural and small urban areas:

1. Alignment with California state transportation goals and objectives.
2. Ability to inform current goals and objectives of each rural and small urban RTPA.
3. Applicability to all rural and small urban regions.
4. Relevance to specific decisions on transportation investment, management, and
operations.
5. Capable of being produced without imposing substantial resource requirements on rural
and small urban RTPAs.
6. Normalized to provide equitable comparisons among all regions.

**RECOMMENDED PERFORMANCE MEASURES**

Based on the results of the interviews and the criteria described above, we developed the
following seven performance measures for rural county transportation agencies:

1. **Congestion/delay/VMT** – Measures road use and level of congestion on local roads.
2. **Mode share for work travel** – This was chosen as a general indicator for use of single-
occupant auto trips. These data are available from ACS. Mode share for other purposes
would be useful, but is not possible to assess without expenditure of significant resources.
3. **Safety** – Accident cost was chosen as an indicator that incorporates both the number of
accidents and severity of crashes. Rural areas typically have a higher percentage of
fatality and serious injury crashes than urban areas. Hence, this measure reflects that
difference.
4. **Transit operating cost per mile** – This was chosen as an overall measure of transit
service efficiency. Cost per passenger measures were not considered because of typically
1 low transit ridership, and the fact that transit in rural areas is primarily provided for
2 captive riders.
3
5. **Distressed lane miles** – Road maintenance is a critical issue for rural areas. This measure
4 is an indicator of critical maintenance needs.

6. **Pavement condition index** – An overall measure of pavement condition.

7. **Land use efficiency** – This measures the amount and rate of urbanization within a
8 region. More efficient land use patterns – i.e., those that require less land to accommodate
9 development – can rely upon existing roads, require fewer new lane miles, and have
10 lower overall operating and maintenance costs.

11 A summary of these measures, data sources, and estimated resource requirements is shown in
12 Table 3.
<table>
<thead>
<tr>
<th>Performance measures</th>
<th>Data sources</th>
<th>Estimated resource requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Congestion/delay/vehicle miles of travel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VMT:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Per capita</td>
<td>• HPMS (15)</td>
<td>Minimal. Less than one person-day of staff time to look up published data.</td>
</tr>
<tr>
<td>- By locality (city)</td>
<td>• Caltrans Vehicle Volumes (16)</td>
<td></td>
</tr>
<tr>
<td>- By facility ownership</td>
<td>• Dept. of Finance annual population estimates (17)</td>
<td></td>
</tr>
<tr>
<td>- Local vs. tourist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak V/C ratio or thresholds</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Caltrans Vehicle volumes (average, peak traffic; K &amp; D factors) (16)</td>
<td>Moderate. Depends on number of state highway segments.</td>
</tr>
<tr>
<td></td>
<td>• HCM 2010 threshold volumes (18)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Highway geometrics (number of lanes, lane widths)</td>
<td></td>
</tr>
<tr>
<td>2. Mode share/split</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Journey to work mode share</td>
<td>• Triennial American Community Survey estimates of work mode shares by county</td>
<td>Minimal. Less than one person-day to look up data.</td>
</tr>
<tr>
<td>3. Safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total accident cost:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Per VMT</td>
<td>• SWITRS/TIMS (accidents by type) (13, 19)</td>
<td>Minimal. Less than one person-day to look up data and compute measures.</td>
</tr>
<tr>
<td>- Per capita</td>
<td>• Same data as for VMT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• NHTSA data on cost by accident type (20)</td>
<td></td>
</tr>
<tr>
<td>4. Transit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transit: operating cost per revenue mile</td>
<td>• Annual transit agency reports</td>
<td>Minimal. Less than one person-day to look up data and compute measures.</td>
</tr>
<tr>
<td>5. Transportation system investment/preservation/service/fuel use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distressed lane miles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Total and % of total</td>
<td>• Regional or local pavement management system</td>
<td>Depends on size of road system in county.</td>
</tr>
<tr>
<td>- By jurisdiction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- By facility type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pavement condition index (PCI) for local roads</td>
<td>• Regional or local pavement management system</td>
<td>Minimal additional effort assuming done in coordination with local roadway needs report.</td>
</tr>
<tr>
<td>6. Land use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land use efficiency</td>
<td>• Farmland Mapping and Monitoring Program (FMMP)</td>
<td>Minimal. Less than one person-day to look up data and record measures.</td>
</tr>
<tr>
<td></td>
<td>• DOF Annual population estimates (17)</td>
<td></td>
</tr>
</tbody>
</table>
POTENTIAL FUTURE PERFORMANCE MEASURES

Future planning issues, as well as new federal and state reporting requirements, are likely to require new performance measures. We identified the following performance measures for possible consideration in the future.

MAP-21 calls for the eventual use of benefit-cost methods to evaluate transportation investment alternatives. Several tools are available to assist in carrying out benefit-cost analysis for transportation including the AASHTO “Red Book” (21), the Caltrans Cal B-C model (22), and NCHRP 03-110 life cycle cost estimation tool for evaluating intersection treatments (23); a separate tool, TIMS, is available for calculating benefits and costs of safety projects in California (19).

Benefit-cost analysis offers some significant advantages over other evaluation methods such as scoring; for example:

- It provides a consistent method for evaluating investment alternatives because market values are used to weight the outcomes of the alternatives.
- By bringing all benefits and costs to a net present value measure, benefit-cost analysis allows comparisons of projects with different time horizons and investment scales. It also puts supply-side and demand-side measures on an equal footing.
- Although it may not be the sole criterion for investment decisions, experience has shown that benefit-cost analysis can be highly useful in separating out projects that perform exceptionally well or poorly.

Benefit-cost analysis may require more staff and analytic resources than are readily available to small planning agencies in rural counties. Hence, we expect that it would be used primarily for assessing major transportation investment alternatives.

Complete streets analysis has recently become a significant planning initiative given the passage of AB 1358 (Complete Streets Act). The typical rural application is when a state highway serves as the Main Street for a small city or unincorporated community. The concept behind complete streets analysis is that a roadway should be evaluated for all modes that share the right-of-way: automobiles, transit riders, pedestrians, and bicyclists. It can be performed at the both the roadway section and intersection scales. Complete streets analysis is now included in the Highway Capacity Manual as multimodal level of service analysis. Caltrans now provides guidance for complete streets analysis (24).

Complete streets analysis can require significant amounts of staff time to set up because of the data requirements: geometric characteristics of streets and sidewalks, intersection characteristics, and traffic volumes. To the extent that the first two of these do not change significantly over time, updating a complete streets analysis would only require updating traffic volumes, and therefore not require a significant amount of staff time. We see that a complete streets analysis may be feasible for some limited areas within a rural county, but it is unlikely that a county transportation planning agency would have the resources to carry out such an analysis over the entire county.
We also looked at several potential land use measures that may be adopted in the future. These would be indicator measures only, because in California land use decisions are locally controlled and are outside the scope of responsibility of county transportation planning agencies. Potential land use measures we looked at included the following:

- **Compact development / housing density** – Ratio of acres developed to number of dwelling units. Measures ability to provide greater number of transportation choices, promote active transportation, and protect farmland.

- **Housing efficiency** – Percentage of residential uses by type and location. Data are available from the California Department of Finance to track these numbers by county.

- **Employment / housing ratio** – Measures effectiveness of land use patterns to provide local employment opportunities to residents. This measure is relevant only if computed by locality (e.g., city or CDP); it is less relevant as a countywide measure in most rural counties, most of whose residents live and work in the same county.

- **Agricultural land / open space conversion** – Measures amount of agricultural land converted to urban uses. This is a significant concern in rural areas as high prices in urban areas have been pushing housing outward into rural areas.

**CONCLUSIONS**

This paper has described the development of performance measures for rural counties in California. This study was motivated primarily by the following: 1) existing state performance measures did not adequately address the issues faced by rural counties; 2) transportation agencies in rural counties have limited sources for collecting and analyzing data to produce performance measures.

We have proposed seven measures that are relevant to the needs of rural counties, concise, and require only minimal staff resources to develop. The California Transportation Commission has adopted these measures wholesale. Hence, rural counties in California now have a frame of reference for using these measures and expanding on them as needed.

Performance measurement has become increasingly important not only because of federal and state standards, but because transportation managers and decision makers are seeking information on which to base their investment, management, and operational decisions. But if performance measures are to be truly relevant to transportation decision making, they need to be selected carefully and economically. We see the following as the most important issues in developing performance measures:

- Performance measures should be linked to potential transportation management and policy decisions. The value of a performance measure is directly related to the extent that it can inform decision makers. It is particularly important to have performance measures that can inform tradeoffs between different transportation goals and objectives.

- The number of performance measures should be systematic and as few as possible to provide the necessary information for decision makers. Too many performance measures
will confuse rather than inform decision makers. We deliberately limited the number of
recommended performance measures for California’s rural counties with this in mind.

- Performance measures must take into account availability of data, funding, and staff
resources. If performance measures are seen as too demanding in their resource
requirements they will be seen as a cost rather than a benefit to a planning agency.

- Performance measures will likely change over time as goals and objectives change. The
recommendations we made to the Rural Counties Task Force are therefore a starting
point, but we also studied potential future performance measures to account for changing
priorities. We therefore regard the framework we established for choosing performance
measures as one of the most important results of this study.

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REFERENCES
   http://www.arb.ca.gov/cc/sb375/sb375.htm
7. San Diego Association of Governments. Statewide Performance Monitoring Indicators for

   http://dot.ca.gov/hq/LocalPrograms/hsip.html

12. Caltrans. Active Transportation Program (ATP).
   http://www.dot.ca.gov/hq/LocalPrograms/atp/

   http://iswitrs.chp.ca.gov/Reports/jsp/userLogin.jsp

14. Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our

   http://www.dot.ca.gov/hq/tsip/hpms/


   http://www.dot.ca.gov/hq/tpp/offices/eab/LCBC_Analysis_Model.html

23. National Cooperative Highway Research Program. NCHRP 03-110. Estimating the Life-
   Cycle Cost of Intersection Designs.

   http://www.dot.ca.gov/hq/tpp/offices/ocp/complete_streets.html#CSBIA