Transportation Planning and GIS for the 22nd Century

Author

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Abstract

Just seven years beyond 2000, the Regional Transportation Commission Planning/GIS Staff has commenced a new initiative to identify future transportation corridors, well beyond the federal long range planning horizon of twenty years. With rapid growth in the Reno/Sparks, Nevada Metropolitan Area, it is clear that existing and planned twenty year transportation improvements will come far short of meeting the needs of land available for development. With nearly 400,000 people today, developable land within twenty-five miles of the urban core (including eight counties in two states) could potentially support a population of one million or more. GIS applications are critical in this effort to classify developable and undevelopable land, so that planners can identify potential transportation corridors. Identification of these corridors today will facilitate more detailed planning efforts when actual development occurs in outlying areas of the region.

Introduction to the Planning for the 22nd Century Initiative (Long-Long-Range Plan)

The Planning for the 22nd Century Initiative has its roots as far back as the 1960’s. At that time, simple planning documents for the Reno/Sparks, Nevada region contained a roadway linking Lake Tahoe at the southern tip to Pyramid Lake in the northern part of the region. This “line on a map” remained benign over the years until the late 1980’s when significant growth began in Southeast Reno. The function of the Lake Tahoe-Pyramid Lake roadway changed from a rural highway to that of a major arterial corridor between Southeast Reno and Sparks. The corridor, however, generated widespread opposition from older, established areas that would be traversed. Nearly twenty years of controversy resulted in neighborhood against neighborhood, political fallout, misinformation, and no solution in sight. It was not until January of 2007 that the Regional Transportation Commission (RTC) of Washoe County officially adopted a corridor for the Southeast Connector. The forty year saga of the Southeast Corridor controversy made it clear
to planners that the horizon years in the planning process needed to be extended so that future, longer-range transportation corridors could be identified and their legitimacy established.

While the Southeast Connector story was the poster-child for the development of a longer-range planning process, there have certainly been other factors. Washoe County (Figure 1) stretches nearly 200 miles north to south from the Oregon border and to just north of the State Capitol in Carson City (Washoe Valley). The entire, 200 mile, western boundary is with the State of California. The Reno/Sparks Metropolitan Area is 30 miles north of Carson City and the City of Reno downtown core is only 10 miles east of the California border. During the 1990’s and early 2000’s, both the Cities of Reno and Sparks began annexing large areas of unincorporated land. The City of Reno annexed, or placed into its sphere of influence, large portions of the unincorporated Verdi area, west of downtown, taking the city all the way to the California border. The City of Sparks added to its sphere of influence the East Truckee River Canyon, along Interstate 80 for some twenty miles east of the current city limits. Major growth has also been planned by the City of Reno to the northwest, which will also reach the California border. The City of Reno has also just recently placed large potential developments, as far as 35 miles north of downtown, into their “future service area”

The transportation ramifications of these land use decisions became apparent during the development of the 2001 and 2004 versions of the Regional Transportation Plan (RTP). As travel forecasts were completed, existing rural or undersized roadways on the peripheries were being identified as being far too small to serve planned growth. Freeway corridors and urban arterials were starting to be seen as over capacity, as soon as ten years into the future, even with major investments and expansions. The longer-range planning picture was not fully clear, because potential land development beyond 2030 was not included in the RTP process and the Southeast Connector controversy was at its pinnacle of public debate (The 2004 vote on the most viable corridor for the southeast connector was voted down by the Regional Transportation Plan Steering Committee by a 13-12 margin). And while the Southeast Connector issue was solved three years later, planners quickly realized that with so many other similar corridors contained in the RTP, that not only does the federally mandated horizon of twenty years need to be analyzed, but much longer timeframes, which can be used to identify possible future transportation corridors, should now become an important part of the analysis. By identifying potential longer-
range transportation corridors now, planners hope to avert major controversies in the future as
development occurs.

**Planning for the 22nd Century Initiative –The Process**

Shortly after approval of the 2004 RTP, RTC planning staff began development of a longer-
range scenario, in conjunction with planning staffs from the Cities of Reno and Sparks, and
Washoe County. It was determined that the 2008 update to the RTP would include a longer-
range scenario for planning purposes only. The longer-range scenario would focus on the
identification of possible transportation corridors to serve areas of potential development. The
first key assumption was to identify the longer-range “study area”. After several discussions, it
was decided that a twenty-five mile radius from the City of Reno downtown core would be
representative of a longer-range planning area. The northern area of the circle was later extended
further north, to include the proposed Winnemucca Ranch/Sage Communities developments in
the City of Reno’s Future Service Area. The result of the study area identification is reflected in
Figure 2. While it was determined that no specific longer-range horizon year could be estimated,
it was understood that this scenario included areas that may not develop until well into the 22nd
century. Some questions arose, such as the availability of water and other resources. However,
examples of much larger cities in a desert environment, such as Phoenix, Arizona or Las Vegas,
Nevada, demonstrate that resources such as water can be acquired and/or made available.

With the determination of the longer-range study area in place, several more key assumptions
had to be made. With large areas of rugged terrain throughout the region, it was decided that
slopes exceeding 30 percent would be off limits to potential development. Slopes between 15-30
percent would be restricted, and 0-15 percent slopes would be considered potentially
developable. Other public lands such as forest service areas, wildlife refuges, playas, lakes and
rivers, and locally identified sensitive areas, would also be considered undevelopable. Some
public lands, such as Bureau of Land Management (BLM) disposal areas, would be considered
available for potential development through land swaps or purchases. The need to identify all
these potentially developable and undevelopable areas made it certain that GIS applications and
staff would have to be brought into the process.
The creation of the longer-range study area raised one significant issue. The study area shown in Figure 2 brought several additional jurisdictions into the process. In addition to the Cities of Reno and Sparks, and Washoe County, portions of four California counties (Lassen, Sierra, Nevada, and Placer) and three Nevada counties (Storey, Lyon, and Carson (State Capitol)) are within the study area. Churchill County, just east of Lyon County, and just outside the study area, was also included as it has a significant number of commuters to the Reno/Sparks Metropolitan Area.

Contact with the affected agencies resulted in a wide range of responses. Some agencies have provided specific information, others have been able to provide general information, but do not have the political approval to make specific assumptions. Some agencies have expressed fear that participation could represent entitlements and/or upset population distributions. The county seats of several California counties are quite distance from the Nevada border, so information is sparse or non-existence. Throughout the discussions with local staffs, it was made clear that this project was only a planning exercise for the RTP and represents no entitlements or potential master plan designations. At the conclusion of contacts, where information is not available, assumptions of low-density residential with some supporting commercial used in areas of potential developable land will be made by RTC staff for the RTP update. All assumptions will be shared with the jurisdictions involved.

**Planning for the 22nd Century Initiative – GIS Applications**

With the study area defined, the next phase in the Planning for the 22nd Century Initiative was to identify those lands that could be considered potentially developable in the longer-range future based on several parameters. The first parameter involved elimination of forest service lands as these were assumed to be “untouchable” anytime in the future. An overlay of forest service land on the study area is shown in Figure 3 and illustrates large tracts of land, especially in the California counties, that were taken out of play. Placer County within the study area was removed in its entirety as it rings Lake Tahoe and any existing undeveloped land is considered to remain that way. Major portions of Nevada and Sierra counties were also removed from consideration for future development, except for areas along the Interstate 80 corridor in Truckee, California and its surrounding area, and the northern portions of Sierra County, west of
FIGURE 3
LONG-LONG RANGE PLANNING AREA
(FOREST SERVICE LAND – UNDEVELOPABLE)
US 395 in what is called Long Valley. Other forest service land within Nevada was also removed, primarily along the Sierra Front in Washoe County, west of US 395. No forest service lands are found north of US 395 and I-80 in Washoe County and small amounts shown in Storey and Lyon counties.

The next phase was to identify all other public lands that were considered potentially developable. This information was only available from Washoe County sources, as many of the surrounding counties do not have GIS capabilities or resources. The public lands in Washoe County that are considered developable are shown Figure 4. The final application dealing with public lands is shown in Figure 5, which represents those areas considered potentially developable and those that are not.

Subsequent to the identification of public lands came a much more challenging GIS application process. As mentioned, one of the key parameters in the identification of potentially developable land was restrictions due to hillsides, slopes, and mountainous regions.

Using the same methodology as used in the public lands applications, GIS staff began identifying of all slope data in excess of 30 percent. This land would be removed from consideration in the longer-range planning scenario. Figure 6 reflects the slopes in excess of thirty percent overlain on the study area. The information was then tabularized by county and is shown in Table 1. As Placer County within the study area was already eliminated from potential development, it was not listed in the slope data.
FIGURE 4
LONG-LONG RANGE PLANNING AREA
(PUBLIC LANDS -- CONSIDERED DEVELOPABLE)
FIGURE 5
LONG-LONG RANGE PLANNING AREA
(FOREST SERVICE and PUBLIC LANDS)

LEGEND
- Public Lands
- Forest Service Lands

[Map showing a region with various counties and labels such as Lassen County, Washoe County, Reno, Sparks, Carson County, Lyon County, Nevada County, etc.]
FIGURE 6
LONG-LONG RANGE PLANNING AREA
(SLOPES EXCEEDING 30% -- UNDEVELOPABLE)
Table 1
Long-Long Range Planning Area
Acreages with More Than 30 Percent Slope
(Considered Undevelopable)

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>ACRES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carson, NV</td>
<td>4,874</td>
</tr>
<tr>
<td>Lassen, CA</td>
<td>12,796</td>
</tr>
<tr>
<td>Lyon, NV</td>
<td>18,299</td>
</tr>
<tr>
<td>Nevada, CA</td>
<td>20,398</td>
</tr>
<tr>
<td>Placer, CA</td>
<td>Covered by Federal Lands</td>
</tr>
<tr>
<td>Sierra, CA</td>
<td>13,195</td>
</tr>
<tr>
<td>Storey, NV</td>
<td>55,538</td>
</tr>
<tr>
<td>Washoe, NV</td>
<td>180,462</td>
</tr>
</tbody>
</table>

After identifying the lands that were considered undevelopable due to excessive slopes, the same procedure was used to identify the slope data between 15 to 30 percent and from 0 to 15 percent. Figure 7 and Table 2 show the information for slopes between 15 and 30 percent. Figure 8 and Table 3 show the information for slopes between 0 and 15 percent. The 15 to 30 percent slopes are considered developable with restrictions, while the slopes ranging from 0 to 15 percent are considered developable, or are already developed.
FIGURE 7
LONG-LONG RANGE PLANNING AREA
(SLOPES 15 - 30% -- RESTRICTED DEVELOPMENT)
Table 2
Long-Long Range Planning Area
Acreages with 15 to 30 Percent Slope
(Considered Developable with Some Restrictions)

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>ACRES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carson, NV</td>
<td>3,783</td>
</tr>
<tr>
<td>Lassen, CA</td>
<td>10,660</td>
</tr>
<tr>
<td>Lyon, NV</td>
<td>17,408</td>
</tr>
<tr>
<td>Nevada, CA</td>
<td>11,817</td>
</tr>
<tr>
<td>Placer, CA</td>
<td>Covered by Federal Lands</td>
</tr>
<tr>
<td>Sierra, CA</td>
<td>8,710</td>
</tr>
<tr>
<td>Storey, NV</td>
<td>40,072</td>
</tr>
<tr>
<td>Washoe, NV</td>
<td>216,212</td>
</tr>
</tbody>
</table>
FIGURE 8
LONG-LONG RANGE PLANNING AREA
(SLOPES LESS THAN 15% -- DEVELOPED OR DEVELOPABLE)
Table 3
Long-Long Range Planning Area
Acreages with 0 to 15 Percent Slope
(Considered Potentially Developable)

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>ACRES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carson, NV</td>
<td>10,504</td>
</tr>
<tr>
<td>Lassen, CA</td>
<td>42,569</td>
</tr>
<tr>
<td>Lyon, NV</td>
<td>55,488</td>
</tr>
<tr>
<td>Nevada, CA</td>
<td>28,344</td>
</tr>
<tr>
<td>Placer, CA</td>
<td>Covered by Federal Lands</td>
</tr>
<tr>
<td>Sierra, CA</td>
<td>20,418</td>
</tr>
<tr>
<td>Storey, NV</td>
<td>61,224</td>
</tr>
<tr>
<td>Washoe, NV</td>
<td>454,807</td>
</tr>
</tbody>
</table>
The final step in the slope information was to combine all slope data to calculate the acres available for potential development. This slope data would also be combined with the public lands information to get a final estimate of potential developable land, which could be used in the creation of the longer-range Traffic Analysis Zones (TAZ’s) that would go into the travel forecasting portion of the project.

The final slope information was developed and is reflected in Figure 9 and Table 4. The information shows that large portions of Storey County and eastern Washoe County are quite rugged with large amounts of slopes considered restricted or undevelopable. Several mountain ranges in the northern part of the study area in Washoe County and along the California border are also clearly seen through the slope information. Much of the slope information in the California counties is consistent with Forest Service lands.
## Table 4
Long-Long Range Planning Area
Slope Information Summary

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>SLOPE 0 to 15%</th>
<th>SLOPE 15 to 30%</th>
<th>SLOPE More than 30%</th>
<th>Total Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carson, NV</td>
<td>10,504</td>
<td>3,783</td>
<td>4,874</td>
<td>19,161</td>
</tr>
<tr>
<td>Lassen, CA</td>
<td>42,569</td>
<td>10,660</td>
<td>12,796</td>
<td>66,025</td>
</tr>
<tr>
<td>Lyon, NV</td>
<td>55,488</td>
<td>17,408</td>
<td>18,299</td>
<td>91,196</td>
</tr>
<tr>
<td>Nevada, CA</td>
<td>28,344</td>
<td>11,817</td>
<td>20,398</td>
<td>60,559</td>
</tr>
<tr>
<td>Placer, CA Covered by Federal Lands</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sierra, CA</td>
<td>20,418</td>
<td>8,710</td>
<td>13,195</td>
<td>42,323</td>
</tr>
<tr>
<td>Storey, NV</td>
<td>61,224</td>
<td>40,072</td>
<td>55,538</td>
<td>156,834</td>
</tr>
<tr>
<td>Washoe, NV</td>
<td>454,807</td>
<td>216,212</td>
<td>180,462</td>
<td>851,480</td>
</tr>
</tbody>
</table>
The last GIS application in this phase of the initiative required an overlay of the final slope data with the public lands data, in order to determine land available for potential development. To accomplish this, the final slope data information (Figure 9) had to be combined with the public lands considered undevelopable (Figure 3) to give a final picture and acreage of potentially developable land. This final picture would be the cornerstone of the longer-range traffic model scenario. Staff could now identify potentially developable areas and create the necessary TAZ’s. Staff from the local jurisdictions could create land use scenarios for the longer-range scenario. Where no information was available or provided, assumptions could be made.

Figure 10 shows the final slope data overlaying the undevelopable lands, which provided staff with the areas assumed as available for potential future development. Table 5 shows the acreages by county of potentially developable land as a result of the GIS applications.

**Planning for the 22nd Century Initiative – GIS Applications in TAZ Development**

With the determination of potentially developable land in the study area complete, the GIS maps could be used to make new TAZ’s to incorporate into the RTC Traffic Model for locating possible transportation corridors. An example of the development of longer-range TAZ’s is shown in Figure 11 using Lassen County. The map shows the TAZ’s that were created to represent the potentially developable portion of Lassen County in the study area. TAZ’s for the entire study area are now in the final stages of completion. The longer-range TAZ’s will be added to the RTP TAZ structure, so that transportation impacts to the entire regions transportation system can be analyzed.

**Planning for the 22nd Century Initiative – GIS in Transportation Corridor Identification**

Even though land use assumptions for the longer-range study area are still being completed, the potentially developable land map also allows preliminary ideas on the location of future transportation corridors. As with the identification of longer-range, potentially developable land, the possible longer-range transportation corridors will also need to avoid, for the most part, public lands considered undevelopable and steep slopes.
Table 5
Long-Long Range Planning Area
(Developable Land)

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>Acres in Study Area</th>
<th>Slope Areas Considered Undevelopable</th>
<th>Public Lands Considered Undevelopable</th>
<th>Land Considered Potentially Developable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carson, NV</td>
<td>19,161</td>
<td>8,657</td>
<td>6,600</td>
<td>3,904</td>
</tr>
<tr>
<td>Lassen, CA</td>
<td>66,025</td>
<td>23,456</td>
<td>357</td>
<td>42,212</td>
</tr>
<tr>
<td>Lyon, NV</td>
<td>91,196</td>
<td>35,707</td>
<td>14,129</td>
<td>41,360</td>
</tr>
<tr>
<td>Nevada, CA</td>
<td>60,559</td>
<td>32,215</td>
<td>18,717</td>
<td>9,627</td>
</tr>
<tr>
<td>Placer, CA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sierra, CA</td>
<td>42,323</td>
<td>21,905</td>
<td>2,272</td>
<td>18,146</td>
</tr>
<tr>
<td>Storey, NV</td>
<td>156,834</td>
<td>95,610</td>
<td>2,970</td>
<td>58,254</td>
</tr>
<tr>
<td>Washoe, NV</td>
<td>851,480</td>
<td>396,674</td>
<td>25,544**</td>
<td>429,262**</td>
</tr>
</tbody>
</table>

**Current Estimates, Final Numbers Still Being Assembled
A first glance at the final potentially developable land map (Figure 10) shows some promising, possible future transportation corridors that can serve future growth in the longer-range study area. A first draft of possible future transportation corridors is shown in Figure 12.

**Planning for the 22nd Century Initiative – Next Steps in the Process**

The 2008 RTP will be underway in the summer of 2007. While the year 2040 has been selected as the horizon year for federal regulations, the longer-range scenario will be placed in the RTP for the first time. To complete the longer-range process, a final set of assumptions for the longer-range TAZ’s will be needed. In addition, the model will need to incorporate a possible longer-range transportation network (a starting point would be corridors shown in Figure 12) to assign trips. With these assumptions in place, staff can then run the traffic model and get an understanding of how big these possible transportation corridors will need to be to meet community congestion standards. Some facilities may only need to be arterials, while others may need to be freeway-like facilities. Rail or transit services may be feasible in some of the corridors. The ultimate objective is to memorialize the possible corridors and identify right-of-way swaths that will be necessary as future development occurs. This type of planning, even at the most general of levels, will go a long way in preventing major controversies, such as what happened with the Southeast Connector. It will also put into place a functional transportation system able to support the large amount of new citizens expected in the Northern Nevada region. It will also establish a longer-range planning process that, with the help of GIS applications, can be updated as the region moves forward into the future.
FIGURE 12
LONG-LONG RANGE PLANNING AREA
(PROPOSED CORRIDORS)

LEGEND
- Slopes >= 30%
- Slopes 15 - 30%
- Slopes 0 - 15%
- Forest Lands
- Proposed Roads
Planning for the 22\textsuperscript{nd} Century Initiative – Summary

Many discussions have taken place over the last several years, following the Southeast Connector controversy, on the need for longer-range planning efforts. As this effort slowly but surely becomes a reality, it is an initiative that never could have been possible without the use of GIS and skilled GIS staff. GIS has provided the necessary data for use in creating the longer-range scenario. It is with certainty that as this region moves forward, that additional refinements, adjustments, and assumptions will be tried, tested, and analyzed, and in every case, it is also a certainty that GIS will be the necessary tool planners use to develop an appropriate future transportation system. GIS will help make it possible for our citizens of the 22\textsuperscript{nd} Century to continue to enjoy the great Northern Nevada beauty and lifestyle that has attracted all of us to this part of the country in the first place.

Acknowledgements

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