Appendix E: Transportation Analysis

Transportation Planning and Travel Demand Forecasting Process

The consultant analyzed three different traffic scenarios: (1) existing 2006, (2) 2020, and (3) ultimate build-out, as described below.

The land use scenarios resulted from meetings with Town staff. For each land use scenario, a volume-to-capacity ratio (v/c) figure was created to show where the transportation demand in the PM peak hour was more than the capacity of the roadway.

A default of 800 vehicles per hour per lane (vphpl) was used as the capacity for Highway 160, Highway 84, the east-west connector roads and the by-pass roadway. Eight hundred (800) vehicles per hour per lane is a standard used for many signalized major arterials. The legend on each figure color classifies links based on the v/c ratio. Streets representing zone connectors have lower capacities than the main arterials. It should be noted that many streets representing zone connectors appear to be over-capacity on the maps, but that might not be the case in reality since the zone connectors represent all access points within the zone, which in actuality might be multiple streets.

Analysis for this project was performed using VISUM, a transportation modeling program developed by Planung Transport Verkehr (PTV). VISUM has the capability of replicating real world turning movements acquired from traffic counts, while routing vehicles.

Planning Area

The traffic volume analysis study area was based on the planning area for the Pagosa Springs Comprehensive Plan. The roadway network modeled for Pagosa Springs includes Highway 160, Highway 84, CR-119 (Hot Springs Road near Highway 160), and Piedra Road. Other key roadways, such as Trujillo Road, were modeled via centroid connectors feeding into study area roadway links.

Intersections

Intersections on Highway 160 were analyzed at the following locations:

- Vista Blvd/Meadows Dr,
- Pagosa Blvd,
- Piñon,
- Timber Ridge
- Piedra Road,
- Majestic Dr,
- Great West Ave,
- 8th Street,
- 4th Street/Hot Springs, and
- Highway 84.

These locations were identified as existing signalized intersections or intersections that could be signalized in the future, according to the Highway 160 Access Management Plan (*2002*). PM peak hour traffic counts were performed on January 17, 2006 at the study intersections to determine the existing turning movements at these locations.

Traffic Analysis Zones

The study area was divided into 25 traffic analysis zones (TAZs) that correspond to areas that feed traffic onto the modeled roadway network at the study intersections (see Figure A-11: TAZ map). The number of residential dwelling units and the total square footage of commercial space were summarized, as shown in Appendix D. These land use summaries were compiled for each of the three traffic scenarios analyzed.

Existing Conditions Model Set-up

In order for VISUM to replicate turning movement volumes while routing the vehicular demand for the study area, traffic volumes must be balanced between each study intersections. Because of existing roadways and driveways between study intersections, the turning counts for the PM peak hour did not balance. The first step was to balance the existing counts. In two locations, 1) between Pagosa Blvd and Piñon and 2) between Hot Springs and Highway-84, the discrepancies between volumes at the study intersections were large so an intermediate intersection was created to balance the volumes.

An existing year origin-destination (OD) matrix was developed for routes between each TAZ. The factors influencing the number of trips between each TAZ were determined by Fehr & Peers based on proximity, existing land use, and the counted turn volumes. This OD matrix served as the input basis for VISUM.

The balanced turn volumes were entered into VISUM along with the existing lane geometries for each of the study intersections. With the base OD matrix and balanced turn volumes for each study intersection, VISUM is capable of creating vehicular routes that will match the balanced turning volumes. This function was performed and a final existing OD matrix was produced. The results are shown on Figures A-13A and A-13B: Existing Transportation 2006.

2020 and Ultimate Build-out Scenarios Model Set-up

The final existing OD matrix was used as the base OD matrix for future conditions. The amount of traffic demand growth added to the existing OD was based on the amount of residential and commercial growth in each TAZ. The residential growth and commercial growth numbers were based on the difference between the future year conditions and existing 2006 land use numbers. A generalized trip rate for residential dwelling units and commercial area was calculated based on ITE Trip Generation rates for a representative cross section of land use types. The generalized trip rates are summarized below in Table E-1.

Table E-1. Generalized Trip Rates for PM peak hour

	Total	In	Out
Residential (dwelling unit)	0.96	0.61	0.35
Commercial (1000 ft²)	4.01	1.79	2.22

The new trips were assigned to each TAZ based on growth. For each future year scenario, a growth OD matrix was created. The factors influencing the number of trips between each TAZ were based on proximity and land use intensity. The growth OD matrix was added to the final existing OD matrix to come up with the scenario OD matrix. The scenario OD matrix was used in vehicle assignment process for each scenario to determine travel demand on the roadways.

Roadway Network Changes

The future year scenario OD matrices were assigned to the existing roadway network and it was found that the existing network would not have sufficient capacity to serve the traffic demand in 2020 and beyond. Highway 160 was found to be over capacity in at least one direction from east of the Highway 84 junction to Pagosa Blvd in 2020. The PM peak hour vehicular traffic demand increases from 2,300 vehicles in 2006 to 6,800 vehicles in 2020 and 14,800 in the ultimate build-out. In order to relieve traffic demand on Highway 160 through Pagosa Springs, additional roadways were modeled.

2020 Transportation Network

The following describes the changes made to the existing Pagosa Springs roadway network in the 2020 scenario and the build-out scenario. The changes made to the 2020 network were carried over into the build-out network unless stated otherwise.

For the 2020 scenario, no additional lanes were added to Highway 160, as shown on Figures A-14A and 14B: 2020 Transportation Model. Two east-west connector streets running parallel to Highway 160 were added to the network. Each connector road was coded as a two-lane roadway with left-turn lanes coded at each intersection. One connector road was coded into the VISUM model south of Highway 160 starting at Pagosa Blvd and connecting to the intersection of 8th Street/Apache Street. The other connector road was coded into the VISUM model north of Highway 160 starting at Highway 160/Timber Ridge and connecting into 8th Street just north of Highway 160. In addition, a short two-lane connector road was created between the Junction of Highway 160/Highway 84 and 2nd Street (Snowball Road) to give the opportunity to westbound traffic destined for that area to exit Highway 160 before 2nd Street.

Buildout Transportation – Beyond 2020

The build-out scenario VISUM model used the same configurations for the connector roads as the 2020 model. Further changes were made to the build-out scenario. Highway 160 was changed to a 4-lane arterial through the study area. A two-lane bypass was created from roughly Pagosa Blvd/Capricho Circle to CR 119 and ultimately to Highway 84/Tierra Deloro Road, as

shown on Figures A-15A and 15B: Buildout Transportation Model.

Model Results

Existing Conditions (2006)

The model shows there is an existing PM peak hour demand of 2,288 trips. No roadway links are over 75% of capacity in 2006, as shown on Figures A-13A and A-13B (Existing Conditions). The locations that carry the largest volumes are near downtown Pagosa Springs and westbound Highway 160 between 8th Street and Piedra Road. The existing roadway network appears to be sufficient for the existing travel demand in Pagosa Springs.

2020

The model shows there is a PM peak hour demand of 6,856 trips in 2020. Two locations along Highway 160 were determined to be over capacity (red or purple links) in 2020, as shown on Figures A-14A and A-14B. The locations are:

- WB Highway 160 between Timber Ridge and Pinon (near the proposed Lakes Town Center development).
- WB Highway 160 between 2nd Street and development east of Highway 84 (near the proposed Sawmill Town Center development).

For the over-capacity link near the Lakes Center Town Center there is excess capacity still on the southern east-west connector that might be used by drivers destined further west than Lakes Center.

The over-capacity links on Highway 160 near the Sawmill Center have no parallel roadway that could alleviate some of the future demand of the development around this area. This section of Highway 160 is currently a two-lane roadway. This section is over capacity even with the short connector from Highway 84 to Snowball Road.

The east-west connectors appear to alleviate enough demand from Highway 160 so that all three facilities will operate satisfactory in the year 2020. Highway 160 still carries the majority of the east-west traffic.

Buildout

It was calculated that there is a PM peak hour demand of 14,775 trips at buildout of the future land use plan. This is more than twice the demand of the 2020 scenario. As expected, more locations were found to be over capacity in the buildout scenario, even with the increased capacity on Highway 160 and the addition of the bypass south of town. The following locations are at or over capacity in the build-out, as shown on Figures A-15A and 15B:

- WB Highway 160 from just east of Highway 84 to Great West Avenue (near the Sawmill Town Center and the Downtown Center) and from Majestic Drive to Piedra Road.
- EB Highway 160 from Timber Ridge to Piedra Road and from Great West Avenue to 4th Street (near the Downtown Center).
- The entire bypass is over capacity, but the 800 vphpl might be a low estimate for capacity since there will be no signalized intersections along most of the bypass.
- Highway 84 from the bypass junction to CR 302.
- Downtown Pagosa streets (surrounding the Downtown Center)

The Downtown Center and the Sawmill Center will have the most concentrated capacity. This is due to the large amount of land use growth, and thus trip demand, of these two areas between 2006 and the ultimate build-out. Trip demand in these areas is exceeding the amount of capacity increase along Highway 160 or parallel facilities. The section of Highway 160 from 4th Street to Highway 84 is over 125 percent capacity even with the widening of Highway 160 to four lanes.

The bypass effectively diverts traffic from Highway 160 around Pagosa Springs and provides another option to accessing the development along Hot Springs Road. The segment of the bypass from Hot Springs Road to Highway 84 carries a large volume in the westbound direction into downtown.

The east-west connector roads carry more traffic on them than in 2020. Traffic increases on Highway 160 are greater in the eastbound direction because of the addition of a full lane all the way through the study area.