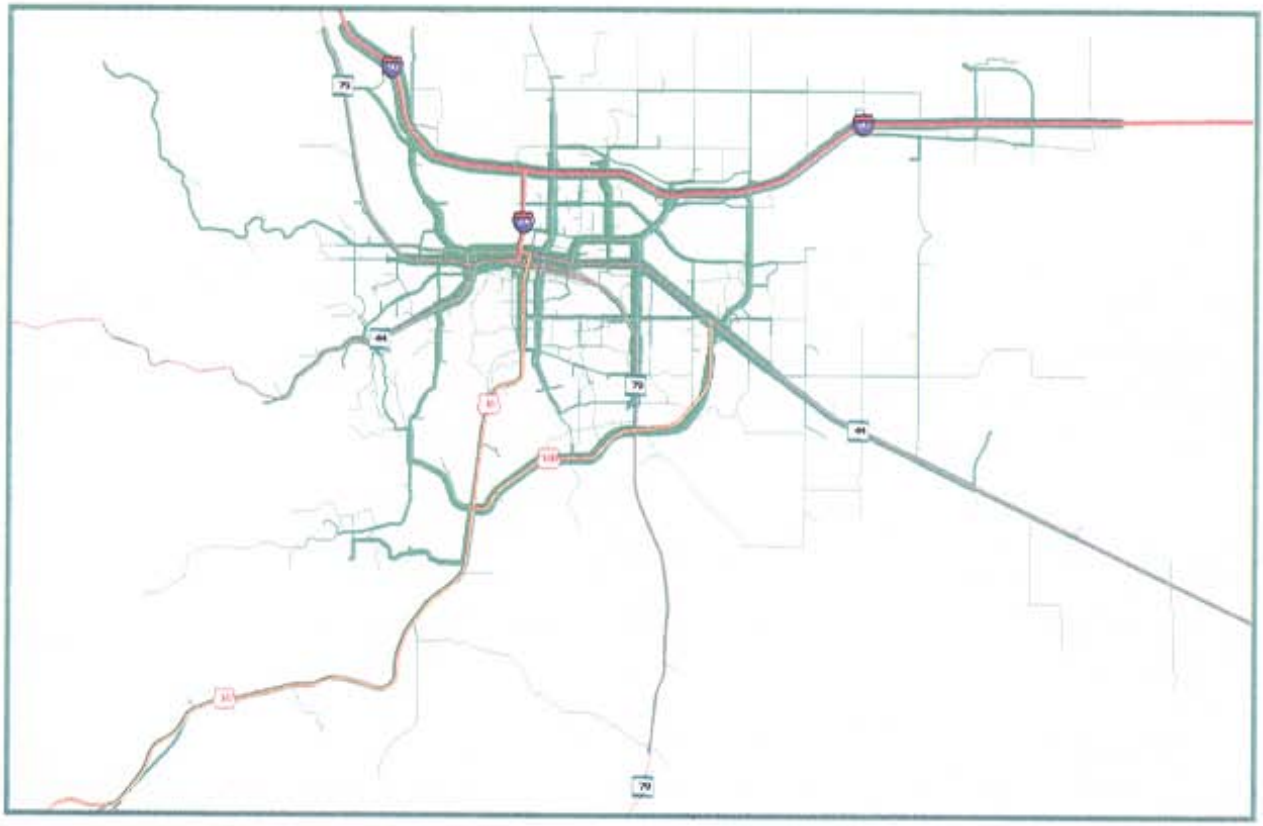
DRAFT REPORT

RAPID CITY TRAVEL DEMAND MODEL
Documentation & Users Guide



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RAPID CITY TRAVEL DEMAND MODEL

Summary of Travel Demand Model Development and Validation

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1. Introduction

Urban areas throughout the United States are required to base their transportation investment decisions on a comprehensive, cooperative, and continuing transportation planning process. A significant element of the transportation planning process involves projecting future transportation demand. The most accepted method of projecting future transportation demand, and for evaluating investment strategies to serve the projected demand, is the use of travel demand and forecasting models. These models utilize socioeconomic data to estimate travel demand with a simulation of the transportation system to represent transportation supply. Together, the socioeconomic data, the simulated network, and mathematical travel models simulate the ability of the transportation system to serve the estimated demand.

Travel models have been implemented using a wide variety of model structures, computer software systems, and data requirements. While it is rare to find two models that have identical model structures, software, and data requirements, the majority of travel models used in the United States are similar in that they include the following basic four steps or components:

1. Trip generation,
2. Trip distribution,
3. Mode split / auto occupancy factors,
4. Traffic assignment.

Until this model development undertaking, the Rapid City Metropolitan Planning Organization utilized a TModel2 model to assist with transportation planning strategies. The TModel2 travel forecasting model was developed in April 1997 by City, MPO and South Dakota Department of Transportation staff. The TModel2 travel forecasting model was a peak hour model and, as such, was intended to produce traffic representative of the evening peak hour (4:30 p.m. to 5:30 p.m.) on an “average” day.

Due to changes in socioeconomic conditions and changes to the transportation network in the Rapid City area, an update was desired. In addition to changes in area streets and demographics, advances in model software prompted a change from the TModel2 platform to the more sophisticated TransCAD platform.

The TransCAD travel forecasting model for the Rapid City Metropolitan Planning Organization makes use of the four basic steps listed above to product travel forecasts. This report documents development of each of these components in detail. In addition, appendices are provided which include tabular data summaries, trip generation program documentation, and detailed validation results for the base year (2000) model. A complete model user’s guide is also included as a part of this documentation.

2. Review of Original Rapid City Travel Model (TModel2)

The TModel2 model developed for the Rapid City area between 1995 and 1997 is a peak hour model, in that it develops travel demand for the evening peak hour period. Model data, including traffic counts, land use, and network characteristics were collected and developed specifically to develop a calibrated model to represent 1995 conditions.

The modeling area encompassed the entire Metropolitan Planning Organization Study Area, and was divided into small geographic areas called traffic analysis zones (TAZ's). The TModel2 model included a total of 145 TAZ's. The development of the TAZ structure considered barriers to travel that would naturally separate land uses, natural loading points in the network, and existing data source structures (US Census data).

TAZ data contains demographic information for each TAZ. The land uses within each TAZ are quantified for use with trip generation to determine the number of trips which originate or are destined for each TAZ. Land use information consisted of the following data for each TAZ:

- Single family dwelling units,
- Multiple family dwelling units,
- Manufacturing, industrial and wholesale employees,
- Military employees,
- Retail employees,
- Drive-through retail employees,
- Office / service employees,
- Medical employees,
- School / public employees, and
- Motel / hotel employees.

Residential dwelling unit data was generated from 1990 Census data at the block level and supplemented by building permit information from both the city and county to bring data to 1995 levels. Employee data was generated from commercial structural square footage data, converted to employees through the use of several conversion factors.

The TModel2 model network contained both links (representing street segments) and nodes (representing intersections). Links were coded to identify numerous link attributes including the following:

- Functional classification,
- Link type,
- Number of lanes,
- One or two-way traffic identifier,
- Capacity,
- Length,
- Design speed,
- Volume, and
- Link delay coefficients.

Dynamic node modeling was utilized in the TModel2 model to enhance modeling intersection delays. To enable dynamic node modeling, node attributes were coded to each intersection node, including the following:

- Node classification,
- Node area,
- Node type, and
- Capacity.

In addition to intersection capacity and delay functions, certain turn movements were prohibited through the use of turn penalties or prohibitions.

TModel is primarily designed to model hourly traffic conditions, and as such both trip generation and link capacities were developed using hourly rates. All trips within the model area were distributed by peak hour origins and destinations according to three trip types; Home based work (HBW) trips, home based non-work (HBO) trips, or non-home based (NHB) trips. Trip generation rates were derived from both local data supplied by city staff as well as data from TModel Corporation. Trips in the TModel2 model were generated as *vehicle trips*, eliminating the need to incorporate adjustments due to auto occupancy or mode share. External traffic counts were utilized to identify those trips entering and exiting the study area at the model boundaries to account for the differential in the total trip origins and destinations within the model boundaries.

For trip distribution and network assignment, the TModel2 model utilized an incremental loading process. Under this methodology, a portion of the total hourly trips are assigned to the network, shortest paths are re-calculated, then the next increment of are assigned. This process is intended to address the notion that a driver, in order to satisfy some travel need, may utilize different routes based on congestion influences.

The TModel2 model was calibrated to meet allowable link errors specified by NCHRP Report No. 255, “Highway Traffic Data for Urbanized Area Project Planning and Design”, and to meet calibration accuracy levels specified by TModel Corporation.

3. Travel Model Development and Validation for 2000 Base Year

To facilitate development of an updated travel demand model for the Rapid City MPO, a "model working group" was formed. The model working group was comprised of City and MPO engineering and planning staff as well as representatives from the South Dakota Department of Transportation. The model working group met at key points during the model development process to provide guidance, make fundamental decisions, and provide critical input during the model development process.

Initially, development of an updated travel demand model was thought to primarily involve a *conversion* of the TModel2 model data and procedures to allow execution on the TransCAD model platform. It was discovered, however, that a direct conversion was not feasible since direct one-for-one conversions for the TModel2 methodologies, parameters, and data files was not possible. The TransCAD and TModel2 platforms were just too different in their organization and structure to accommodate a direct conversion. Additionally, it was desired that the updated model have the ability to model daily as well as time-of-day traffic, a process not possible with the TModel2 platform. Finally, the input data used for the peak hour TModel2 model such as roadway network capacities and trip generation rates were *hourly* in nature, and did not lend themselves to a direct conversion for a daily model. Lastly, the TModel2 model generated trips as *vehicle* trips, eliminating the flexibility to model differing auto occupancies or mode splits, a feature desired for the updated model.

Based on these factors, it was decided that the updated model would essentially be a completely new model. This decision, while requiring some additional work, offered much in the way of flexibility and the ability to build a model capable of future enhancements and improvements.

3.1. Model Validation Procedure

Data available for validation of the Rapid City model consisted primarily of base year (2000) traffic count data and US Census travel data. No current behavioral data was available such as a recent origin/destination study. Only very limited travel time survey data was available. As a result, the 2000 validation process focused on using the following measures:

- Matching external station volumes,
- Matching traffic volumes on specific roadway links and across corridor screen lines, and
- Achieving reasonable trip length distribution for HBW trips.

The model development & calibration process included the following primary steps:

- Begin with the previous TModel2 model.
- Revise TAZ structure to reflect current development, revised census block or block group boundaries (changed since TModel2 development), and to provide additional detail in developed areas.
- Update TAZ socioeconomic data to year 2000 levels

- Obtain GIS centerline files for streets and revise for use with travel demand modeling.
- Develop model input parameters and procedures to give the model the ability to reproduce observed 2000 traffic conditions on a screen line and individual link basis.
- Develop a procedure for final adjustment of future year traffic projections on an individual link basis based on a comparison of 2000 model results vs. 2000 traffic counts.

Calibration procedures have, where possible, been conducted based on recommendations detailed in:

- NCHRP Report No. 187, Quick-Response Urban Travel Estimation Techniques and Transferable Parameters User's Guide, 1978

- NCHRP Report No. 255, Highway Traffic Data for Urbanized Area Project Planning and Design, 1982

- NCHRP Report No. 365, Travel Estimation Techniques for Urban Planning, 1998

The process of model calibration has been detailed and iterative with numerous test runs conducted. The lack of behavioral survey data means that the basic parameters, such as trip rates by area, average trip length, value of time, and auto occupancy are not known and must be estimated in the validation process. The selected parameters are each dependent upon each other. The lack of survey data may mean that once other data is available, such as the journey to work data from the Census Bureau, there may be a need for readjustments to some of the model parameters.

3.2. Traffic Analysis Zone Structure

The TModel2 documentation was utilized to develop working maps showing the existing TAZ structure. The existing model TAZ structure contains 129 TAZ's for the MPO planning area, and utilizes 16 external stations to handle trip-making to/from areas outside the modeling area. With the exception of areas outside Pennington County to the north, the TModel2 TAZ's cover roughly the area included within neighborhood planning boundaries. The TModel2 TAZ structure utilizes small TAZ areas within the downtown area of Rapid City (typically 3-4 blocks per TAZ), with TAZ's increasing in size towards the limits of the modeling area.

The existing TAZ structure was compared to current census block, block group, and tract structure. While the TModel2 TAZ structure coincided with some block, block group or tract boundaries, many TAZ boundaries were independent of the census data structure. The TAZ structure provided from the US Census department was also evaluated. It was found to contain only 73 TAZ's for the entire county, a structure too coarse for the purpose of modeling the urban area of Rapid City.

It was also noted that the neighborhood planning boundaries used for urban area land use planning extended beyond the county boundaries, something that the current TModel2 does not do. Since the US Census data was not available beyond the county boundary, it was decided not to extend TransCAD model TAZ's beyond the extent of the county either. External stations will be used to model trip-making to/from areas beyond the county boundary.

Considering the ability of City/MPO staff to easily update land use data and/or utilize data available from other sources (US Census, Bureau of Labor, etc.), a new TAZ structure was developed for use with the TransCAD model that utilizes Census Blocks as the basic unit or 'building-block' for TAZ's. It was recommended that the new TAZ structure closely follow the existing TModel2 TAZ structure by combining census blocks to form TAZ's. Splitting of census blocks is not recommended. The resulting TAZ structure makes it possible to "extract" data from census block or smaller geographic areas (blocks or parcels) directly into the TAZ structure. This will make it easier to perform demographic data updates at periodic intervals, or to further refine the TAZ structure if desired.

The TAZ structure building process resulted with 210 TAZ's for the MPO planning area and 16 additional TAZ's as external stations to handle trip-making to/from areas outside the modeling area. The new TAZ structure represents an increase of 81 TAZ's when compared to the TModel2 model, and includes a modeling area of 228 square miles, approximately the same area as the TModel2 model.

The TAZ numbering scheme was developed to keep consecutive number blocks for each neighborhood planning area. The TAZ numbering system, with respect to each neighborhood planning area is shows below:

NEIGHBORHOOD	TAZ NUMBERS
Downtown / Skyline	1-67
North Rapid	68-91
West Rapid	92-115
Southwest Connector	116-117
South Robbinsdale	118-127
Elk Vale Road	128-138
Box Elder	139-147
Northeast	148-157
Deadwood Avenue	158-165
Black Hawk	166
Nemo Road	167-171
Sheridan Lake Road	172-185
Spring Creek	186-188
Southeast Connector	189-204
Airport	205-210

The additional TAZ's will improve model sensitivity throughout the modeling area, especially in areas experiencing, or anticipated to experience significant growth. The revised TAZ structure is illustrated in Figures 1 and 2.

Figure 1 - Rapid City Model Traffic Analysis Zone Structure – Outlying TAZ's

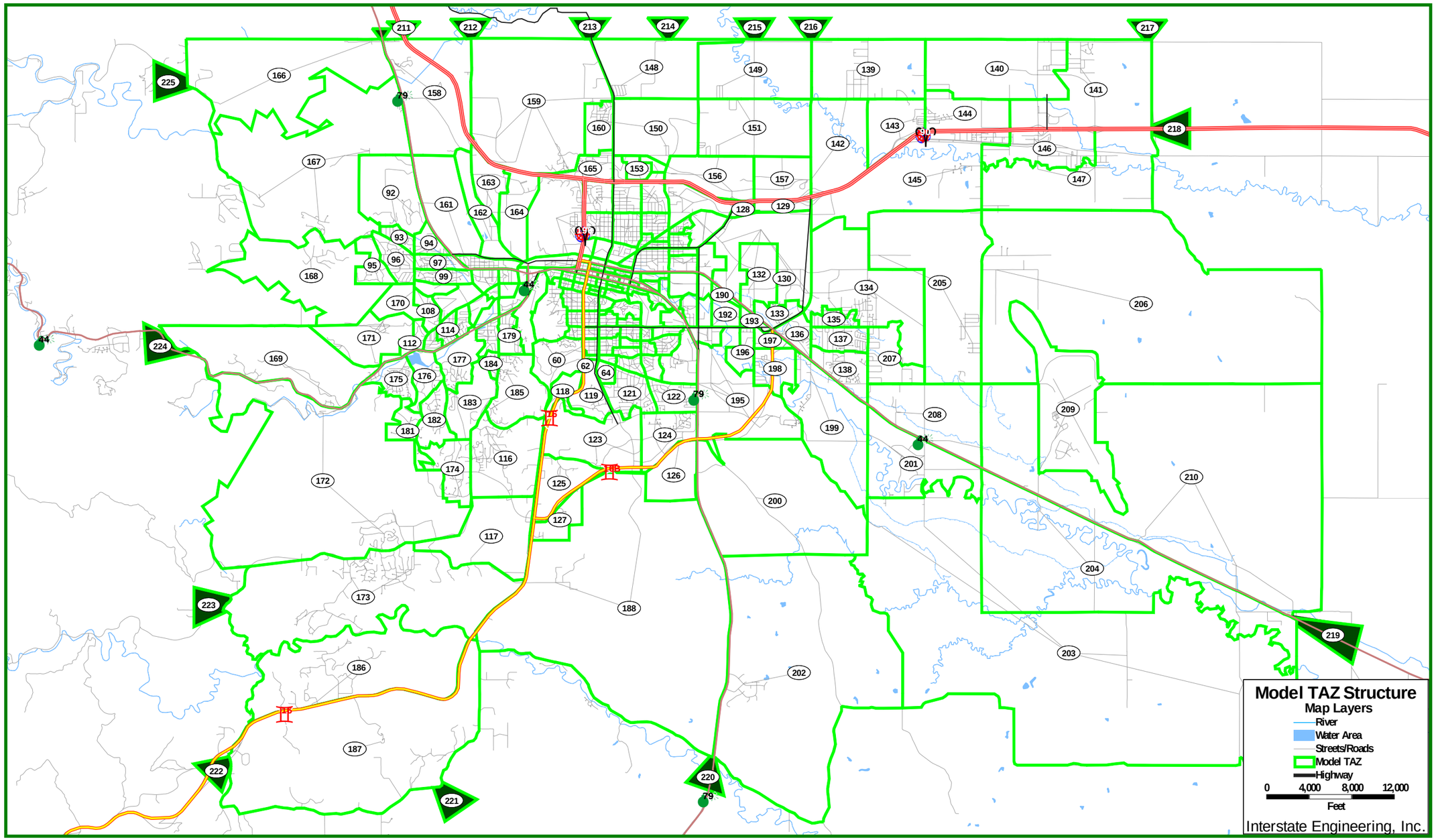
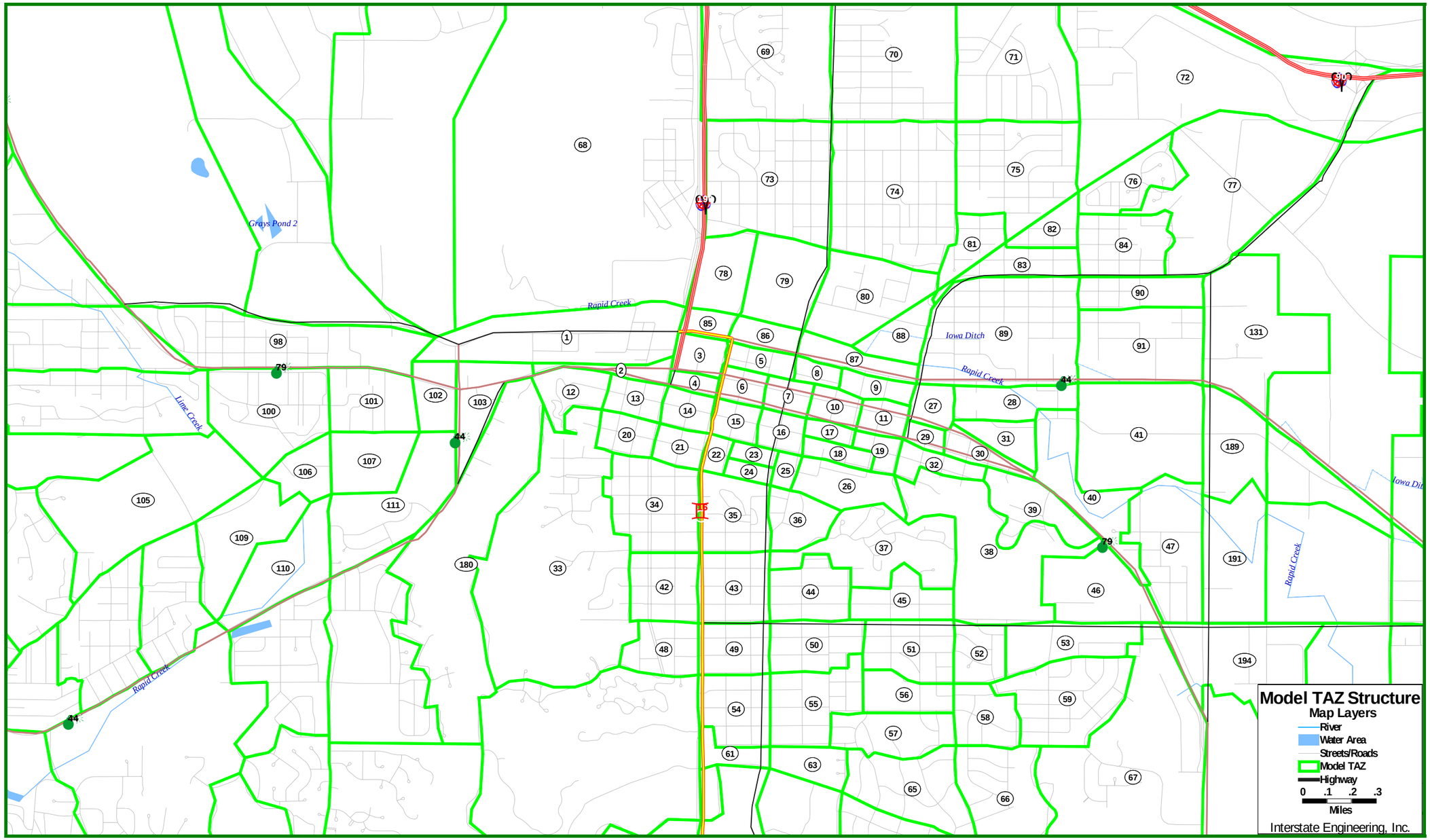


Figure 2 - Rapid City Model Traffic Analysis Zone Structure – Urban Area Detail



3.3. Year 2000 Land Use Data

Travel demand models require land use data representative of both residential uses and non-residential (employment) uses. Traditionally, residential land uses were tabulated in terms of dwelling units or households. Household data is typically stratified further by some variable indicative of wealth (household income, auto ownership, etc.) and/or some indication of household size.

Non-residential data is typically represented in terms of employees of various types, usually retail, service, and other. Some models simplify employment to just retail and non-retail.

The Rapid City MPO maintains an extensive database of socioeconomic data at the parcel level through their GIS. As with the TModel2 model, base year land use information was provided in ten different categories:

1. Single family residential
2. Multi-family residential
3. Manufacturing
4. Military
5. Retail
6. Drive-through retail
7. Office / service
8. Medical
9. School / public
10. motel / hotel

The GIS was able to provide accurate data regarding numbers of households throughout the modeling area. In addition to the MPO GIS data, household data was further supplemented by US Census Bureau data, enabling development of household stratifications at the census block group level for household size and income.

The Rapid City MPO GIS data was also utilized to build a database for non-residential socioeconomic data. Although the GIS database did not contain employment information, non-residential structure square footage information was available that, together with appropriate conversion factors, would yield reasonable estimates of employment within each parcel. The TModel2 model utilized a similar conversion factor system to develop non-residential employment data. Conversion factors utilized by the TModel2 model (where applicable) are summarized in Table 1.

Table 1 - TModel2 Employment Conversion Factors

Land Use Category	Units	Conversion to Employees
Single Family Residential	Dwelling Units	N.A.
Multi-Family Residential	Dwelling Units	N.A.
Industrial	Square Feet	1,000 S.F. / 0.64
Military	Employees	N.A.
Retail	Square Feet	1,000 S.F. / 0.64
Drive-through Retail	Square Feet	1,000 S.F. / 0.36
Service	Square Feet	1,000 S.F. / 0.64
Hospital	Square Feet	1,000 S.F. / 0.31
School	Employees	N.A.
Motel / Hotel	Rooms	N.A.

Non-residential land use data for the TransCAD model was provided in a similar format, although with more non-residential categories. Similar conversions were utilized to develop the number of employees of different types for each TAZ. For the TransCAD model, employment for each TAZ was estimated for the following three categories utilizing a spreadsheet model that performed estimates at the parcel level, and then aggregated results to the TAZ level.

1. Retail employment,
2. Service employment, and
3. Other Employment

Conversion factors utilized for the TransCAD model are summarized in Table 2.

Table 2 - TransCAD Employment Conversion Factors

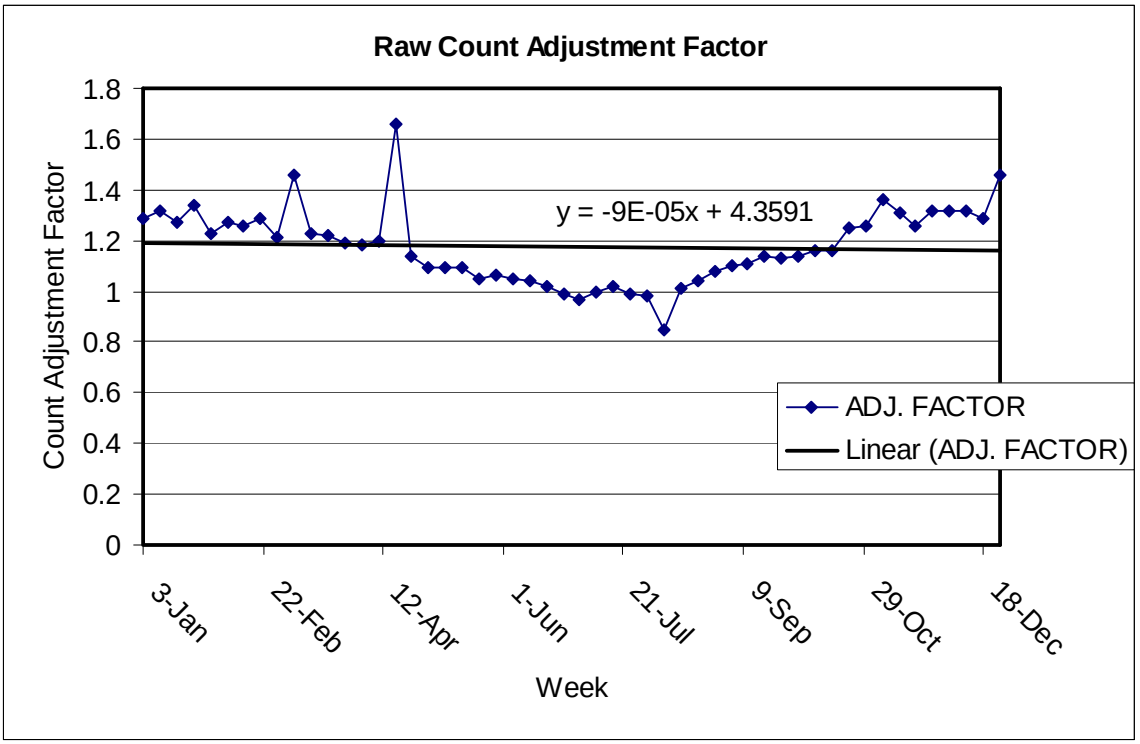
Land Use Category	Units	Conversion to Employees
Retail	Square Feet	1.56 Emp. / 1,000 Sq.Ft.
Drive-through Retail	Square Feet	2.78 Emp. / 1,000 Sq.Ft.
Service	Square Feet	1.56 Emp. / 1,000 Sq.Ft.
Hospital / Medical	Square Feet	3.23 Emp. / 1,000 Sq.Ft.
Warehousing / Manufacturing	Square Feet	1.56 Emp. / 1,000 Sq.Ft.
Elementary School / Daycare	Square Feet	1.11 Emp. / 1,000 Sq.Ft.
High School	Square Feet	2.86 Emp. / 1,000 Sq.Ft.
Hotel / Motel	Square Feet	0.50 Emp. / 500 Sq.Ft.
Campground	Sites	N.A.
Office	Square Feet	3.03 Emp. / 1,000 Sq.Ft.
Special Generator	N.A.	N.A.

3.4. Year 2000 Traffic Count Data

Traffic count data was compiled from available MPO and SDDOT sources for use with model calibration. Traffic count data was available at over 300 locations from City/SDDOT traffic count locations that are routinely counted on an annual basis. The SDDOT maintains permanent count stations at four locations. At most of the City count locations, peak season average daily traffic (PSADT) data was available for each year from 1995 to 2000.

The City of Rapid City routinely factors raw count data to develop a peak season average daily traffic figure that is utilized for design and planning. Depending on the week raw counts are collected, the data is factored to develop a PSADT. Figure 3 shows the factors used to convert raw traffic counts to a PSADT.

Figure 3 - Raw Count Conversion Factors to Achieve PSADT

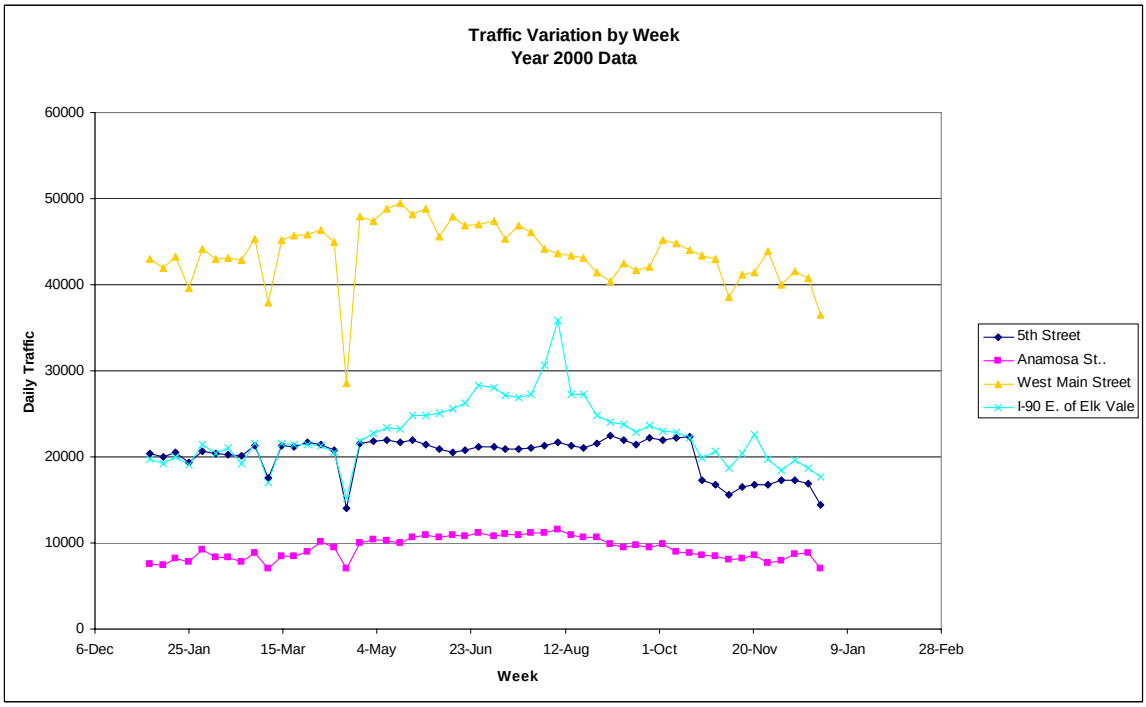


As the table shows, the peak season, when compared to annual average is about 20% higher (factor of 1.20). The City developed the adjustment factors based on variations of traffic evident with SDDOT permanent count stations.

Data at SDDOT permanent count stations was available showing daily traffic totals for a complete year. Data from these permanent count stations has been utilized by the City as the basis for adjusting count data throughout the city. The average weekday traffic for the four permanent count stations is shown in Figure 4. As the figure shows, significant seasonal variations in average weekday traffic are only evident for the I-90 location.

Although other locations show seasonal variations, the magnitude is not as pronounced as it is for the I-90 station. Based on this data, the validity of adjusting city street count data to 120% of average annual to achieve a peak season value is questionable.

Figure 4 - Seasonal Variation of Traffic, SDDOT Permanent Count Station Data



Since the travel demand model is developed using demographics that are representative of average annual conditions (schools in session), and since trip generation factors are representative of average weekday conditions, traffic count data received was adjusted to represent average annual daily traffic. With the exception of SDDOT count data (which is not initially adjusted to a PSADT value), all City counts were reduced by 20% to represent average annual weekday traffic volumes (AAWDT) for purposes of model calibration.

Traffic count data was entered into the model network and used as the primary source of data for model calibration. Each count location was coded with a unique "count ID" value to assist with future updates as traffic count data is updated. In addition, the "count ID" values were also provided to City staff for consistency.

3.5. Roadway Network

The roadway network utilized for traffic model development was based on GIS street centerline files obtained from the Rapid City MPO. The street centerline files included coverage for all streets, roads and highways in Pennington County. The detail and coverage of the GIS centerline files was much greater than what was needed for the travel

demand model. Subsequently, some modifications were necessary to prepare the centerline files for travel demand modeling. Modifications are detailed in the sub-sections that follow.

3.5.1. Functional Classification

Functional classes utilized with the Rapid City Major Streets plan were already coded to the street centerline files. The codes indicating functional classification are listed below:

0 – Alley or non-standard roadway
1 – Interstate highway
2 – Interstate ramp
11 – Principal arterial
21 – Minor arterial
31 – Collector
41 – Local
42 – Private road

Codes indicating functional classification are retained in the model network, but are not used directly for model execution. Functional class codes were utilized to assist with coding of other network attributes, and are utilized for reporting model statistics and creating network graphics. As part of the travel model development process, functional class codes were examined for accuracy and corrected where necessary.

3.5.2. Area Types

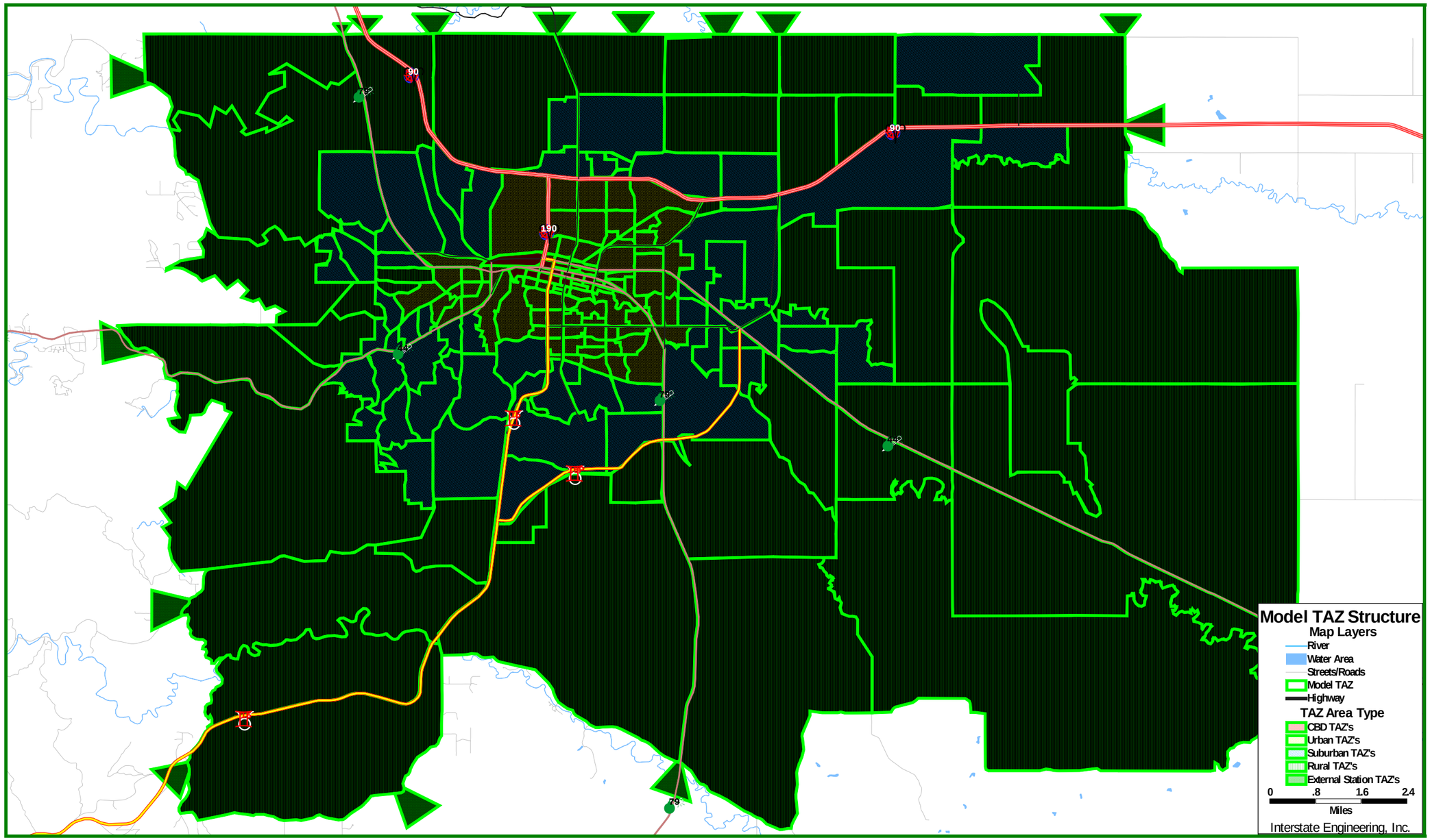
Within the modeling area, four distinct "area types" were established to assist with model parameter development. Area types have been coded to network links and TAZ's as follows:

CODE	AREA TYPE
1	Central Business District (CBD)
2	Urban
3	Suburban
4	Rural

The use of area type codes allows for a distinction of roadway operational characteristics based on the differences that occur between the different area types. For example, a principal arterial will have distinctly different operational characteristics if situated in a CBD environment as opposed to being situated in a rural environment.

Area types were utilized to assist with coding of link data, including assignment of terminal and access times for TAZ centroid connector links. Figure 5 shows the assignment of area types throughout the model area.

Figure 5 - Area Type Distribution



3.5.3. Vehicular Speeds

Vehicle, or travel speeds must be established for each roadway link for development of travel times used for trip distribution and traffic assignment. In general, actual posted speed limits were already coded to GIS centerline file links. As part of the model development process, speed limits coded to individual links were checked for accuracy and corrected where necessary.

Speed limits may not necessarily be representative of travel speeds on model corridors due to many factors such as congestion, intersection delays, temporary lane blockages due to left turn maneuvers or parking maneuvers, etc. For purposes of developing the model network, a data field called "model speed" was added. Initially set equal to posted speed limits, this field was utilized to represent actual travel speeds and to aid with calibration of model assignments. This way, the original coded "speed limits" remained unchanged as they may be useful for other purposes.

3.5.4. Roadway Daily Link Capacities

Roadway link capacity is a necessary input for the model network not originally present in the GIS centerline data. Link capacities are utilized to adjust link travel times (speed) as volumes approach capacity.

Link capacities are a function of the number of lanes, but are also influenced by other factors such as peak hour factors, type of intersection controls, percent trucks, green-to-red cycle length ratios at signalized intersections, etc. Determining actual capacities for each link in a network is extremely time consuming and was not performed for this initial model development. Instead, generalized capacities were determined for links based on functional class, number of lanes, and area type. Link capacities were further refined during the model calibration process.

Additionally, development of a 24-hour model requires determination of 24-hour capacities, since streets carry varying flows during different periods of the day. Typically, peak flow rates occur during the morning and evening peak hours, or "rush hours". For most urban communities, peak hour traffic represents 8-10% of the all-day volume present on a facility. In addition, peak hour traffic rarely has a 50/50 directional distribution split. Typically, directional splits during peak hours are closer to 60/40.

Finally, "capacity" is a relative term that may have different meanings to different individuals, or even from one community to another. The Highway Capacity Manual defines Level of Service (LOS) to quantify roadway operating characteristics. Much like school grades, LOS A represents excellent operating characteristics of minimal delay and great freedom to maneuver while LOS F represents extremely congested conditions, long queues and delays, and little or no freedom to maneuver. While large urban areas may define LOS D, or even LOS E as the minimum acceptable condition for planning, urban areas the size of Rapid City (80,000 population) typically view LOS C as an acceptable

minimum for design and planning. Based on procedures of the Highway Capacity Manual, values of link LOS can be generally related to volume-to-capacity ratios (v/c) as shown in Table 3.

Table 3 - Level of Service Related to V/C Ratio

Link V/C Ratio	Approximate Link Peak Hour LOS*
0.0 to 0.60	A
0.61 to 0.70	B
0.71 to 0.80	C
0.81 to 0.90	D
0.91 to 1.00	E
> 1.00	F

Using typical values that relate daily to peak hour volumes, and based on directional splits common during peak hour periods, 24-hour "capacities" can be developed for use with 24-hour assignments that will reflect v/c conditions (and congestion) that typically occurs during peak hour periods. The relationship is written as follows:

> V/C = [ADT x 0.10 x 0.60] / [(number of directional lanes) x (per lane per hour capacity for that facility type and area type)]

For purposes of this model, roadway capacities by facility type and area type were initially set utilizing recommendations of NCHRP Report No. 365, Tables 52-58. Representative hourly capacities for various facility types and area types are listed in Table 4.

Table 4 - Representative Per Lane Capacities (vehicles per hour per lane)

Facility Type	Area Type	Hourly Per Lane Capacity
Freeways	Suburban/Rural	1,800
Divided Multi-lane Highway	Rural	1,800
Divided Multi-lane Highway	Suburban	1,600
Two Lane Road	Suburban/Rural	1,500
Single Lane Signalized Intersection Approach	Urban/Suburban	825
Two Lane Signalized Intersection Approach	Urban/Suburban	825
Collector – All Way Stop Control Intersection	Urban/Suburban	750

Utilizing representative values for hourly per-lane capacity listed in NCHRP Report No. 365, a "Link Type Look-up Table" was developed for use with the Rapid City TransCAD model. The table is used by TransCAD as a "look-up" table to assign capacity to each link based on a link type code established for each model link utilized in the travel

demand model. Over 80 different link types were established to allow easy global changes to daily capacity based on facility type, area type, one-way or two-way flow, and different numbers of directional through lanes.

In general daily per-lane capacities for different facility types were established as follows. A complete listing of the link type look-up table is included in Appendix A.

Facility Type	Daily Per-Lane Capacity
Interstate	15,000 - 18,000 vpd
Principal Arterial	8,500 – 14,000 vpd
Minor Arterial	8,250 – 10,000 vpd
Collector	5,500 – 8,250 vpd

3.5.5. Terminal Times

Terminal time is time added to the end of each trip to simulate zonal access time and time to reach the model network (time on local streets to reach collector network). These times are coded to the TAZ centroid connector links and vary with area type to simulate distance of travel (time). Network access times coded to TAZ centroid connectors are as follows:

Area Type	Terminal Time
1 – CBD	1.00 minutes
2 – Urban	1.00 minutes
3 – Suburban	2.00 minutes
4 – Rural	3.00 minutes

3.5.6. Year 2000 Roadway Network Revisions

While the GIS centerline files formed a solid basis for development of the TransCAD model network, some revisions were necessary due to differences with the way ArcInfo and TransCAD treat line files. For instance, when two lines (streets) cross, ArcInfo creates a node at their junction as if an intersection existed. ArcInfo does not have a way to allow two lines (streets) to cross without an intersection node. In locations where grade separations exist (overpasses or underpasses), revisions were required within TransCAD to allow two intersecting lines *without* a resulting node (intersection).

Other revisions were required to identify the correct direction of flow (traffic flow) where the line's topology did not indicate the correct direction. TransCAD uses a "DIR" field to differentiate one or two-way flow, and to indicate if the one way flow is with, or opposite the link's topology. Lastly, many links in the GIS centerline file were not "connected". The centerline file links used as model links were carefully checked for connectivity, a necessary condition for conveyance of vehicle flows.

Most significant network revisions related to adding data fields to links. While the GIS centerline file contained many fields necessary for modeling, they were not set up for

modeling. To retain the centerline data as originally supplied (for other purposes), additional data fields were added and some existing fields were re-named. Significant changes to link data are summarized below. A complete listing of model link data fields and their use/meaning is included in Appendix A.

DATA FIELD	CHANGE
Lanes	Changed to "Total Lanes"
LANES	Added as field to indicate directional through lanes
Network_ID	Added to indicate links to be included in specific network scenarios
Model Speed	Added to indicate modeled traffic free-flow speed
Count_ID	Added to code link ID's to links with traffic count data, also useful for post-processing model output and updating link counts for future model updates (same ID is coded to City traffic count spreadsheet)
Link Type	Added to allow coding of link types specific for facility type, area type, one or two-way flow, and number of lanes
TravTime	Added to show free-flow travel time across a link using Model Speed and link length

3.6. Trip Generation

Trip generation is the step in the modeling process that utilizes the land use data (socioeconomic data) to calculate the trip making characteristics (person trips) of each TAZ that will eventually be modeled on the roadway network. In this process, person trips are classified into three main trip purposes as follows:

1 HBW – Home Based Work Trips
2 HBO – Home Based Non-work Trips
3 NHB – Non-home Based Trips

These trip purposes are consistent with the TModel2 model and allow travel characteristics associated with each to be quantified separately in many different aspects (average trip length, auto occupancy, variation by time-of-day, etc.).

Many factors influence the amount of travel in a region, including automobile ownership, income, household size, density and type of development. Most travel demand models make use of disaggregate socioeconomic data, such as households classified by vehicle ownership, households classified by family size, or households classified by income to determine the amount of travel generated in the region.

The trip generation model used for this project estimates trip *productions* and trip *attractions* separately. In describing the direction for a trip, the term *origin* refers to the starting point while the term *destination* refers to the ending point. However, the trip ends at the household are called productions, while the trip ends at nonresidential land

uses are called attractions. Hence, the production-attraction format does not indicate the true direction of travel as opposed to the origin-destination format.

Trip generation models consist of two sub-models: trip production models and trip attraction models. While household data is used to estimate trip productions, employment data is the primary data used to estimate trip attractions. Each model is discussed separately in sub-sections which follow. Also discussed within this section are special generators (zones where productions and attractions are calculated separately), trip generation procedures for external trips (trips with either an origin or destination outside the model area), and procedures for estimating through trips (trips with neither an origin nor destination within the model area). Lastly, procedures for balancing trips to obtain an equal number of productions and attractions are discussed.

3.6.1. Trip Production Model

Trip productions are associated with the traveler's home. For instance, if a person went from home to work in the morning, and then went from work to home in the evening, the traveler would have generated two productions at the home TAZ and two attractions at the work TAZ. Households, or the number of family units, are the primary data source for estimating trip productions.

Many different sources are available for estimating trip rates per household. While some sources consider only the number of households, studies have shown that when households are stratified by a second variable (household size, income, or auto ownership), more realistic results can be obtained. In addition, it was found that trip rates varied by the size of the urbanized area.

To develop trip rates for the Rapid City TransCAD model, several sources were consulted, including NCHRP Report No. 187, NCHRP Report No. 365, and documentation included with the TransCAD software platform.

Using the year 2000 household data, several trip production models based on national data were tested. The results of initial production models are shown in Table 5.

Table 5 - Initial Production Model Results

Method	Total Daily Person Trip P's	Daily HBW Person Trip P's	Daily HBO Person Trip P's	Daily NHB Person Trip P's	Daily P's per HH	Daily P's per Person
Cross-Classification using Avg. HH Income and Avg. HH Size.	350,244	66,939	196,840	86,464	11.35	4.43
Cross-Classification using Avg. HH Income and Sub-Classification of HH Size.	300,589	59,216	170,125	71,248	9.74	3.80
Cross-Classification using Avg. HH Size and Avg. Autos/HH.	341,742	65,314	192,026	84,401	11.07	4.33
Cross-Classification using Avg. HH Income and Avg. Autos/HH.	374,041	75,826	208,105	90,110	12.12	4.73

* Population = 79,006
* Households = 30,860

The initial production model results were compared with available local data, including a trip generation rate study conducted by the Rapid City MPO in 1995, and with available work trip data from the 1990 census. Factoring 1990 census data (trips to work by mode) to year 2000 levels indicated that about 77,000 daily HBW trips could be expected from the model area. Additionally, local trip generation rate studies indicated that vehicle trip productions per household in the Rapid City area averaged about 12 trips per day. Based on these comparisons, and considering available data, household data cross-classified by average household size and auto ownership was determined the best method for estimating productions for the Rapid City area.

It was recognized that the selected method under estimated HBW trips by about 15%. Consequently, the NCHRP Report No. 365 trip rates contained in the production model supplied with TransCAD were adjusted to compensate. A custom production rate table resulted that is utilized for the Rapid City TransCAD model. The results of the trip production model for the year 2000 household data are summarized in Table 6. Complete trip production results by TAZ are included in Appendix B.

Table 6 - Trip Production Model Results, Year 2000 Model

Total Daily Person Trip P's	Daily HBW Person Trip P's	Daily HBO Person Trip P's	Daily NHB Person Trip P's	Daily P's per HH	Daily P's per Person
403,307	77,078	226,625	99,604	13.07	5.10

3.6.2. Trip Attraction Model

Trip attractions are the trip end associated with the non-home end of a trip, such as a workplace, shopping center, or school. Trip attractions are estimated based on employment within each TAZ. While the older NCHRP Report No. 187 considered only two types of employment (retail and non-retail) for its trip attraction model, the more recent NCHRP Report No. 365 utilizes three categories of employment (retail, service, other). An additional option for the trip attraction model would be to utilize site-specific vehicle trip rates, such as are published in the ITE reference "Trip Generation". Drawbacks to this method are the availability of site-specific data for each TAZ, and the existence of an applicable rate for each land use. Additionally, the use of vehicle trips for attractions limits the model's ability to perform modeling of mode shifts or changes to auto occupancy.

For this model, the NCHRP Report No. 365 methodology was selected for the trip attraction model. That methodology uses four formulas to calculate attractions for HBW, HBO, and NHB purposes. The model formulas are listed in Table 7.

Table 7 - Person Trip Attractions by Purpose

HBW Attractions = 1.45 x Total Employment
HBO Attractions CBD = 2.00 x CBD RE + 1.7 x SE + 0.5 x OE + 0.9 x HH
HBO Attractions NCBD = 9.00 x NCBD RE + 1.7 x SE + 0.5 x OE + 0.9 x HH
NHB Attractions CBD = 1.40 x DBD RE + 1.2 x SE + 0.5 x OE + 0.5 x HH
NHB Attractions NCBD = 4.10 x NCBD RE + 1.2 x SE + 0.5 x OE + 0.5 x HH + 2.25 x CG*

where:

CBD RE	= Retail Employment in Central Business District Zones,
NCBD RE	= Retail Employment in Non-Central Business District Zones,
SE	= Service Employment,
OE	= Other Employment (Basic and Government), and
HH	= Households
CG	= Camp Ground Sites

* Campground rate added to NCHRP #365 procedure for Rapid City Model

Model trip attractions were calculated with an Excel spreadsheet model separate from the TransCAD modules for ease of data manipulation and rate-changes. The spreadsheet uses square footage of non-retail space in each category as input, and results with attractions (person trips) summed by TAZ as output. Resulting trip attractions by TAZ are included in Appendix B.

3.6.3. Special Generators

Special generators are zones that exhibit trip making patterns that are not consistent with the attraction rates discussed above. Special generator zones typically include large or intense trip-attracting facilities where employment would not produce attractions of a

magnitude actually experienced by the land use. Special generators typically include such land uses as universities, shopping malls, airports, etc. When identified as special generators, separate attraction models are utilized in addition to the model discussed in the previous section.

To identify which land uses should be analyzed as special generators, a comparison of production and attraction model-generated trips was made to trips estimated for a specific land use using the ITE reference "Trip Generation". Initially, 120 land uses (parcels) were identified within 76 different TAZ's that might qualify to be treated as special generators. Attractions were formulated for these TAZ's given their household and employment data. In addition, ITE trip rates were also utilized to calculate trips associated specifically with the suspected special generator land use. Then a comparison was made of total attractions. Where the suspected special generator land use attractions constituted 50% or more of all TAZ attractions, the TAZ was considered a special generator zone. These TAZ's are treated differently than others in that attractions are held (not adjusted) during the balancing process (discussed in a later section).

For the Rapid City TransCAD model, 22 TAZ's were deemed to have land uses that qualified them to be identified as special generators. The special generator zones are identified with a "1" in the "SpGen" field of the TAZ model layer. Special generator zones are identified in a table contained in Appendix B, and include such land uses as the National American University, museums, SDSM&T, Storybook Island, Ellsworth Air Force Base, Rushmore Mall, and the Regional Airport.

3.6.4. External Station Traffic Volumes

Traffic that enters or leaves the modeling area around its perimeter is not included specifically in trip generation as outlined above. The Rapid City TransCAD model contains 16 locations where the roadway network connects with the "outside world". It is at these locations where internal/external interactions must be accounted for.

Traffic count data at the external stations provides the total volume of traffic that constitutes the internal/external interaction, although some portion of the traffic volume at these locations merely passes through the modeling area without an internal origin or destination. Those "pass-through" trips are called external-external (E-E) trips, the remaining portion of total traffic has an internal origin or destination and are classified as either external-to-internal (E-I) or internal-to-external (I-E) trips. Each is discussed separately in subsequent sub-sections.

Traffic count data was acquired for highways linked to the 16 external station TAZ's from which to estimate the portion of E-E trips (and the resulting E-I or I-E trips). The 16 external station links and their corresponding daily traffic volumes are shown in Table 8.

Table 8 - External Station Traffic Volume (Year 2000)

External Sta. Number	Description	ADT
211	I-90 - West	22,500
212	Deadwood Ave. North of I-90	2,750
213	Haines Avenue North of Viking Rd.	1,667
214	W. Nike Road North of Country Rd.	177
215	Dyess Avenue North of 225 St.	329
216	Elk Vale Road North of Country Rd.	750
217	151st Avenue North of I-90	178
218	I-90 East	17,566
219	E. Highway 44	3,233
220	S. Highway 79	6,035
221	Neck Yoke Road	675
222	S. Highway 16	8,500
223	Sheridan Lake Road	582
224	W. Highway 44	4,310
225	Nemo Road	1,376
226	SD Highway 79	5,496

3.6.5. External-External Traffic

E-E trips are trips that pass through the modeling area without a stop. The NCHRP Report No. 365 procedure for estimating through trips was utilized to formulate an estimate of this portion of traffic at each external station.

Research has shown that the percent of through trips at and between external stations is related to the functional classification of the link, the connectivity of each external station pair, the average daily traffic volume at the external station, the size of the population of the modeling area, and the vehicle composition at the external station. Generally, the greater the volume and more direct the connectivity with other external stations, the greater the percentage of pass-through trips. Also, a greater percentage of truck traffic tends to indicate a greater fraction of pass-through trips.

The NCHRP #365 procedure was formatted to an Excel spreadsheet to allow a somewhat automated procedure to calculate the percentage of through trips for the Rapid City TransCAD model. The resulting estimate of through trips at each external station, including formula inputs, is shown in Table 9.

Table 9 - Through Trip Estimate for External Stations (Year 2000)

External Sta. Number	Description	ADT	% Tks	%Pu/Van	Functional Class			Area Population	% of ADT as E-E Trips	E-E Trips
					Interstate	Princ. Art.	Minor Art.			
211	I-90 - West	22,500	11%	10%	1			79,000	57.8	6,500
212	Deadwood Ave North of I-90	2,750	13%	10%		1		79,000	18.4	250
213	Haines Avenue North o Viking Rd.	1,667	3%	10%			1	79,000	1.8	20
214	W. Nike Road North of Country Rd.	177	5%	10%			1	79,000	1.6	-
215	Dyess Avenue North of225 St.	329	5%	10%			1	79,000	1.7	-
216	Elk Vale Road North of Country Rd.	750	8%	10%			1	79,000	1.7	10
217	151st Avenue North of I90	178	5%	10%			1	79,000	1.6	-
218	I-90 East	17,566	12%	10%	1			79,000	57.2	5,020
219	E. Highway 44	3,233	12%	10%		1		79,000	18.5	300
220	S. Highway 79	6,035	16%	10%		1		79,000	18.8	570
221	Neck yoke Road	675	3%	10%			1	79,000	1.7	10
222	S. Highway 16	8,500	8%	10%		1		79,000	19.1	810
223	Sheridan Lake Road	582	2%	10%			1	79,000	1.7	-
224	W. Highway 44	4,310	5%	10%			1	79,000	2.1	50
225	Nemo Road	1,376	8%	10%		1		79,000	18.2	130
226	SD Highway 79	5,496	14%	10%		1		79,000	18.8	520

Following the estimate of E-E trips at each external station, it is necessary to create a matrix for E-E trips…that is a matrix that shows the station-to-station volume for all through trips. Again, NCHRP #365 was consulted in the absence of any local data or studies. That reference has developed a procedure to estimate the initial interaction between external stations that is based on the functional classification of each external station link and whether the route is continuous to a corresponding external station. This procedure is part of the same spreadsheet, and results with the initial station-to-station E-E trip matrix shown in Table 10.

Table 10 - Initial Station-to-Station E-E Trip Matrix

External Sta. Number	Description	ADT	E-E Trips	Origin Zone	Destination Zone							
					211	212	218	219	220	222	225	226
211	I-90 - West	22,500	6,500	211	0	265	4446	285	406	510	205	383
212	Deadwood Ave North of I-90	2,750	250	212	7	0	56	30	42	53	21	40
213	Haines Avenue North o Viking Rd.	1,667	20									
214	W. Nike Road North of Country Rd.	177	-									
215	Dyess Avenue North of225 St.	329	-									
216	Elk Vale Road North of Country Rd.	750	10									
217	151st Avenue North of I90	178	-									
218	I-90 East	17,566	5,020	218	3433	205	0	220	314	394	159	295
219	E. Highway 44	3,233	300	219	38	19	38	0	29	36	14	127
220	S. Highway 79	6,035	570	220	74	36	74	39	0	70	28	248
221	Neck yoke Road	675	10									
222	S. Highway 16	8,500	810	222	67	33	552	35	50	0	25	47
223	Sheridan Lake Road	582	-									
224	W. Highway 44	4,310	50									
225	Nemo Road	1,376	130	225	24	12	24	13	18	23	0	17
226	SD Highway 79	5,496	520	226	67	33	67	36	228	64	26	0

It should be noted that several external stations resulted with less than 100 vpd estimated to be E-E trips. Those stations are not included with the initial E-E trip matrix and E-E trips from those stations are assumed to be negligible.

Because the E-E trips represent average daily trips, the matrix should be symmetrical. The initial E-E trip matrix needs to be balanced for use with the travel demand model, under the assumption that directional distribution of E-E trips is equal for a 24-hour period. The balancing procedure is also part of the spreadsheet and is conducted through an iterative process called Fratar Balancing, where row and column totals are alternatively compared to their target values, and factored by their difference. The process is repeated until row/column totals converge within 1 percent of target values. The balanced E-E trip matrix resulting from the Fratar Balancing process is shown in Table 11

Table 11 - Balanced E-E Trip Matrix (Year 2000)

Origin Zone	Destination Zone							
	211	212	218	219	220	222	225	226
211	0	88	6054	112	193	474	54	159
212	88	0	254	26	45	54	12	38
218	6054	254	0	257	427	1046	129	361
219	112	26	257	0	40	45	10	79
220	193	45	427	40	0	84	19	251
222	474	54	1046	45	84	0	20	70
225	54	12	129	10	19	20	0	15
226	159	38	361	79	251	70	15	0

3.6.6. External-Internal Traffic

The internal-to-external (I-E) and external-to-internal (E-I) trips need to be coded as productions and attractions at the external station TAZ's. Without travel survey data on which to base this estimate, NCHRP Report No. 365 was consulted to formulate estimates based on national data.

All trips (vehicle counts) at external stations that are not included in the E-E trip matrix need to be included as vehicle trip productions or attractions at the same external station to balance the model area interaction with the "outside world". The estimation procedure outlined by NCHRP #365 considers several factors in estimating the external productions and attractions for each purpose, including the size of the modeling area, its socioeconomic characteristics, and proximity to other urbanized and suburban areas. While the existence of a strong employment center within the model area will tend to pull more nonresidents into the region for work trips, a model area that is mostly suburban may have a shortage of overall employment opportunities and a surplus of service and retail employment. In such a community, the flow of trips across the external station boundaries could reflect a net export of work trips and a net import of other trips.

Considering the socioeconomic make-up of the Rapid City modeling area, it is estimated that the region will be a net importer of work and shopping trips. For this modeling effort, the area is considered to be a net importer of work trips by a 70/30 split, with the exception of TAZ's #211 and #226 where the ratio is assumed to be 80/20. The modeling area is assumed to be a net importer of HBO trips by a 60/40 ratio for all external stations. Following the guidelines of NCHRP #365, HBW trips at external stations are assumed to make up 40% of E-I and I-E trips, HBO trips are assumed to

make up 35% of E-I and I-E trips, and NHB trips are assumed to make up 25% of E-I and I-E trips.

The next step of the internal-external interaction is to factor the vehicle trips (achieved from station counts) to person trips to enable balancing with internal person trip productions and attractions. For this step, an average auto occupancy factor of 1.10 was utilized for HBW trips, 1.30 for HBO trips, and 1.20 for NHB trips. These auto occupancy rates were selected during the model calibration process and represent reasonable values for mid-western communities of this size and were shown to result with the correct overall number of vehicle trips on the model network.

The resulting internal-external interaction (productions & attractions) person trips are shown in Table 12.

Table 12 - E-I and I-E Productions and Attractions (Year 2000)

			I-E & E-I Person Trip Productions and Attractions					
External Sta.		I-E & E-I	Productions			Attractions		
Number	Description	Trips	HBW	HBO	NHB	HBW	HBO	NHB
211	I-90 - West	9500	3344	2594	1426	836	1729	1424
212	Deadwood Ave. North of I-90	2250	693	615	337	297	410	338
213	Haines Avenue North of Viking Rd.	1627	502	445	244	215	295	245
214	W. Nike Road North of Country Rd.	177	55	48	26	23	33	26
215	Dyess Avenue North of 225 St.	329	101	90	49	44	60	49
216	Elk Vale Road North of Country Rd.	730	224	199	109	97	134	110
217	151st Avenue North of I-90	178	55	48	26	23	33	28
218	I-90 East	7526	2318	2054	1129	993	1370	1129
219	E. Highway 44	2633	811	719	395	348	480	395
220	S. Highway 79	4895	1508	1336	734	646	891	734
221	Neck Yoke Road	655	201	179	98	87	118	98
222	S. Highway 16	6880	2119	1879	1032	909	1252	1032
223	Sheridan Lake Road	582	179	159	88	77	107	88
224	W. Highway 44	4210	1297	1149	631	556	767	632
225	Nemo Road	1116	343	304	168	147	204	167
226	SD Highway 79	4456	1569	1217	668	392	811	668

3.6.7. Balancing Productions and Attractions

It is necessary to achieve an exact balance between trip productions and attractions before performing the trip distribution process. This is because each production must be paired with a corresponding attraction, including the E-I and I-E productions and attractions.

As with most models, a higher confidence level is placed on productions since they are generated from household data which tends to be easier to collect (through census surveys). Employment data is much more difficult to collect and, hence, has a lower confidence level for accuracy. Consequently, the control totals of trips are the regional totals of trip productions by purpose. The exceptions to this are special generator zones, where attractions are “held” during the balancing process on a TAZ-by-TAZ basis, although the overall model-wide total of productions governs. Attractions (and productions) are also held at external stations since they are a function of observed traffic counts and, therefore, are fixed and not factored.

It is desirable to develop productions and attractions that are within 10-15% of each other before beginning the balancing process. In the case of the Rapid City TransCAD model, total productions and attractions (including externals) were within 11% before the balancing process for the year 2000 model. In this case, productions exceeded attractions by about 11%. Production and attraction results of the trip generation process before balancing are shown in Table 13. A complete listing of balanced productions and attractions by TAZ is provided in Appendix B.

Table 13 - Person Trip Productions and Attractions Before Balancing (Year 2000)

	2000		
	HBW	HBO	NHB
Total P's	92,399	239,660	106,745
Total A's	72,699	196,627	109,584
Internal P's	77,080	226,625	99,605
Internal A's	67,007	187,933	102,421
External P's	15,319	13,035	7,140
External A's	5,692	8,694	7,163
Total P's (all purposes)			438,804
Total A's (all purposes)			378,910
External P's as % of Total			3.5%
External A's as % of Total			1.5%
Difference between Total P's & A's (%)			14%
Difference between Internal P's & A's (%)			11%

3.7. Trip Distribution

Trip distribution is the second major step in the travel demand modeling process. Trip generation (the first major step) provided methodology for estimating trip productions and attractions for each purpose within each TAZ. Trip distribution is the process that links the productions to attractions for each zonal pair. It is these trip interchanges that must be accommodated by the transportation system.

The trip distribution process utilizes a gravity model to define the intrazonal and interzonal trip interchanges between zones. A gravity model is the most common form of trip distribution model. A gravity model utilizes an impedance matrix that reflects the distance, time, or cost (or some combination of these) between zones and explicitly relates flows between zones to interzonal impedance. The gravity model was originally motivated by the observation that flows decrease as a function of the distance (impedance) separating zones, and increase as a function of the number of productions or attractions (size) of zones, much like Newton's Law of Gravity.

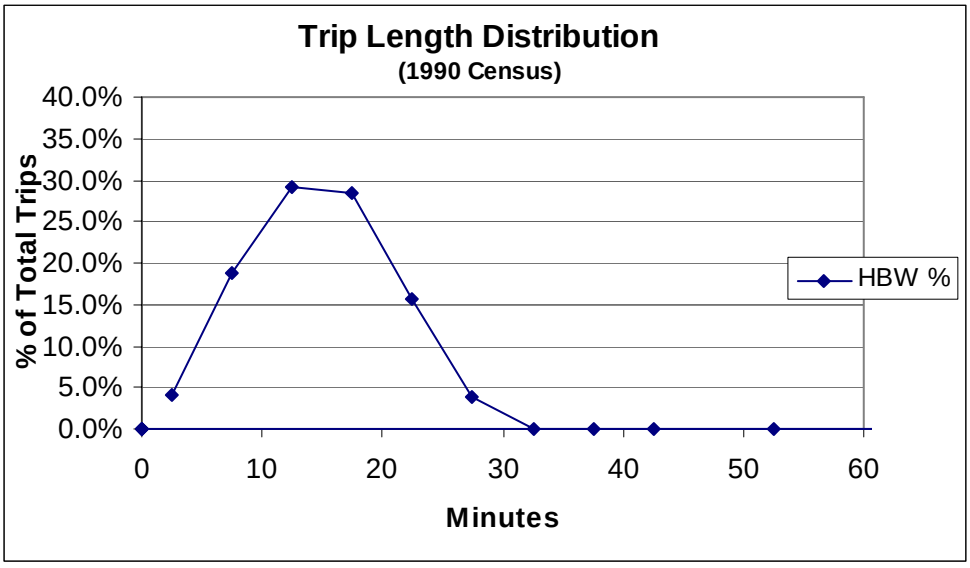
Many different measures of impedance can be used, such as travel distance, time, or "cost". Several potential impedance functions are also available to describe the relative attractiveness of each zone from the impedance, including exponential, inverse power,

and gamma functions. The gamma function is the one most often used and recommended in US planning practice, and is the function that will be utilized for the Rapid City model.

Before applying the gravity model, we must calibrate the impedance function. This is an iterative process that entails selecting the impedance value (time, distance, cost, etc.), then estimating impedance function (gamma function) coefficients until the gravity model replicates trip length frequency distribution desired.

In the absence of origin-destination studies on which to base actual trip length frequency distributions for the Rapid City area, US Census Bureau information and NCHRP #365 were consulted to determine reasonable trip length frequency distributions for the three trip purposes. The census data for travel time to work was utilized to create a trip length distribution for work trips (HBW). This "actual" distribution served as the target for our model HBW distribution. The census data on work trips shows an average trip length (including terminal time) of 14.7 minutes. The distribution of census data work trip lengths is shown in Figure 6.

Figure 6 - Census Work Trip Length Data for Rapid City



The NCHRP #365 reference notes that work trip lengths typically run 15-20 minutes in "smaller" communities (under 500,000 population), and 25-30 minutes in large metropolitan areas. Given the size of the Rapid City model area (79,000 population), a work trip length less than 15 minutes is reasonable. The NCHRP #365 reference also notes that non-HBW trip lengths typically vary from 75-85% of the work trip length for communities with less than 500,000 population. These parameters (average HBW trip length, and the relationship of non-HBW trips to HBW trips) served as targets for calibration of the trip distribution process.

Beginning with gamma function coefficients recommended in NCHRP #365, numerous trial runs were made using distance and travel time as the impedance values. A "cost"

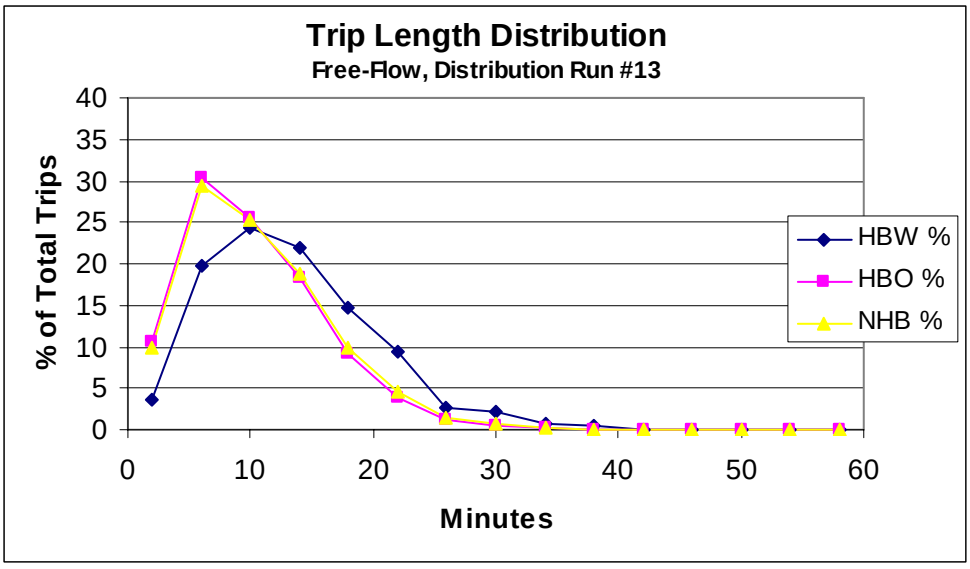
impedance formulated as a combination of time and distance was also tried where impedance was made of 85% time cost and 15% distance cost (using $15/hour for time cost and $0.35/mile for distance cost). Starting with the "default" coefficients resulted with an average HBW trip length of just over 11 minutes, lower than our target value. The coefficients and impedance values were varied throughout numerous trial runs until a reasonable average trip length for HBW trip was obtained, and until the shape of the trip length frequency distribution closely matched that of the census data. The resulting gamma function coefficients are listed in Table 14 while the resulting trip length frequency distribution for all purpose trips is shown in Figure 7.

The calibrated trip distribution utilizes travel time as the impedance value and results with an average *free-flow* HBW trip length of 13.7 minutes. Average trip length for HBO and NHB trips were 10.8 minutes and 11.0 minutes, respectively. At these values, the HBW trip length is 93% of the target value, while non-HBW trip lengths fall within the 75-85% of HBW trip length values, as recommended by NCHRP #365. It should be noted that the trip lengths were based on free-flow network travel times and will likely be somewhat higher under actual assignment conditions of congested network travel times.

Table 14 - Calibrated Gamma Function Coefficients

Trip Purpose	a	b	c
HBW	28,507	.02	.01
HBO	139,173	1.0	.05
NHB	219,113	1.0	.05

Figure 7 - Trip Length Frequency Distribution - Calibrated Gamma Coefficients



3.8. Production-Attraction to Origin-Destination Conversion

The outputs from the earlier stages of the modeling process are in the form of person trip productions and attractions. Since the assignment algorithms require vehicle trip origins and destinations as inputs, the productions and attractions must be converted to origins and destinations, and the person trips must be converted to vehicle trips. TransCAD provides procedures to easily make this conversion. In addition, TransCAD provides the capabilities of producing a 24-hour origin-destination matrix, or to provide separate matrices for each hour of the day. TransCAD also allows vehicle occupancy factors to be applied simultaneously with the P-A conversion to O-D. For initial model development, a 24-hour vehicle trip matrix is desired. The TransCAD P-A to O-D procedure is utilized with auto occupancy rates as discussed below. The result is a 24-hour vehicle O-D matrix.

3.8.1. Auto Occupancy Rates

Trips generated by trip purpose during the trip generation step (and consequently through the trip distribution step) are in person trips, as discussed above. Auto occupancy factors are utilized to convert from person trips to vehicle trips prior to assigning the traffic to the roadway network. Auto occupancy rates can also be utilized to account for alternate modes, including motorized (taxi, bus, etc.) and non-motorized (walk, bicycle, etc.) modes.

Trip purpose is the most significant factor influencing auto occupancy. Other factors such as household income and trip distance are less important factors of auto occupancy.

In the absence of local study data, auto occupancy factors were initially based on national averages listed in NCHRP Report No. 365. That report suggests that for communities of 50,000 to 200,000 population, HBW trip auto occupancy rates are about 1.11 persons/auto. It also suggests that HBO auto occupancy rates averaged about 1.56, while NHB auto occupancy rates averaged about 1.56 persons/auto. Use of these national average rates initially produced assignments that were low when compared to traffic counts. Discussion with the Model Working Group suggested that auto occupancy rates for Rapid City were likely lower than national averages. As one of the final stages of model calibration, lower rates were applied until assignments approximately equaled counts in aggregate. Resulting auto occupancy rates are shown in Table 15.

Table 15 - Auto Occupancy By Trip Purpose

TRIP PURPOSE	OCCUPANCY RATE (Persons/Vehicle)
HBW	1.10
HBO	1.30
NHB	1.20

3.9. Traffic Assignment

The traffic assignment process allocates vehicle traffic to individual roadway links. This step takes as input a matrix of flows (vehicles) that indicate the volume of traffic between origin and destination pairs.

In the preceding section, our P-A to O-D transformation and application of auto occupancy factors resulted with three matrices of vehicle flows…one for each purpose. The external-external vehicle trip matrix developed earlier also needs to be included in the assignment process. To develop the combined vehicle trip matrix for assignment, the four individual matrices (HBW, HBO, NHB, and EE) are added cell-by-cell to create a combined, 24-hour all purpose vehicle trip matrix. Paths for the traffic assignment are developed using the same impedance function (travel time) as was used for trip distribution.

TransCAD supports a wide variety of assignment methods, including all-or-nothing assignments, STOCH assignments, incremental assignments, capacity restraint, and user equilibrium assignments. Since it was desired to consider the impacts of link volume and congestion when assigning trips to a particular path, the all-or-nothing and STOCH methods were not considered appropriate. Although the TModel2 model utilized an incremental assignment technique, this method is a variation of the all-or-nothing method and again was not considered appropriate for use with this model update. Capacity restraint methods attempt to approximate an equilibrium solution by iterating between all-or-nothing loadings and recalculating link travel times following each loading. This method does not converge to an equilibrium solution and results are highly dependent on the specific number of iterations run. A user equilibrium assignment technique was selected for this model update since it uses an iterative process to converge on a solution. After each iteration, link flows are computed and travel times re-calculated. While a specific number of iterations can be specified, typically iterations continue until some user-specified convergence value is reached.

Inputs required for user equilibrium assignment (and other capacity restrained assignment methods) are link performance functions. These functions describe the travel time across a link under various conditions of congestion as measured by volume-to-capacity ratios. Most common for this function is the BPR (Bureau of Public Roads) equation. For this equation, the user selects link capacity and two calibration parameters (alpha and beta). While the basic BPR equation used values of 0.15 and 4.0 for alpha and beta, respectively, recent work has demonstrated that different values should be utilized to better replicate delay as computed using the Highway Capacity Manual. Recently suggested values for alpha vary from 0.71 to 1.0 for multi-lane roadways, and from 0.56 to 0.88 for freeways. Suggested values for beta vary from 2.1 to 5.4 for multi-lane roadways, and from 3.6 to 9.8 for freeways.

Values of BPR equation coefficients selected for this model update are listed in Table 15. The resulting variation of link speed using these values is demonstrated in Figure 8 and Figure 9 for freeway and arterial links, respectively.

Table 15 - BPR Coefficient Values

Coefficient	Interstates	Arterials	Collectors
Alpha (α)	0.88	0.84	0.84
Beta (β)	9.80	5.50	5.50

Figure 8 - Travel Speed Variation with V/C – Interstate Links

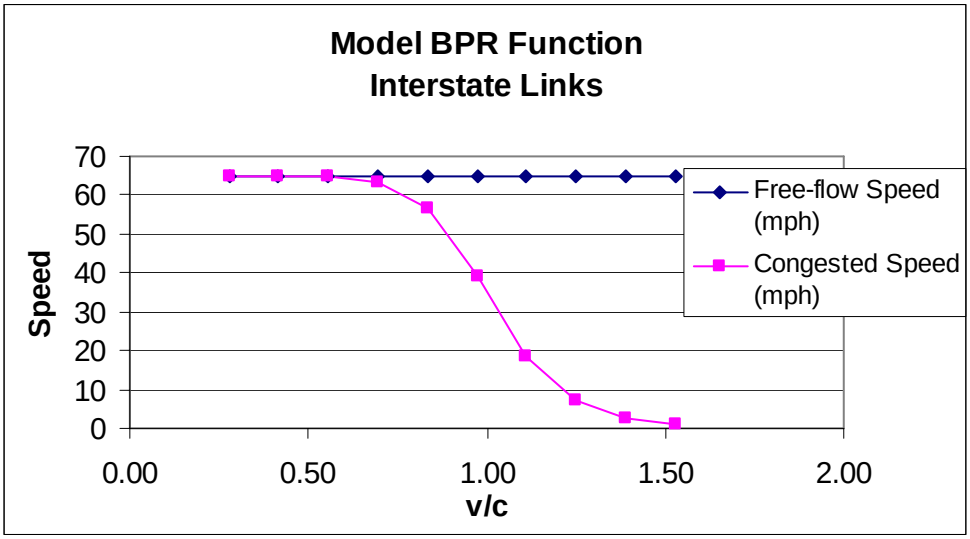
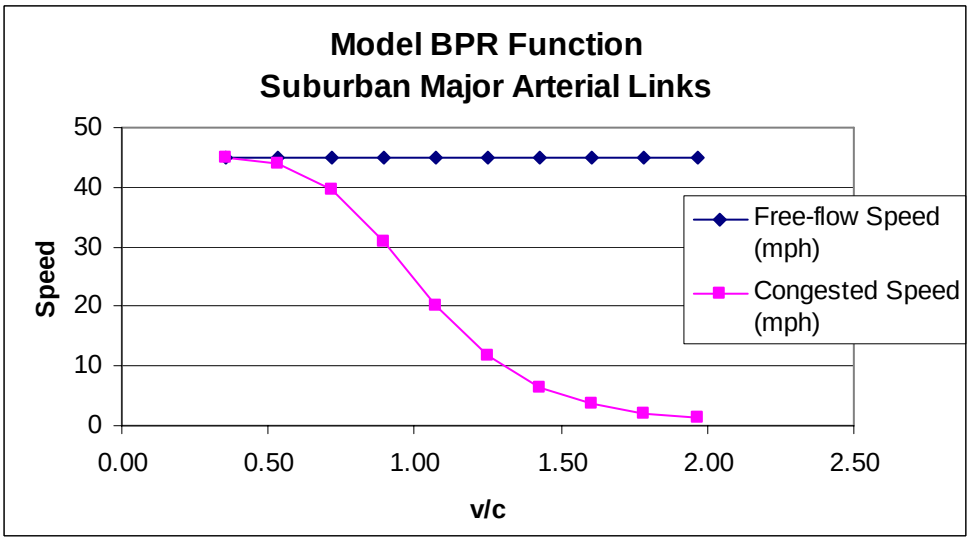


Figure 9 - Travel Speed Variation with V/C – Arterial Links



For the Rapid City TransCAD model, the BPR coefficients, as well as link capacities are maintained in a link type look-up table. Use of this table provides an easy method of

changing these values, and allows the use of a single network for both 24-hour and time-of-day assignments (through use of two different link type look-up tables).

Traffic assignment procedures developed for the Rapid City model require two traffic assignments. Following the initial assignment using link free-flow speeds, a second assignment is made using the congested travel times resulting from the initial assignment. In this way, the path selection for the assignment reflects path choice under congested conditions.

3.10. Travel Model Output Summary & Reporting Procedures

Following execution of the traffic assignment, TransCAD creates a binary file of link volumes, final travel speeds, v/c ratios, and congested travel times. The output file is joined to the link database file. The user merely needs to "export" the joined file as a geographic file to have permanent access to the assignment results.

In any assignment of travel to a network, the link-assigned volumes may require some redistribution between available facilities to more closely reflect actual operating conditions. Historically, transportation planning procedures have used screen lines and /or auxiliary cut lines to validate and analyze assignment results. The use of functional class, count ID, and link type identifiers in the network line file allows complete flexibility to extract model output for various combinations of links. As part of this model development process, several Excel spreadsheets have been set up to quickly perform some "post-processing" of assignment output.

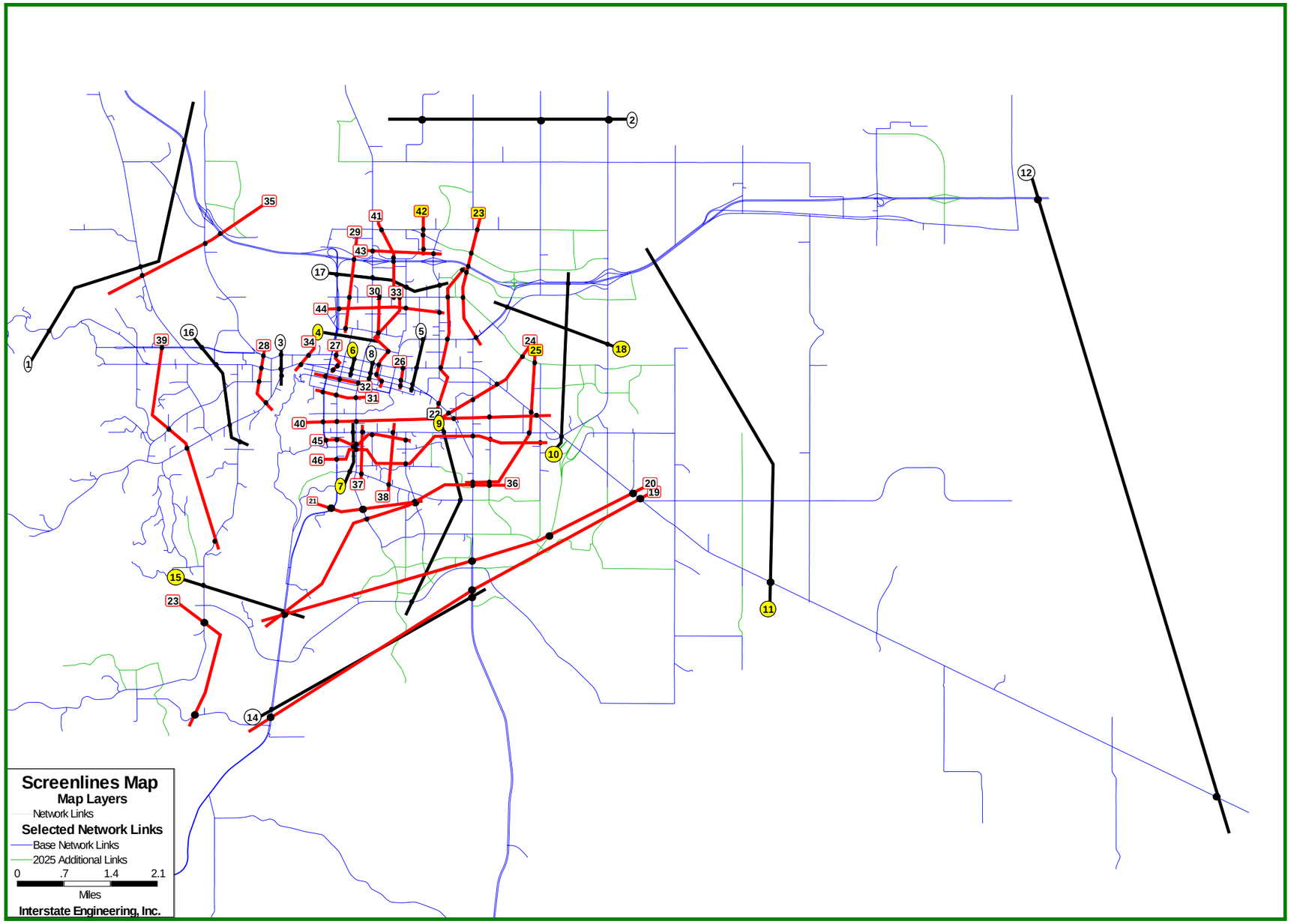
A screen line adjustment procedure documented in NCHRP Report No. 255 has been "programmed" to an Excel spreadsheet. This procedure is based on the premise that while models are accurate with assignments within a travel corridor of multiple routes, models are less accurate with respect to assignments to individual routes within a single corridor. The procedure examines differences between the base year counts and base year model assignment, and then makes corresponding adjustments to a future year assignment. The procedure is capable of accounting for new routes and increased capacity on existing routes as well.

The spreadsheet contains information about the base year (2000) calibrated model results, and only needs results from a specific run to perform screen line adjustments. The process requires only that the assignment output be screened to include only links with counts (where "COUNT_ID" field is >0), and sorted into COUNT_ID ascending order. The screened, sorted data then can be easily saved from TransCAD as a database file, and the results "pasted" directly into the input portion of the spreadsheet. The spreadsheet is currently set up to process over 40 different screen lines and report the results in COUNT_ID order. A printed copy of one of the screen line adjustment spreadsheets is included in Appendix D. A map showing model network links and screen lines established for calibration and assignment adjustments is included as Figure 10.

While the screen line adjustment process is automatic, some user judgment is still required to review results for reasonableness. Since some specific count links are reported by more than one screen line, user judgment is required to select the most reasonable traffic volume projection.

Just as caution is advised when reporting results of the screen line adjustment process, caution is also advised when reporting raw model assignments. The user must keep in mind the required accuracy of travel demand models (plus or minus one lane) and understand that others may expect, or assume greater levels of accuracy.

Figure 10 - Model Screen Lines



3.11. Validation to Year 2000 Traffic Counts

Validation of model parameters and results began with trip generation procedures. At that level, US Census Bureau data was utilized to ensure HBW trip productions matched closely with model-produced HBW trip productions. At subsequent steps, validation adjustments were also made. HBW trip length frequency and average trip lengths were closely matched to census data during the trip distribution process.

Following assignment, validation consists with comparison of model assignments to ground counts to ensure reasonable assignment and route choice by the model. Several references provide guidelines for allowable error with "calibrated" models. NCHRP #365 notes acceptable assignment errors vs. counts based on facility type. NCHRP #255 lists acceptable errors for individual links, also based on facility type. In addition to comparison of assignments at the link level, an examination of differences of total assignment vs. count at the screen line level is also a good method of model validation.

3.11.1. Link Volume Comparisons

On a link-by-link basis, model validation was compared against both the NCHRP #365 and NCHRP #255 standards. With over 300 links coded with traffic count data, the comparison is comprehensive and wide-spread. Table 16 shows the acceptable error and actual error of count vs. assignment for five different facility types throughout the model. Table 17 shows allowable per link error vs. actual per link error for the calibrated model.

Table 16 - Overall Acceptable Error vs. Actual Overall Error

FACILITY TYPE	ACCEPTABLE ERROR*	ACTUAL ERROR
Freeways/Interstates	7%	0.60%
Principal Arterials	10%	-0.03%
Minor Arterials	15%	4.00%
Collectors	25%	-12.30%
Locals	N/A	21.50%
OVERALL	N/A	-1.60%

*From NCHRP #365 and "Calibration and Adjustment of System Planning Models (1990)

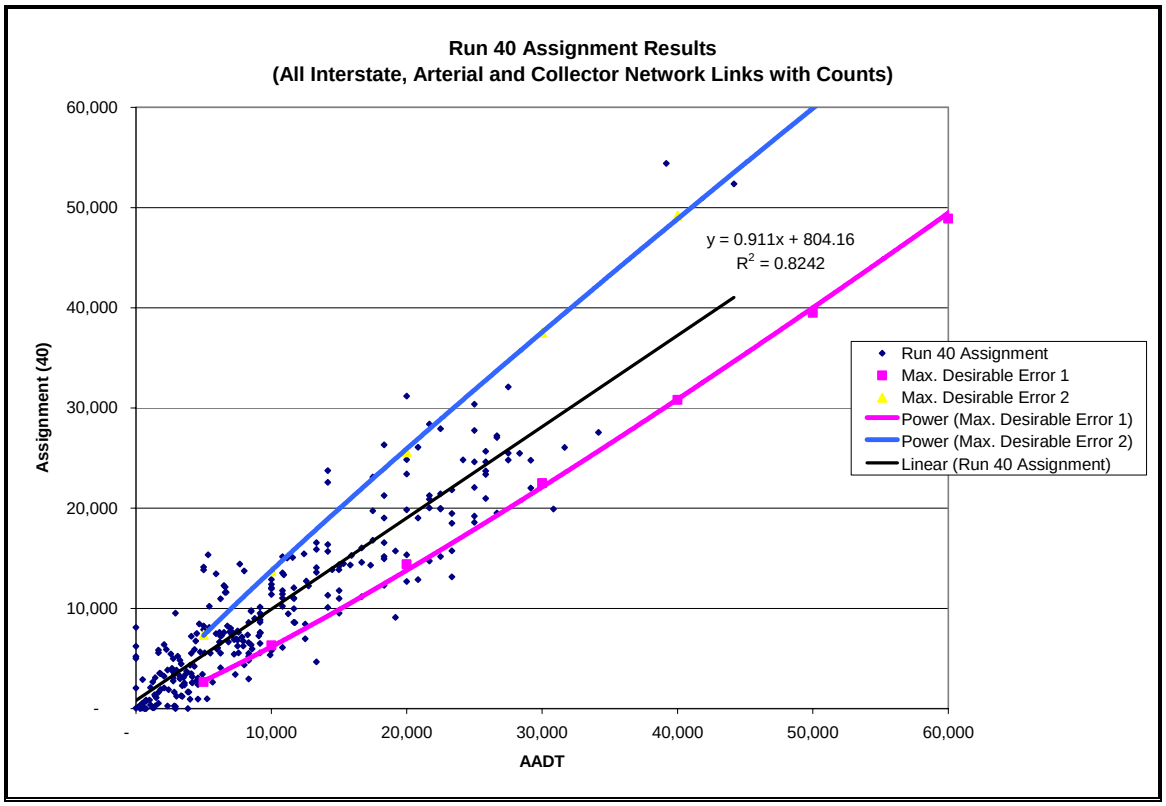
Table 17 - Acceptable Error Per Link vs. Actual Per Link Error

FACILITY TYPE	ACCEPTABLE ERROR*	ACTUAL MAXIMUM ERROR
Freeways/Interstates	+/- 18,000 vpd	3,876 vpd
Principal Arterials	+/- 8,500 to 15,000 vpd	15,244 vpd**
Minor Arterials	+/- 8,250 vpd	6,216 vpd
Collectors	+/- 5,500 vpd	10,005 vpd***

* From NCHRP #255
**Only 12 links of 161 total Principal Arterial links exceed 8,500 vpd absolute error.
**Only 2 links of 50 total Collector links exceed 5,500 vpd absolute error

Figure 11 is a "scattergram" that is a plot of count vs. assignment at every link with a COUNT_ID in the model network. The plot also shows the acceptable error per NCHRP #255. As can be observed, the allowable error is less as the volume is lower. The rationale for this trend with allowable error is that the model should not fail to predict the need for an additional traffic lane on a network roadway or predict an additional lane where one would not be needed. The plot also shows an r-squared coefficient (coefficient of best fit) for the data as $R^2 = 0.8242$. NCHRP #255 and other references generally note r-squared coefficients should be 0.80 or higher.

Figure 11 - Calibrated Model Assignment vs. Counts Scattergram



3.11.2. Screen Line Comparisons

As was stated previously, travel demand models are typically much better at volume assignments on a corridor level, rather than at the individual route level. It is for this reason that screen line adjustments are often undertaken prior to reporting traffic volume projections. For the Rapid City Model, 46 different screen lines were developed to assist with model calibration and reporting. Screen lines are considered "good" when assigned volumes across links of the screen line are within 20% of counts. Of the 46 screen lines utilized for model post processing and calibration, 34 are within acceptable parameters. 37 of the 46 screen lines have assignments within 25% of counts.

The screen lines were utilized to enhance model calibration. The results showed that while most screen lines were "good", individual links on some contained significant assignment errors. To correct individual assignment errors, travel speeds were adjusted (typically by less than 5 mph) on some links. The adjustments where model speed differs from actual posted speed limits are listed below:

- Reduced speed from 30 to 25 mph on North Street from Haines to West Blvd (I-90 Business Loop).
- Increased speed from 25 to 30 mph on West Blvd. from Flormann to St. Joseph.
- Reduced speed from 65 to 55 mph on US 16 Bypass
- Increased speed from 35 to 45 mph on Catron Blvd.
- Increased speed from 20 to 25 mph on St. Joseph and Main St. between West Blvd. and 5th Street.
- Reduced speed from 45 to 35 mph on E. St. Joseph between Steele and Campbell (previously was a mix of 35 and 45 mph…changed all to 35 mph).
- Reduced speed from 35 to 30 mph on Jackson Blvd. from Canyon Lake to Mountain View.
- Reduced speed from 50 mph to 35 mph on W. Chicago from Sturgis Rd. to Mountain View.
- Increased speed from 30 to 35 mph on W. Main from Sturgis Rd to Mountain View.
- Increased speed from 30 to 35 mph on Canyon Lake from Jackson to Mountain View.
- Increased speed from 25 to 30 mph on Anamosa St. from Haines to LaCrosse.
- Increased speed from 30 to 35 mph on E. North speed from Omaha to LaCrosse.

4. Model Development for Year 2025

The base year (2000) model is useful for current planning, but was primarily developed for use in future years. As part of model development, a future year model was developed for the year 2025. For future year modeling, only land use and model network changes are typically modeled, although changes to auto occupancy and mode shift are also possible.

4.1. Year 2025 Land Use Data Projections

Through their Neighborhood Planning process, the Rapid City MPO has developed year 2025 land use projections for both residential and non-residential uses. The neighborhood plans were utilized by MPO staff to provide future land use data at the TAZ level for future year modeling.

A notable difference between non-residential land use data format between the base and future year was discovered. While base year non-residential land use data was reported by structure square footage in ten different categories, future year non-residential land use was reported in only four categories. Consequently, conversion factors developed and utilized for base year modeling could not be used directly for future year modeling. Instead, equivalent conversion factors were developed. Non-residential conversion factors used for both base year and future year modeling are shown in Table 18.

Table 18 - Non-residential Land Use Conversion Factors (sq.ft. to employment)

Year 2000 Employment Conversion Factors		
Employment Category Name	Conversion Units	
Retail	1.56	Emp. / 1000 sq. ft.
Drive Thru Retail	2.78	Emp. / 1000 sq. ft.
Service	1.56	Emp. / 1000 sq. ft.
Hospital / Medical	3.23	Emp. / 1000 sq. ft.
Warehousing / Manufacturing	1.56	Emp. / 1000 sq. ft.
Elementary School / Daycare	1.11	Emp. / 1000 sq. ft.
High School	2.86	Emp. / 1000 sq. ft.
Hotel / Motel	0.5	Emp. / 500 sq. ft.
Campground	1	Site / 1 sites
Office	3.03	Emp. / 1000 sq. ft.
Year 2025 Employment Conversion Factors		
Retail	1.65	Emp. / 1000 sq.ft.
Service	2.13	Emp. / 1000 sq.ft.
Office/Industrial	1.56	Emp. / 1000 sq.ft.
Public	1.84	Emp. / 1000 sq.ft.

Once employment was determined for the future year socioeconomic data, special generator land uses were examined for growth. Based on input from City of Rapid City staff, changes to special generators were made. Those changes included the following:

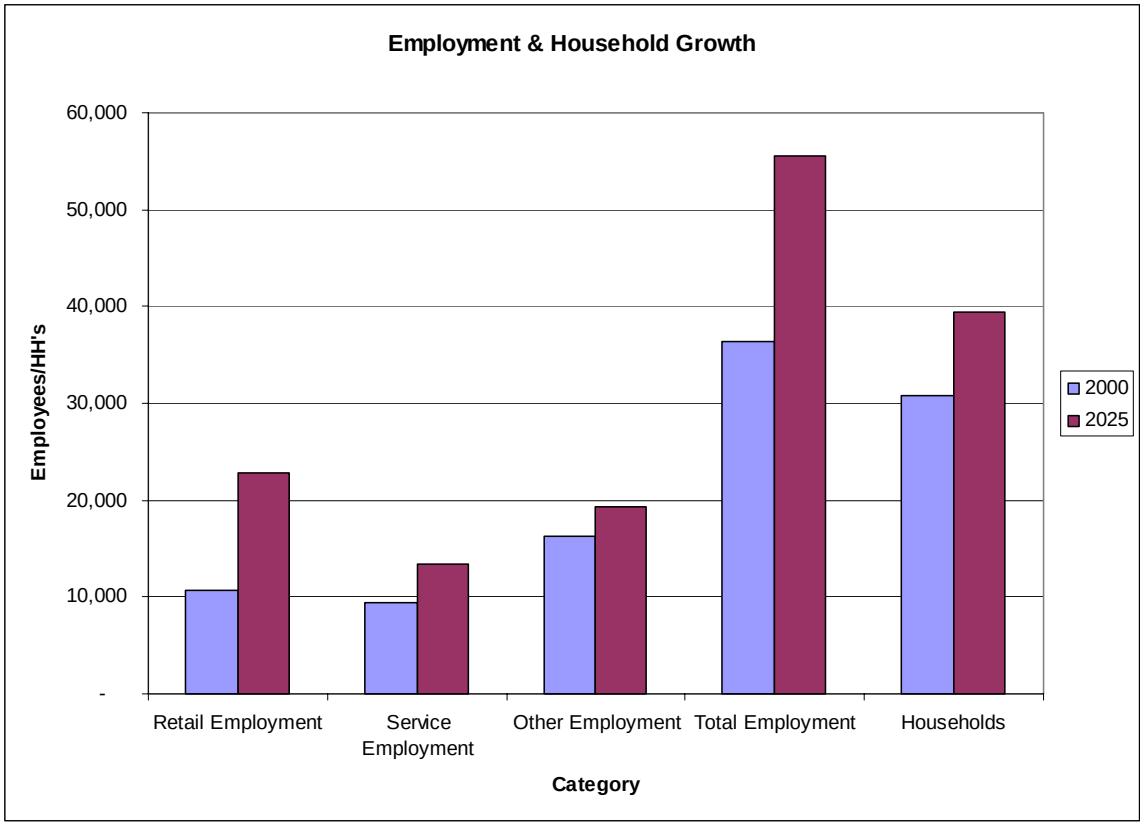
- National American University enrollment increased from 800 to 1,100 students
- Nursing School enrollment increased from 97 to 135 students
- SDSM&T enrollment increased from 2,500 students to 3,500 students
- Oglala Lakota College enrollment increased from 90 to 125 students
- Western Dakota Technical Institute enrollment increased from 850 to 1,200 students
- Western Dakota Tech enrollment increased from 300 to 420 students
- Regional Airport traffic increased from 49 to 75 daily flights

An examination of the socioeconomic growth projected for the modeling area highlights some interesting trends. The growth trends are detailed in Table 19 and shown graphically in Figure 12.

Table 19 - Socioeconomic Growth, 2000 to 2025 (within model area only)

	2000	2025	2000 % of Total	2025 % of Total	Growth (%)
Retail Employment	10,716	22,880	29%	41%	114%
Service Employment	9,390	13,350	26%	24%	42%
Other Employment	16,317	19,326	45%	35%	18%
Total Employment	36,423	55,556			53%
Households	30,860	39,339			27%
Employees per Household	1.18	1.41			

Figure 12 - Socioeconomic Growth, 2000 to 2025 (within model area only)



As the table and figure show, employment growth rate doubles the household growth rate. This means that Rapid City will increase the tendency to "import" workers. This observation is important where future E-I and I-E trips are concerned. The change in balance of households to employment is further illustrated with development of productions and attractions. As Table 20 shows, future land use results with (internal) attractions exceeding productions by about 22%. Recall that for the base year model, productions exceeded attractions by about 11%.

Table 20 - Person Trip Productions and Attractions Before Balancing (Year 2025)

	2025		
	HBW	HBO	NHB
Total P's	158,401	283,720	125,502
Total A's	110,547	335,286	182,425
Internal P's	113,574	246,303	104,941
Internal A's	95,072	310,341	161,869
External P's	44,827	37,417	20,561
External A's	15,475	24,945	20,556
Total P's (all purposes)			567,623
Total A's (all purposes)			628,258
External P's as % of Total			7.9%
External A's as % of Total			2.5%
Difference between Total P's & A's (%)			-11%
Difference between Internal P's & A's (%)			-22%

While the large difference between internal productions and attractions may be cause for concern, we must remember that the model balances productions and attractions by holding total productions, meaning the difference will be "equalized" through the balancing process. Also, it is noted that about ½ of the difference with productions and attractions is equalized through the generation of I-E and E-I productions and attractions (discussed in a later section). A complete listing of the year 2025 socioeconomic data and productions and attractions is provided in Appendix C.

4.2. Existing Plus Committed (E+C) Roadway Network

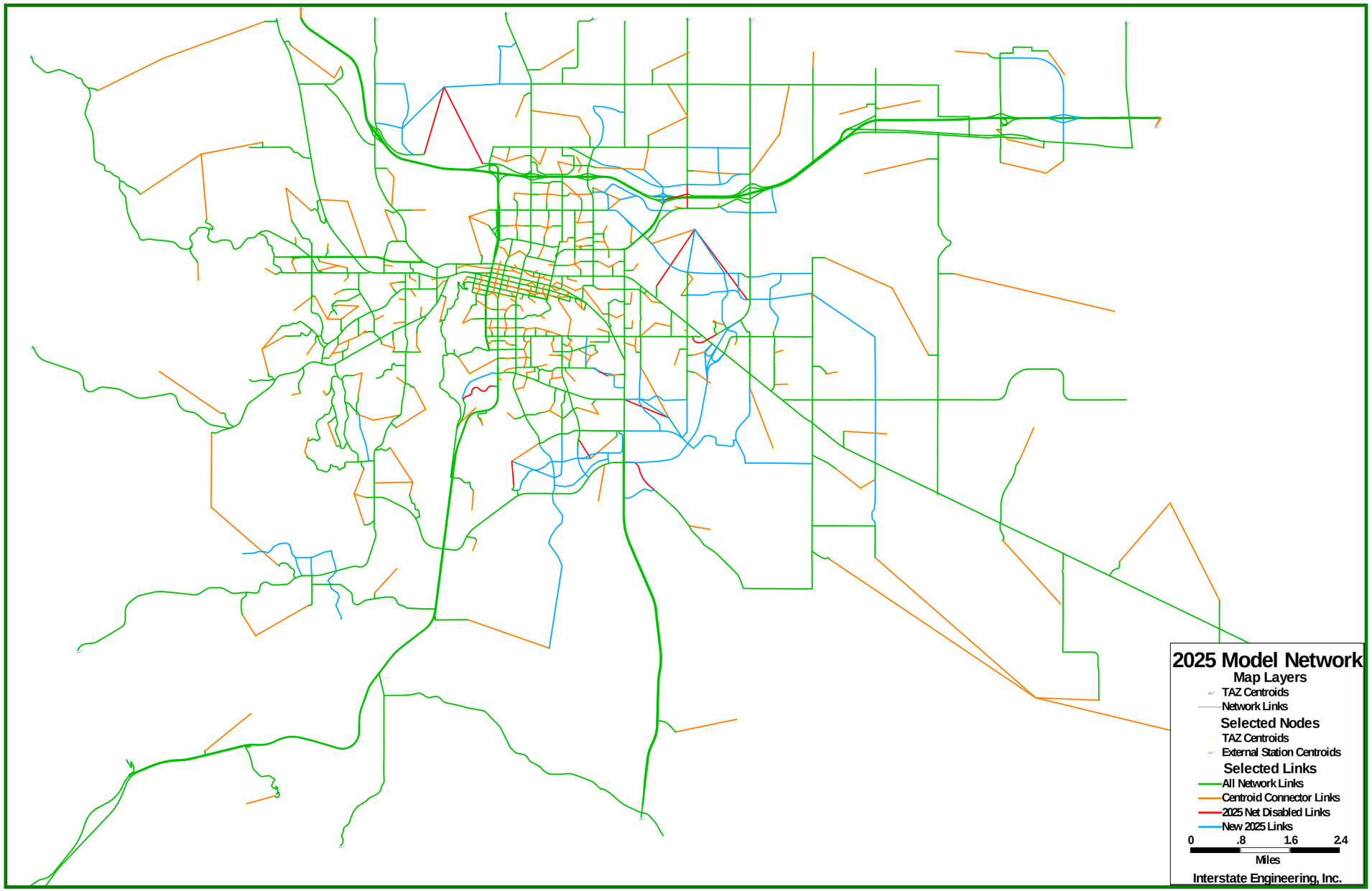
In addition to changes with socioeconomic conditions, changes to the roadway network are also expected. Some improvements to existing facilities and construction of new facilities are already planned and programmed through previous planning processes. These improvements, improvements with a high probability of implementation, are called "committed" projects. Modeling of a future "base scenario" network should include all committed projects. The Rapid City MPO provided a list of future committed projects as follows:

- Addition of Minor Arterials and Collectors Northeast of the Deadwood Ave/Interstate 90 interchange
- Addition of Collectors North and West of the Haines Ave/Country Rd intersection

- N. LaCrosse St. extended to Neva Way
- Seger Dr. extended East to Elk Vale Rd. and a Collector South to Mall Dr.
- Minor Arterial and Collector South of Elk Vale Rd./Interstate 90 interchange
- East North St. extended North to Mall Dr.
- Collector and Minor Arterial network Northeast Of Anamosa St./N. LaCrosse St. intersection
- Minor Arterial and Collector network Southeast of Anamosa St./Elk Vale Rd. intersection, including Homestead St. and Concourse Dr.
- Anamosa St. from Elk Vale Rd. to Reservoir Rd. and Degeest Dr. From Anamosa St. to Twilight Dr.
- Anderson Rd. from Twilight Dr. to South Side Dr.
- Collector and Minor Arterial network South of Hwy 44 and East of the Southeast Connector including Jolly Ln.
- Minor Arterial and Collector network North and West of the Southeast Connector including S. Valley Dr., Creek Dr, E. Minnesota St., and E. Fairmont Blvd.
- Minor arterial from Elk Vale Rd. to Twilight Dr. at the Southeast Connector
- E Oakland St from Hoefer St. to Cambell St.
- Hawthorne Ave from E. Indiana St. to E. St. Patrick St.
- Tower Rd. realignment
- Severson St. from Meadowbrook Dr. to Corral Dr.
- Collector and Minor Arterial network East of Countryside/Red Rock area
- Collector network South of Minnesota St., North of Catron Blvd., West of Cambell St., and East of 5th St.
- 5th St. extended South of Catron Blvd.
- Minor Arterial connecting Hwy. 79 S. and Old Folsom Rd.
- Southeast Connector
- Elm Ave extension to Catron Blvd.
- 5th St. Extension to Catron Blvd.
- E. Anamosa St. extension
- Mall Dr. extension to Elk Vale Rd.
- Liberty Blvd. construction
- Extended E. 27th Street to connect to E. Anamosa St.
- Removal of Dyess Ave. overpass
- Removal of WB on-ramp to I-90 from Dyess Ave.
- Created a Single Point Urban Interchange at E. North St. & I-90
- Prohibit left turns at Beale & Elk Vale

Network changes also suggested changes to some TAZ centroid connector links. Centroid connector links were changed as necessary to reflect local street connections to new collector links. Figure 13 shows the year 2025 model network with changes highlighted.

Figure 13 - Year 2025 E+C Model Network



4.3. Year 2025 External Station Traffic

Growth of traffic at model external stations cannot be predicted by the model itself. Growth at these locations must be predicted by the user through other means. For the Rapid City model, several years of traffic count data were available for most external stations, allowing a linear projection of future daily traffic at those locations. Based on historic growth trends, Table 21 shows projected year 2025 traffic at external stations.

Table 21 - Future (year 2025) Daily Traffic at External Stations

Count on:	Between:	And:	2000 AADT	2025 AADT
Deadwood Ave	county line	I-90	2,750	6,550
Elk Vale Rd	County Line	Seger Dr	667	1,550
Haines Av	north	Viking Dr	1,417	2,400
I-90	Deadwood Av	SD 79	22,500	69,000
Mt Rushmore Rd	Catron Bl	south	17,083	34,500
W Nike Rd	Country Rd	County Line	177	1,250
Dyess Ave	Country Rd	County Line	329	2,000
151st Ave	I-90	225th St	178	400
I-90 - WB	N Ellsworth Rd	154th Ave	8,783	21,100
I-90 - EB	N Ellsworth Rd	154th Ave	8,783	21,100
E Hwy 44	St Germaine Rd	Wisehart Rd	3,233	10,600
S Hwy 79	Lower Spr. Cr. Rd	Daughenbaugh Rd	6,035	6,900
Neck Yoke Rd	Evans Ct	Aero Rd	675	1,200
Sheridan Lake Rd	Sawmill Rd	Old Sheridan Rd	582	1,700
W Hwy 44	Carter Dr	Falling Rock Rd	4,310	4,800
Nemo Rd	Miller Dr	Potter Rd	1,376	6,950
N Hwy 79	Merritt Rd	County Line	5,496	14,500

Projected daily traffic at external stations is utilized in the same fashion as with the base year model to determine the portion of traffic that will be external-external (through) trips, and the remaining portion that will constitute external-internal and internal-external productions and attractions. The results of this process are summarized in Table 22.

Table 22 - E-E and I-E/E-I Trips at External Stations (Year 2025)

External Sta. Number	Description	ADT	% Tks	%Pu/Van	Functional Class			Area Population	% of ADT as E-E Trips	Directional E-E Trips	I-E & E-I Trips
					Interstate	Princ. Art.	Minor Art.				
211	I-90 - West	69,000	10	10	1			101,000	55.2	11,000	47,000
212	Deadwood Ave. North of I-90	6,550	13	10		1		101,000	12.6	410	5,730
213	Haines Avenue North of Viking Rd.	2,400	3	10			1	101,000	-10.3	-	2,400
214	W. Nike Road North of Country Rd.	1,250	5	10			1	101,000	-9.2	-	1,250
215	Dyess Avenue North of 225 St.	2,000	5	10			1	101,000	-9.1	-	2,000
216	Elk Vale Road North of Country Rd.	1,550	8	10			1	101,000	-7.4	-	1,550
217	151st Avenue North of I-90	400	5	10			1	101,000	-9.3	-	400
218	I-90 East	42,200	12	10	1			101,000	53.2	11,230	19,740
219	E. Highway 44	10,600	12	10		1		101,000	12.5	660	9,280
220	S. Highway 79	6,900	16	10		1		101,000	14.4	500	5,900
221	Neck Yoke Road	1,200	3	10			1	101,000	-10.4	-	1,200
222	S. Highway 16	17,250	8	10		1		101,000	10.9	940	15,370
223	Sheridan Lake Road	1,700	2	10			1	101,000	-11.0	-	1,700
224	W. Highway 44	4,800	5	10			1	101,000	-8.8	-	4,800
225	Nemo Road	6,950	8	10		1		101,000	9.7	340	6,270
226	SD Highway 79	14,500	14	10		1		101,000	14.1	1,020	12,460

4.3.1. External-External Traffic

As with the base year model, a balanced station-to-station matrix of E-E trip interchanges is required for model assignment. Utilizing the same procedure as was utilized for the base year E-E trip interchange (per NCHRP Report No. 365) yields the balanced E-E trip matrix shown in Table 23. The E-E trip interchange is shown graphically in Figure 14.

Table 23 - Balanced External-External Vehicle Trip Matrix (Year 2025)

Origin	Destination Zone						
Zone	211	212	218	220	222	225	226
211	**0**	151	9874	124	239	107	283
212	151	**0**	142	15	28	15	34
218	9874	142	**0**	118	552	97	269
219	206	25	195	16	30	26	161
220	124	15	118	**0**	16	19	193
222	239	28	552	16	**0**	35	39
225	107	15	97	19	35	**0**	40
226	283	34	269	193	39	40	**0**

Again, as with the base year model, the external-internal and internal-external productions and attractions must also be determined for the external stations. These productions and attractions are formulated in person trips, with the resulting productions and attractions shown in Table 24. As with the base year, the model area is assumed to be a net importer of work and shopping trips.

Figure 14 - External-External Traffic (Year 2025)

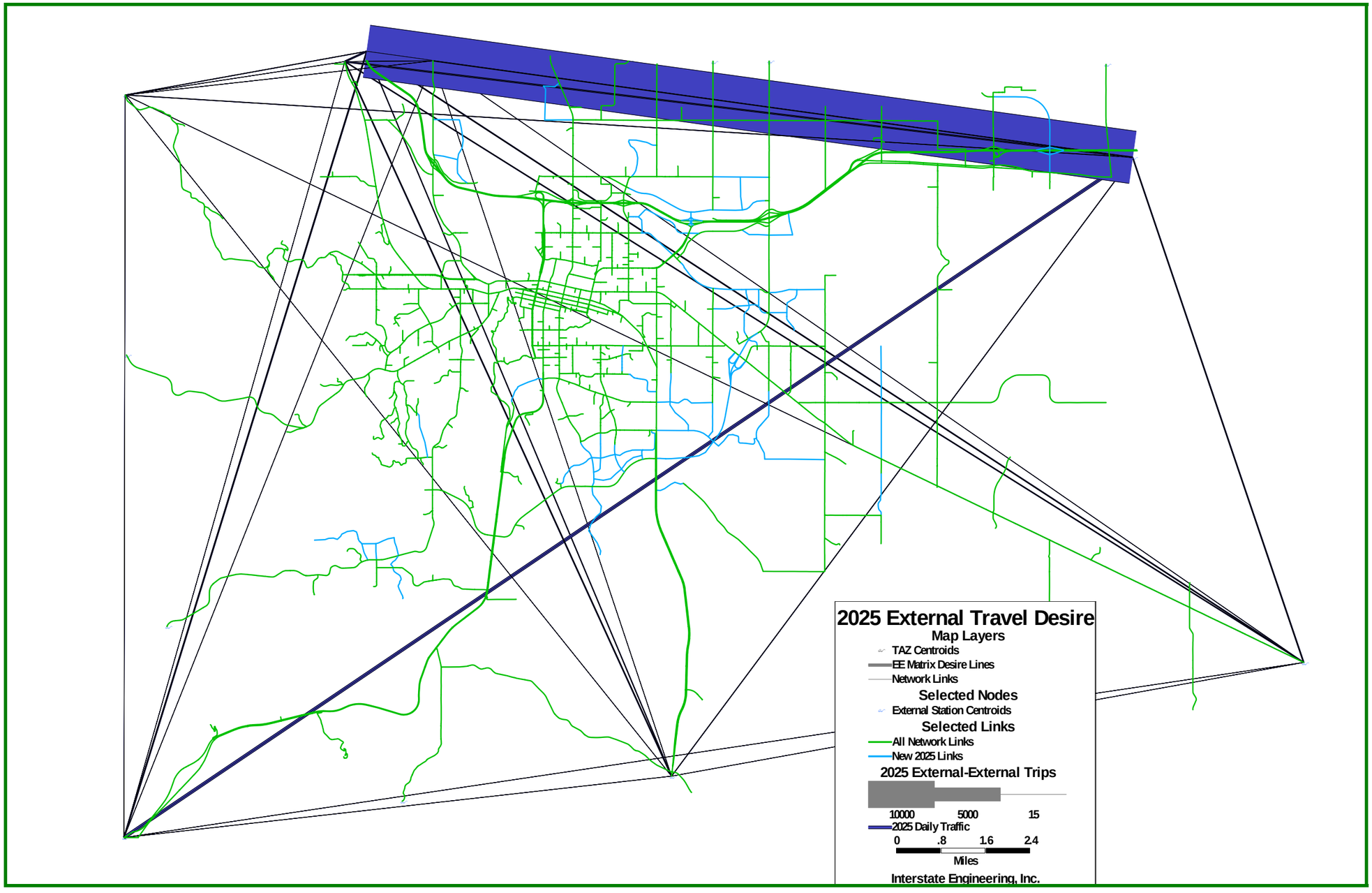


Table 24 - External Station Productions & Attractions (Year 2025)

				I-E & E-I Person Trip Productions and Attractions					
External Sta.			I-E & E-I	Productions			Attractions		
Number	Description	ADT	Trips	HBW	HBO	NHB	HBW	HBO	NHB
211	I-90 - West	69000	47000	16544	12831	7050	4136	8554	7050
212	Deadwood Ave North of I-90	6550	5730	1764	1564	859	757	1044	860
213	Haines Avenue North o Viking Rd.	2400	2400	739	655	360	317	437	360
214	W. Nike Road North of Country Rd.	1250	1250	385	342	187	165	228	188
215	Dyess Avenue North of225 St.	2000	2000	616	546	300	264	364	300
216	Elk Vale Road North of Country Rd.	1550	1550	477	424	233	205	282	233
217	151st Avenue North of I90	400	400	123	109	60	53	73	60
218	I-90 East	42200	19740	6080	5389	2962	2606	3593	2960
219	E. Highway 44	10600	9280	2858	2534	1392	1225	1689	1392
220	S. Highway 79	6900	5900	1817	1611	886	779	1074	884
221	Neck yoke Road	1200	1200	370	328	180	158	218	180
222	S. Highway 16	17250	15370	4734	4196	2305	2028	2798	2306
223	Sheridan Lake Road	1700	1700	524	464	256	224	309	254
224	W. Highway 44	4800	4800	1478	1310	720	634	874	720
225	Nemo Road	6950	6270	1932	1712	941	827	1141	941
226	SD Highway 79	14500	12460	4386	3402	1870	1097	2267	1868

4.4. Adjusting & Reporting Future Year Model Traffic Projections

As with the base year model assignment, execution of the traffic assignment causes TransCAD to create a binary file of link volumes, final travel speeds, v/c ratios, and congested travel times. The output file is joined to the link database file. The user merely needs to "export" the joined file as a geographic file to have permanent access to the assignment results as a geographic file.

In any assignment of travel to a network, the link-assigned volumes may require some redistribution between available facilities to more accurately predict actual operating conditions. Historically, transportation planning procedures have used screen lines and /or auxiliary cut lines to analyze assignment results. The use of functional class, count ID, and link type identifiers in the network line file allows complete flexibility to extract model output for various combinations of links. As part of this model development process, several Excel spreadsheets have been set up to quickly perform some "post-processing" of assignment output.

A screen line adjustment procedure documented in NCHRP Report No. 255 has been "programmed" to an Excel spreadsheet ("Vol_Adj_Rapid 2025_1.xls"). This procedure is based on the premise that while models are accurate with assignments within a travel corridor of multiple routes, models are less accurate with respect to assignments to individual routes within a single corridor. The procedure examines differences between the base year counts and base year model assignment, and then makes corresponding adjustments to a future year assignment. The procedure is capable of accounting for new routes and increased capacity on existing routes as well.

The spreadsheet contains information about the base year (2000) calibrated model results, and only needs results from a specific run to perform screen line adjustments. The process requires only that the assignment output be screened to include only links with

counts (where “COUNT_ID” field is >0), and sorted into COUNT_ID ascending order. The screened, sorted data then can be easily saved from the TransCAD dataview to a database file, and the results “pasted” directly into the input portion of the spreadsheet. The spreadsheet is currently set up to process 46 different screen lines and report the results in COUNT_ID order. A printed copy of the spreadsheet process results for the year 2025 assignment is included in Appendix D.

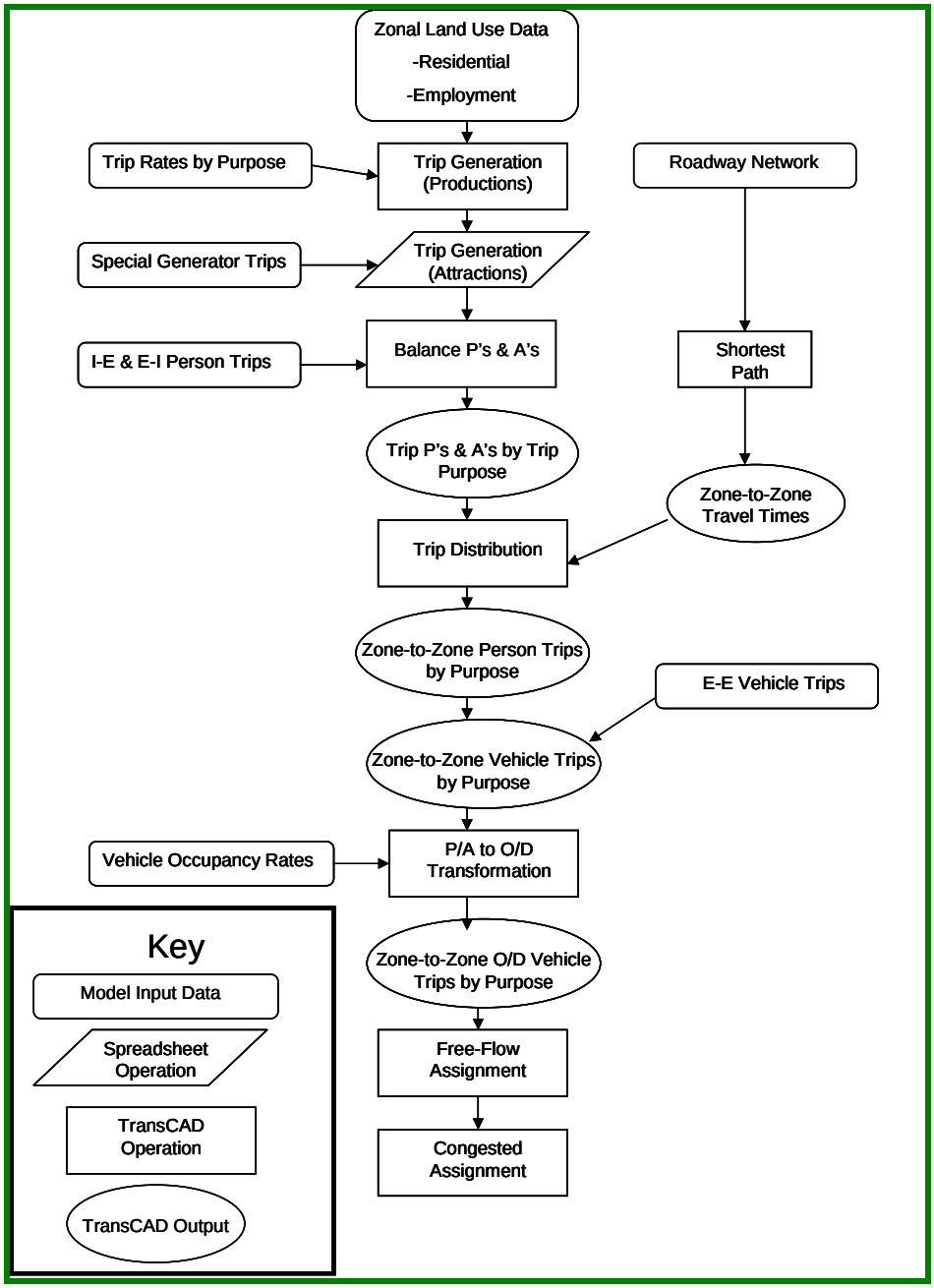
While the screen line adjustment process is automatic, some user judgment is still required to review results for reasonableness. Since some specific count links are reported by more than one screen line, user judgment is required to select the most reasonable traffic volume projection.

Just as caution is advised when reporting results of the screen line adjustment process, caution is also advised when reporting raw model assignments. The user must keep in mind the required accuracy of travel demand models (plus or minus one lane) and understand that others may expect, or assume greater levels of accuracy.

5. Model Users Guide

This section has been prepared to guide the user through the execution the Rapid City TransCAD model. The Users Guide begins with development and/or revisions to socioeconomic data, covers model network preparation, includes discussions and instructions to operate all models (trip generation through assignment), and includes detailed instructions to perform post-processing operations. A modeling step flow diagram graphic is provided as Figure 15 to show overall model flow and execution.

Figure 15 - Modeling Flow Diagram



5.1. Socioeconomic Data Preparation

Socioeconomic data is necessary to perform trip generation steps. Residential data required includes households, average household size, and autos per household. This data is coded directly to the TAZ geographic file and is utilized with TransCAD procedures for generating trip *productions*.

Non-residential data is required in the form of employees in three different categories; retail, service, and other. Non-residential data is utilized by Excel spreadsheets to develop trip *attractions*. Since raw non-residential land use data is formatted differently for the base year and future, two separate Excel spreadsheets have been utilized to convert square footage of non-residential building space to employment. One spreadsheet utilizes the 10 different categories of employment provided for base year modeling and provides the required three categories of trip attractions; another utilizes the 4 categories of non-residential building space provided for future land use and results with three categories of trip attractions. A third spreadsheet was utilized to take parcel-level non-residential building area information and convert it to the 10 different categories of employment.

Special generator zone attractions are handled by separate Excel spreadsheets; one for the base year and one for the future year. The spreadsheets are identical. Only the input data regarding land use intensity is different. Since special generator attractions are calculated separately from "ordinary" attractions, the two must be added together to form total attractions before being joined to the TransCAD TAZ file.

Since base year socioeconomic data is "fixed", data preparation steps will concentrate on methods for using different socioeconomic data for a future land use scenario. Several potential methods for developing different socioeconomic data scenarios are possible:

1. Residential data (households, etc.) could be prepared "off-line" and saved to a database format. Provided that the TAZ number is part of the database, the revised residential data could then merely be "joined" to the TransCAD TAZ file for use with generating trip productions.
2. Residential data already part of the TransCAD TAZ file could be edited directly within the TransCAD dataview. Caution should be exercised with this method as the editing process will overwrite any existing data unless the TAZ file is first exported to a new file.
3. Non-residential building areas can be revised directly in the Excel spreadsheet. The revisions will result with newly generated trip attractions which can then be added to special generator attractions and joined to the TransCAD TAZ file as total attractions.

5.2. Roadway Network Preparation

The model network is "built" from the TransCAD line layer for streets. This line layer file contains all data necessary for use as a model network, and contains coding to enable

several network scenarios to be individually utilized. To enable the line layer to be utilized as a network for traffic modeling, the network needs to be "created" using the TransCAD *Networks/Paths….Create* menu. Prior to creating the network, several selection sets need to be formulated based on the line layer and its nodes so the user can control and identify particular aspects of the line file for use with modeling.

All line layer links that are to be utilized for network modeling need to be coded with a non-zero "NETWORK_ID". Through the initial model set-up, base year 2000 network links are all coded with NETWORK_ID=1. Future links have been coded with ID's greater than 1, as follows:

NETWORK_ID = 2: Southeast Connector
NETWORK_ID = 3: Not utilized
NETWORK_ID = 4: Elm Avenue extension to Catron Boulevard (US 16B)
NETWORK_ID = 5: 5th Street extension to Catron Boulevard (US 16B)
NETWORK_ID = 6: East Anamosa Street extension from E. North St. to Elk Vale Rd.
NETWORK_ID = 7: East Mall Drive extension to Elk Vale Road
NETWORK_ID = 8: I-90 / Liberty Blvd. interchange and connection to N. Ellsworth Rd
NETWORK_ID = 25: Various other collector streets expected to be in-place and operating by the year 2025.

In addition to identifying links to be included with the model network, a field called "NetDisable" has been established to allow identification of links that will be disabled or out of service for the future. For instance, the reconstruction of the Exit 60 interchange with I-90 (E. North Street) will require that the Dyess Avenue overpass be eliminated as well as the westbound on-ramp to I-90 from Dyess Avenue. These links are identified with a "NetDisable" code of "25", since the new interchange is identified with a NETWORK_ID code of "25". Likewise, disabled links associated with a specific project listed with the specific NETWORK_ID's above have corresponding "NetDisable" codes. This way, if it was desired only to model the Southeast Connector project, links with NETWORK_ID = 2 would be included while links with "NetDisable" = 2 would be disabled.

To prepare a line file for use as a network for travel demand modeling, the following steps are necessary:

1. Open centerline geographic file
    a. Make selection sets for following:
        i. Network links. *(Select using the NETWORK_ID field)*
        ii. Centroid connector links. (*Select links with Link Type or 2025 Link Type = 99)*
        iii. Disabled Links *(Select using the "NetDisable" field)*
    b. Change selection set settings (selection tools) to make other links invisible…to simplify displayed centerline file (optional).
    c. Make endpoints geographic file visible and make selection sets for the following:
        i. TAZ centroids *(ID<=226)*

ii. External station centroids *(ID between 211 and 226)*

d. Make non-centroid nodes invisible to simplify and clean up displayed map (optional).

2. Create Model Network from line layer *(using the "Networks/Paths…Create" menu)*:
   a. Include all link attributes
   b. Include ID in node fields
   c. Save to network file (name of your choice).
   d. Edit Network "Settings" *(using the "Networks/Paths…Settings" menu)*
      i. Check the "centroids" box and select "Link Type" or "2025 Link Type" field, both on the "options" tab of the "info" window.
      ii. Select "Turn Penalties" radio button, then select "Turn Penalties" tab to allow selection of turn penalty file ("2025 TurnPenalties.bin"). This file prohibits left turns at Elk Vale Rd. and Beale St., and could be modified to include other locations, as desired.
      iii. Select "other settings" tab…check "in selection set" for centroids and pick set from pull-down menu for TAZ centroids.
      iv. Select link type codes file (LINKTYPE LOOKUP 24.DBD, for 24-hour assignment)
      v. Select the "Update" tab at the bottom of this window to allow selection of disabled links. Select the "Enable/Disable Links" pull-down and select "disable". Then select specific links from the selection set listed.
      vi. Select "OK" for the Update window.
      vii. Select "OK" for the Settings window. The network is now completed.
   e. Select "*Networks/Paths…Multiple Paths"* menu and run multiple shortest paths using "25_Model Time" from TAZ centroids to TAZ centroids (be sure to use the free-flow travel time that includes a 2-minute "penalty" for interstate ramps…not including ramps to/from I-190 or ramps to/from E. North Street. Those ramps have a 1-minute penalty.).
   f. Fill intrazonal travel times on resulting travel time matrix using the "planning utilities" menu. Use nearest neighbor method (adjacent 3 zones) factoring times by 0.5 to fill the diagonal (intrazonals).
   g. Clear E-E interchange impedance values (done by highlighting the rows/columns of 211-226 (external zones), right-click the highlighted area and select "clear". This prevents E-E trips from being distributed (they are user input separately with the EE Trip matrix).

Once these steps are completed, a network is now prepared and ready for assignment. Once the network is created, it is recommended that the "map" file be saved. This way, the map and associated network settings can easily be called up at a later time without having to re-create the network from scratch.

The user is cautioned to exercise care when editing the line file from which the network will be created. When adding links, it is frequently necessary to split existing links to form a new node for connecting the new link. TransCAD allows the user to determine how the data associated with the link being split is treated. Care is needed to ensure that critical link data (COUNT_ID, Link Type, FunClass, etc.) are not mathematically "split" during the process. Care also needs to be exercised to ensure new links are physically attached to existing links to create a continuous path for flow of traffic.

5.3. Trip Generation

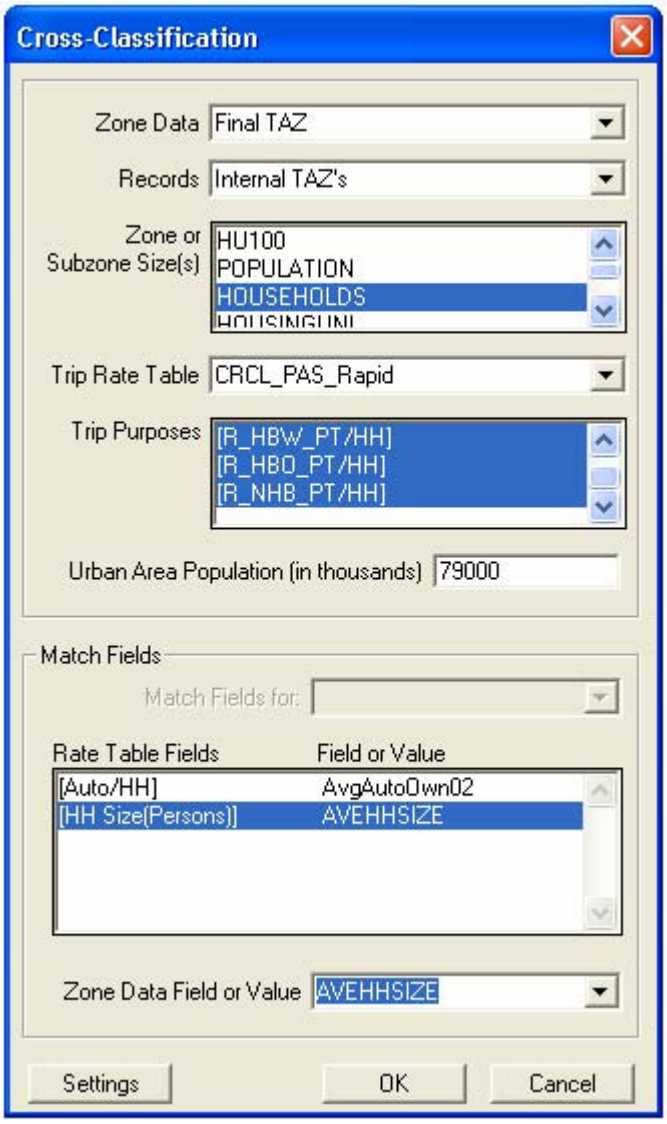
The next series of steps will perform the development of trip attractions and productions, and the balancing of productions and attractions. This step will include use of the external-internal and internal-external productions and attractions. The result will be balanced production and attraction fields for each TAZ that will be a part of the TAZ file.

5.3.1. Productions

Trip productions are developed using a modified cross-classification file and a TransCAD procedure. The TAZ layer is required for this operation, and data for TAZ households, average household size, and autos per household are required to be part of the file. Development of the residential socioeconomic data was covered in an earlier section. The procedure is as follows:

1. Open the TransCAD TAZ geographic file.
2. Make selection sets for External Station TAZ's *(ID between 211 and 226)*
3. Make selection set for Special Generator Zones *(SpGen = 1)*
4. Make a selection set for Interior TAZ's *(ID<=210)*
5. Open the cross-classification table *(CRCL_PAS_Rapid.bin)*
6. Select the "Planning" pull-down menu, then "Productions", then "cross-classification"
    a. Select the correct file for "zone data" *(TAZ layer file)*
    b. Select "Interior TAZ's" for the "records" section
    c. Select the households field for the "Zone or Sub-zone Size) selection
    d. Fill in area population box with model area population
    e. Select the appropriate fields for Autos/HH and HH Size
    f. Once the inputs are complete, the *Productions* window will appear as that shown in Figure 16.
    g. Select OK to close window
    h. Name the output file
7. Once the productions run is completed, you will have a dataview containing the TAZ data joined to the production results for interior zones. Export this file to a new file name for use later.

Figure 16 - Productions Window



5.3.2. Attractions

Attractions for internal TAZ's are developed using spreadsheets detailed earlier in this document. TAZ attractions developed from spreadsheets need to be saved as database files so they can be joined to the TAZ file using the TAZ identifier to accomplish the join.

Attractions are developed from employment data in three categories; retail, service, and other. Non-residential building square footages are used as input to the attractions spreadsheet to generate the attractions. In addition to non-residential floor area, the spreadsheet has an input field for attractions generated through the special generator spreadsheet. Unless special generator uses are changed, that portion of the attractions spreadsheet may be left unchanged. Otherwise, the results of the special generator

spreadsheet need to be pasted into the attractions spreadsheet before total attractions are extracted and joined to the TAZ file.

Once the attractions are joined to the TAZ layer, it again needs to be exported to make the join permanent.

5.3.3. External Zone Productions & Attractions

Productions and attractions (person trips) at external station TAZ's are developed separately from the TransCAD platform by an Excel spreadsheet (2025 IE & EI Trip Estimate – Final.xls). This spreadsheet results with productions and attractions by purpose for each external station TAZ. Results from this spreadsheet can be either hand-coded to the TAZ file, or may be joined by first creating a database file of the results and joining the database file to the TAZ file.

5.3.4. Balancing Productions and Attractions

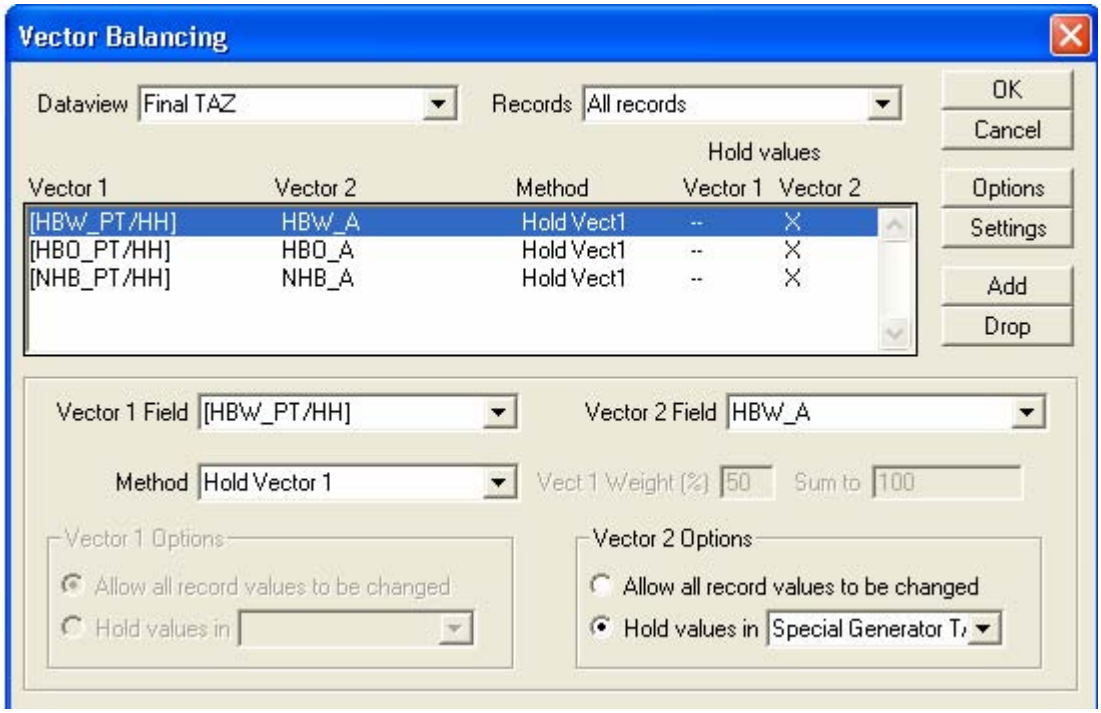
Once productions and attractions from both internal and external station TAZ's are included on the TAZ file, they may be summed to create total productions and attractions by purpose (HBW, HBO, and NHB). The summed productions and attractions need to be balanced (where total productions and attractions, by purpose, are equal) prior to performing the trip distribution step.

For the Rapid City model, the balancing process is performed by holding productions and allowing attractions to adjust to result with the balance. This is true for all TAZ's except for special generator zones and external station TAZ's.

To balance productions and attractions, the following steps are necessary:

1. Open the TAZ geographic file (if not open already)
2. Make selection sets for the following:
    a. Special Generator Zones *(SpGen=1)*
    b. External Station Zones *(ID>=211)*
3. Initiate balancing process by choosing the "*Planning…Balancing"* menu.
4. Add a row of vectors to balance for each purpose (HBW, HBO, and NHB).
5. For each purpose, select the appropriate production field for Vector 1, and the appropriate attraction field for Vector 2.
6. For each purpose, select "Hold Vector 1" in the *Method* list (this assumes that productions are selected as Vector 1.)
7. For each purpose (row), select the "Hold vector in" radio button, and select the "special generator TAZ" selection set created earlier. The Vector Balancing window should look like the one shown in Figure 17.

Figure 17 - Vector Balancing Window



8. Select “OK” and provide a name for the resulting file.

The results of the balancing process will be data for balanced productions and attractions for each purpose. This result will be temporarily joined to the TAZ dataview. To make the join permanent, export the TAZ file.

Once productions and attractions are balanced, this step does not need to be repeated unless a change of land use is modeled.

5.4. Trip Distribution

Trip distribution uses the impedances developed earlier (based on travel time), and distributes our balanced production-attraction matrix from zone to zone. The Rapid City model uses a gravity model application using a gamma function. The result of the trip distribution process will be a matrix file with three matrices, one for each trip purpose. The file will still be in person trips and will still be in production-attraction format.

Trip distribution begins with a TransCAD window with both the network (line layer) and TAZ files open. Also, the shortest path matrix of travel times between zones (a result of network preparation step) will need to be open.

The trip distribution process steps are detailed below:

1. Select TAZ layer as dataview – all features

2. Select the *Planning…Trip Distribution…Gravity Evaluation* from the pull-down menu.
3. Set up evaluation for each purpose (HNW, HBO, and NHB), and select the balanced P's and A's from the TAZ dataview. Use default number of iterations (10) and convergence value (0.01). Ensure *constraint type* is set to *doubly* with the radio button.
4. Select the *Friction Factors* tab, and then select the *Gamma* radio button.
5. Use the following Gamma function parameters for gravity evaluation:

Trip Purpose	***a***	***b***	***c***
HBW	28,507	0.02	0.01
HBO	139,173	1.0	0.05
NHB	219,113	1.0	0.05

6. Ensure the proper Impedance Matrix File and Matrix are selected
7. Use free flow time (with 2-min. and 1-min. interstate ramp penalties) for free-flow Trip Distribution
8. Create 24-hour all purpose trip matrix:

5.5. Converting P/A to O/D Format

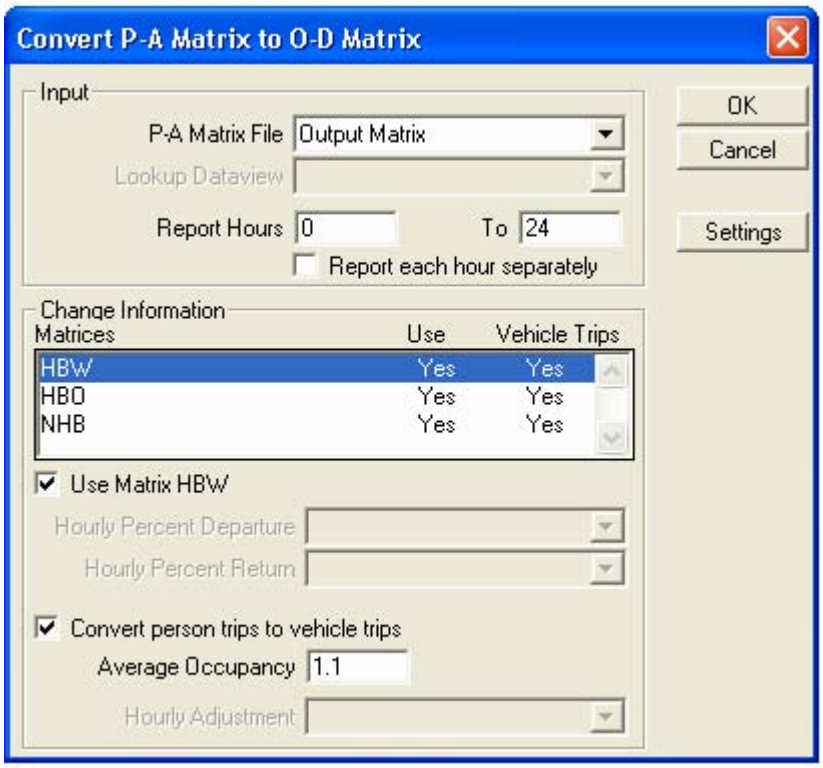
The trip distribution process results with a 24-hour zone-to-zone person trip matrix file with matrices for each purpose. This matrix is still in production-attraction format and now needs to be converted to origin-destination format. TransCAD provides a procedure to make this conversion simultaneously with converting person trips to vehicle trips. The P/A to O/D conversion (and person trip to vehicle trip conversion) is accomplished as follows:

1. Select the Planning…PA to OD pull-down menu.
2. Uncheck "report each hour separately" to create a 24-hour trip matrix.
3. Highlight each trip purpose matrix in turn, check the "use matrix" box and the "convert person trips to vehicle trips" box, then fill in the auto occupancy factors listed below for each purpose. The window will look like the one shown in Figure 18.

Trip Purpose	HBW	HBO	NHB
Auto Occupancy	1.10	1.30	1.20

4. Save the resulting file.

Figure 18 - P/A to O/D Window



5.5.1. Development of 24-Hour All-Purpose Vehicle Trip Matrix

The result of the P/A to O/D process will be a matrix file with three matrices of vehicle trips for each purpose. For the 24-hour assignment, it is desired to have a 24-hour all purpose vehicle trip table. To obtain the all-purpose table, we need to combine the three purpose matrices with the external-external vehicle trip matrix. That is accomplished through the following steps:

1. Add resulting O/D matrices together to form a combined-purpose vehicle trip matrix using "quick sum" matrix operation.
2. Within the same matrix file, create a new (empty) matrix using *Matrix…Contents*. Rename the new matrix as "24-Hr. All Purpose".
3. Open E-E Trip Matrix file.
4. Fill the newly created "24-Hr. All Purpose" matrix using cell-by-cell addition, adding the "quick sum" matrix and the external-external trip matrix. The result is the 24-hour all purpose vehicle trip matrix that is ready for assignment to the model network. Be sure to check the box so that empty cells are treated as zeros.

5.6. Initial Free-Flow Assignment

Now that we have created a 24-hour all purpose vehicle trip table (matrix), it can be assigned to the network. The initial assignment will utilize the free-flow travel times (created using the "2025 Model Time" field for time). The initial free-flow assignment is accomplished using the following steps:

1. Perform assignment using "user equilibrium assignment" and the travel time with added ramp penalty and capacity, alpha and beta parameters from the 24-hour link-type look-up table.
2. Export line layer to permanently join the initial assignment results and the line layer database.
3. Modify the link attributes of Free-Flow Assignment to eliminate unnecessary attributes…saving the congested travel times and any other desired attributes.

The result is an assignment using the free-flow travel times for route selection. Since it is desired to emulate congested roadways for route selection, an additional assignment is necessary…one using the "congested" travel times for route selection. The congested travel times are the "max time" field that result from the initial free-flow assignment.

5.7. Final, Congested Assignment

In this step, we will perform another assignment of the 24-hour all purpose vehicle trip table, only this time we will utilize the congested travel times that resulted from the free-flow assignment. This assignment is accomplished using the following steps:

1. Use Free-Flow Assignment line layer to create new network file…make this network file ready for congested-flow trip assignment.
2. Reassign the "24-Hr All Purpose vehicle" trip table created earlier to the new network, selecting the congested travel time (max time) as the impedance.

The result from this assignment is the 24-hour all purpose vehicle assignment. The new assignment results are joined to the network layer and need to be exported to make the join permanent. Export the dataview to make the results readily available. This assignment is ready for post-processing and interpretation by the modeler.

5.8. Post-processing Adjustment Procedures

Post-processing of the future model results entails saving all results for links with *COUNT_ID*>0. By creating a selection set with only links with a COUNT_ID value greater than 0, the resulting network link attributes can be saved to a database file for copy-paste into the volume adjustment spreadsheet that works with the established screen lines. The screen line adjustment spreadsheet will automatically adjust future assignments and result with future traffic projections. Some cautions are necessary, as some screen lines may not be reliable, and some links are reported by more than one screen line. User judgment and discretion is required for reporting of future "projections".

Once future projections are finalized, they can be formulated in a database file and, using the “COUNT_ID” value, they can be joined to the line layer for use with creating plots showing future projections.

5.9. Output Summary and Reporting

The output of future traffic assignments can be reported in many different ways. TransCAD allows full freedom with selection of links, and with mathematical manipulation of link data. Measures of future network performance such as Vehicle Hours of Travel (VHT), or Vehicle Miles of Travel (VMT) are easily generated using mathematical formulas with the assignment results. Results can be summarized by facility type through the use of the functional class field, or can be summarized by area type through the use of area type field. The creation of model graphics depicting assignment results is virtually limitless.

6. Recommended Additional Traffic/Travel Studies

Through development of the Rapid City travel demand model, the need for additional data became apparent. Although use of national "average" data or US Census data is acceptable, it is not a replacement for local data. Model development required the use of national or average data for several key components. The development of actual local data and statistics would be very beneficial for model accuracy and applicability. Useful and suggested local data would include data gathered through conduct of the following local studies or data collections efforts:

- Additional Traffic Count Data: Although traffic count data is available at over 300 sites throughout the modeling area, numerous discrepancies were disclosed through the model development process.
    - It was discovered that the process of factoring local count data to peak season average daily traffic (PSADT) may have inherent flaws. Through development of model inputs, it was discovered that seasonal factors were developed through examination of permanent count stations maintained by the SDDOT…mostly on state highways on the fringe of the modeling area. An examination of permanent count station data nearer the center of Rapid City urban area failed to show the large seasonal variation exhibited by count stations located towards the fringe of the urban area. I-90 count stations exhibited the largest variation in seasonal traffic counts. Additional permanent count stations, or more frequent traffic counts are needed to verify the seasonal variation of traffic throughout the modeling area.
    - The City of Rapid City conducts a regular traffic count program…a commendable activity. An examination of year-by-year count data revealed that counts are recorded for each year regardless of extenuating circumstances that may have a significant impact to the count. We evaluated traffic counts year-by-year and found significant variations (both increases and decreases). Most often the variations were "explained" by construction or detours in effect at the time of the counts. The annual count program should consider changes to roadways and delay, or skip counts on facilities that are experiencing unusual traffic volumes due to construction activities. Counts during detours or major construction activities are not "normal" and only detract from data that has the ability to track normal growth or changes.
- Origin-Destination Travel Studies: Origin-destination studies are extremely useful for calibration of travel demand models. In the absence of such studies, limited data is available to "localize" travel demand models to specific, local conditions. While these sorts of studies are expensive and comprehensive, their value is tremendous where travel demand modeling is concerned. Most often these studies are conducted as mail-in surveys supplemented with telephone follow-ups. Such data may be substituted to some degree with US Census Bureau Journey to Work data, when available, although the census data is typically not as comprehensive.

- Vehicle Occupancy Studies: Vehicle occupancy for particular trip purposes had to be estimated to achieve acceptable model results. In the absence of real, local data, these estimates are somewhat arbitrary and are sometimes no better than guesses. National averages may not be applicable in the Rapid City area. Vehicle occupancy studies conducted during the peak periods or near major employment centers would help establish real vehicle occupancy rates by purpose.
- Trip Generation Studies: The trip generation study conducted by the City of Rapid in 1995 was instrumental with establishment of trip generation rates used for model development. The study demonstrated that trip generation rates of Rapid City varied substantially from national average rates. Additional studies are needed. Studies should target residential subdivisions where access is limited (to obtain accurate results) and where other land uses (other than residential) are limited. Studies should also target non-residential developments of varied uses. For instance, the Rushmore Mall should be targeted to establish "real" trip generation rates for this special generator. Likewise, other major special generators identified through this model development process should be studied individually to establish their true trip generation rates.
- Travel Time Studies: While the uses of posted speed limits are useful for determination of travel times, travel time studies are invaluable for model calibration to local conditions. Travel time studies would be beneficial for major corridors to establish "real" congested travel times, including the impacts of signalized intersections and traffic congestion. Through the model calibration process, several corridors were revealed to receive traffic assignments that were substantially different from reality. It is suspected that travel times in these corridors are substantially different than what might be assumed through utilization of speed limits for model travel times.

7. Recommended Model Enhancements

The travel demand model developed through this project is a starting point. It is not the end product and can be enhanced in many ways. Limited by budget and schedule, this model is not "perfect". Much room exists for enhancements to the level of detail. The following are areas where the model can be enhanced to add detail, and possibly accuracy without adding to data collection efforts:

- Turn Penalties/Delays: Intersection delays are an important part of daily vehicle travels within the model area. Certain intersections present minimal delays, while others present significant delays. Through the use of "actual" delay, route choices can be influenced to a significant degree. TransCAD offers fairly easy methods of establishing delay for left and right turns at intersections of different facility types. A more detailed approach might be to establish turn delays specific to individual intersections to more closely emulate actual conditions on the roadway network. The City staff could provide such estimates, and identify specific intersections with significant delays to improve model assignments.
- Volume-Delay Curve Parameters: Estimates of the volume/delay relationship for the Rapid City area were made for the initial model assessment based on nationally accepted parameters. The relationships may be completely different for the specific situation of Rapid City and they might well be investigated. The initial model was established with sufficient link type codes to enable very detailed volume-delay relationships that are specific to Rapid City. The flexibility of the model set-up also allows establishment of additional link-type codes to handle specific links that may experience volume-delay relationships different than other similarly classified links.

In addition to the enhancements identified above, additional enhancements could be made to further refine and add accuracy to basic model elements:

- Traffic Analysis Zone Structure: The trend as of late, given the computing ability available, is to move towards a very fine-grained traffic analysis zone structure. Specifically, the Montana Department of Transportation has been developing TransCAD models for MPO's using the census block as the TAZ structure. This also involves utilizing local streets in the network structure. This trend brings both positives and negatives to the regional planning work task. While the advanced computing capabilities allows much more detail with respect to the TAZ structure, and requires inclusion of local streets in the model network, it also gives the impression that regional transportation planning activities are accurate, and reasonable down to the local street level. This move may give the impression that regional planning models have the accuracy to be utilized for local, traffic impact study-level planning. This is a misconception. The use of very fine-grained TAZ structures does, however, allow for a more accurate and realistic assignment of traffic to collector streets. In most cases of fine-grained TAZ structure models, assignments to local streets should be ignored and should be excluded from the calibration and reporting processes.

- Trip Generation Rates: With additional local studies, better trip generation rates could be established, specifically with respect to non-residential trip attractions. Residential trip productions are currently cross-classified using average household size and average vehicles per household. Data for the cross-classification was available only at the block-group level. Should data become available at the census block level, the cross-classification could be refined.
- Development of Time-of-Day Parameters: While the TransCAD software comes with tables for time-of-day trip factoring, the tables represent national "average" conditions and may not be representative of conditions specific to the Rapid City area. Time-of-day parameters are necessary for accurate modeling of peak hour conditions, a condition of great interest in the transportation planning process. To develop area-specific time-of-day parameters, the MPO will need to amend their traffic count program to begin collecting hourly volumes in addition to daily totals. A peak hour assignment model will also be greatly enhanced with the addition of some of the other enhancement recommendations, such as development of turning delays.

APPENDIX A

Roadway Network Data

LINK TYPE LOOK-UP TABLE – 24-HOUR ASSIGNMENTS

LINKNAME	CODE	BPRA	BPRB	SPEED	CAP	LANES	ERROR	FUNCTIONK
2-lane Rural Non-Standard, 2-way	1	0.84	5.50	30.00	5500.00	1	5.00	1
Centroid Connector, 2-way	99	0.84	5.50	100.00	50000.00	2	9.00	1
4-lane CBD Interstate	100	0.88	9.80	65.00	18000.00	4	9.00	1
2-lane Urban Interstate	101	0.88	9.80	65.00	18000.00	2	9.00	1
4-lane Urban Interstate	102	0.88	9.80	65.00	18000.00	4	9.00	1
2-lane Suburban Interstate	103	0.88	9.80	65.00	18000.00	2	9.00	1
2-lane Rural Interstate	104	0.88	9.80	65.00	18000.00	2	9.00	1
1-lane Urban Interstate Ramp	105	0.88	9.80	35.00	15000.00	1	8.00	1
2-lane Urban Interstate Ramp	106	0.88	9.80	35.00	15000.00	2	8.00	1
1-lane Suburban Interstate Ramp	107	0.88	9.80	35.00	15000.00	1	8.00	1
2-lane Suburban Interstate Ramp	108	0.88	9.80	35.00	15000.00	2	8.00	1
1-Lane Rural Interstate Ramp	109	0.88	9.80	35.00	15000.00	1	8.00	1
2-lane CBD Principal Arterial, 1-way	200	0.84	5.50	30.00	8500.00	2	5.00	1
3-lane CBD Principal Arterial, 1-way	201	0.84	5.50	30.00	8500.00	3	5.00	1
4-lane CBD Principal Arterial, 1-way	202	0.84	5.50	45.00	8500.00	4	5.00	1
5-lane CBD Principal Arterial, 1-way	203	0.84	5.50	45.00	8500.00	5	5.00	1
6-lane CBD Principal Arterial, 2-way	204	0.84	5.50	45.00	8500.00	3	5.00	1
2-lane Urban Principal Arterial, 1-way	205	0.84	5.50	30.00	10000.00	2	5.00	1
3-lane Urban Principal Arterial, 1-way	206	0.84	5.50	30.00	10000.00	3	5.00	1
4-lane Urban Principal Arterial, 1-way	207	0.84	5.50	45.00	10000.00	4	5.00	1
5-lane Urban Principal Arterial, 2-way	208	0.84	5.50	45.00	11000.00	2	5.00	1
6-lane Urban Principal Arterial, 2-way	209	0.84	5.50	45.00	11000.00	3	5.00	1
2-lane Suburban Principal Arterial, 1-wa	210	0.84	5.50	30.00	14000.00	2	5.00	1
3-lane Suburban Principal Arterial, 1-wa	211	0.84	5.50	30.00	14000.00	3	5.00	1
4-lane Suburban Principal Arterial, 1-wa	212	0.84	5.50	45.00	14000.00	4	5.00	1
5-lane Suburban Principal Arterial, 2-wa	213	0.84	5.50	45.00	14000.00	2	5.00	1
6-lane Suburban Principal Arterial, 2-wa	214	0.84	5.50	45.00	14000.00	3	5.00	1
2-lane Rural Principal Arterial, 1-way	215	0.84	5.50	30.00	11000.00	2	5.00	1
3-lane Rural Principal Arterial, 1-way	216	0.84	5.50	30.00	11000.00	3	5.00	1
4-lane Rural Principal Arterial, 1-way	217	0.84	5.50	45.00	15000.00	4	5.00	1
5-lane Rural Principal Arterial, 2-way	218	0.84	5.50	45.00	15000.00	2	5.00	1
2-lane CBD Principal Arterial, 2-way	219	0.84	5.50	30.00	8500.00	1	5.00	1
5-lane CBD Principal Arterial, 2-way	220	0.84	5.50	45.00	8500.00	2	5.00	1
2-lane Urban Principal Arterial, 2-way	221	0.84	5.50	30.00	10000.00	1	5.00	1
3-lane Urban Principal Arterial, 2-way	222	0.84	5.50	30.00	10000.00	1	5.00	1
4-lane Urban Principal Arterial, 2-way	223	0.84	5.50	45.00	10000.00	2	5.00	1
2-lane Suburban Principal Arterial, 2-wa	224	0.84	5.50	30.00	14000.00	1	5.00	1
3-lane Suburban Principal Arterial, 2-wa	225	0.84	5.50	30.00	14000.00	1	5.00	1
4-lane Suburban Principal Arterial, 2-wa	226	0.84	5.50	45.00	14000.00	2	5.00	1
2-lane Rural Principal Arterial, 2-way	227	0.84	5.50	30.00	11000.00	1	5.00	1
3-lane Rural Principal Arterial, 2-way	228	0.84	5.50	30.00	11000.00	1	5.00	1
4-lane Rural Principal Arterial, 2-way	229	0.84	5.50	45.00	15000.00	2	5.00	1
2-lane Urban Minor Arterial, 2-way	300	0.84	5.50	30.00	8250.00	1	5.00	1
3-lane Urban Minor Arterial, 2-way	301	0.84	5.50	30.00	8250.00	1	5.00	1
4-lane Urban Minor Arterial, 2-way	302	0.84	5.50	45.00	10000.00	2	5.00	1
2-lane Suburban Minor Arterial, 2-way	303	0.84	5.50	30.00	8250.00	1	5.00	1
3-lane Suburban Minor Arterial, 2-way	304	0.84	5.50	30.00	8250.00	1	5.00	1
4-lane Suburban Minor Arterial, 2-way	305	0.84	5.50	45.00	8250.00	2	5.00	1
6-lane Suburban Minor Arterial, 2-way	306	0.84	5.50	45.00	8250.00	3	5.00	1
2-lane Rural Minor Arterial, 2-way	307	0.84	5.50	30.00	8250.00	1	5.00	1
3-lane Rural Minor Arterial, 2-way	308	0.84	5.50	30.00	8250.00	1	5.00	1
2-Lane Suburban Minor Arterial, 1-way	309	0.84	5.50	30.00	8250.00	2	5.00	1
2-lane CBD Collector, 1-way	400	0.84	5.50	30.00	5500.00	2	6.00	1
1-lane Urban Collector, 1-way	401	0.84	5.50	30.00	8250.00	1	6.00	1
2-lane Urban Collector, 2-way	402	0.84	5.50	30.00	8250.00	1	6.00	1
3-lane Urban Collector, 2-way	403	0.84	5.50	30.00	8250.00	1	6.00	1
4-lane Urban Collector, 2-way	404	0.84	5.50	30.00	8250.00	2	6.00	1
1-lane Suburban Collector, 1-way	405	0.84	5.50	30.00	5500.00	1	6.00	1
2-lane Suburban Collector, 1-way	406	0.84	5.50	30.00	5500.00	2	6.00	1
3-lane Suburban Collector, 2-way	407	0.84	5.50	30.00	5500.00	1	6.00	1
4-lane Suburban Collector, 2-way	408	0.84	5.50	30.00	5500.00	2	6.00	1
2-lane Rural Collector, 2-way	409	0.84	5.50	30.00	5500.00	1	6.00	1
3-lane Rural Collector, 2-way	410	0.84	5.50	30.00	5500.00	1	6.00	1
2-lane CBD Collector, 2-way	411	0.84	5.50	30.00	5500.00	1	6.00	1
2-lane Suburban Collector, 2-way	412	0.84	5.50	30.00	5500.00	1	6.00	1
1-lane CBD Local Street, 1-way	500	0.84	5.50	30.00	5500.00	1	6.00	1
2-lane CBD Local Street, 1-way	501	0.84	5.50	30.00	5500.00	2	6.00	1
3-lane CBD Local Street, 2-way	502	0.84	5.50	30.00	5500.00	1	5.00	1
1-lane Urban Local Street, 1-way	503	0.84	5.50	30.00	5500.00	1	6.00	1
2-lane Urban Local Street, 1-way	504	0.84	5.50	30.00	5500.00	2	6.00	1
3-lane Urban Local Street, 1-way	505	0.84	5.50	30.00	5500.00	3	5.00	1
1-lane Suburban Local Street, 1-way	506	0.84	5.50	30.00	5500.00	1	6.00	1
2-lane Suburban Local Street, 1-way	507	0.84	5.50	30.00	5500.00	2	6.00	1
3-lane Suburban Local Street, 2-way	508	0.84	5.50	30.00	5500.00	1	5.00	1
2-lane Rural Local Street, 2-way	510	0.84	5.50	30.00	5500.00	1	6.00	1
3-lane Rural Local Street, 2-way	511	0.84	5.50	30.00	5500.00	1	5.00	1
2-lane CBD Local Street, 2-way	512	0.84	5.50	30.00	5500.00	1	6.00	1
2-lane Urban Local Street, 2-way	513	0.84	5.50	30.00	5500.00	1	6.00	1
3-lane Urban Local Street, 2-way	514	0.84	5.50	30.00	5500.00	1	5.00	1
2-lane Suburban Local Street, 2-way	515	0.84	5.50	30.00	5500.00	1	6.00	1
2-lane Urban Private Road, 2-way	600	0.84	5.50	30.00	5500.00	1	6.00	1
2-lane Suburban Private Road, 2-way	601	0.84	5.50	30.00	5500.00	1	6.00	1

LINK DATA FIELD DESCRIPTIONS, page 1 of 2

ID .....Unique identification number assigned to each link by TransCAD
Length .....Length (miles) of each link
Dir .....Indicator of one or two-way flow, and direction of flow for each link in relation to link topology. Dir = 0, two-way flow, Dir = 1, one-way flow in topology direction, Dir == -1, one-way flow in direction opposite to topology.
Roadname .....Street or roadway name
TOT_LANES.....Total number of lanes, including auxiliary (turn) lanes.
00_Speed.....Posted speed limit, base year conditions
25_Speed.....Anticipated speed limit, year 2025 conditions
FunClass.....Functional classification code per Rapid City Major Street Plan
NETWORK_ID .....Identifier for links to be included in model network. A value of "1" is used for the base year network, a value of "25" used for 2025 network links, other values greater than 1 used for specific improvement projects.
NetDisable.....Field used to indicate links that are disabled for use with various modeling scenarios.
COUNT_ID.....Used as a unique identifier for links with base year count data.
PSADT.....Peak Season ADT for count links from Rapid City count program data.
TAZ.....Indicator of TAZ that contains link. Primarily utilized for centroid connector links.
Link Type.....Identifier of link type. Used primarily for link capacities and to identify centroid connector links (link type = 99).
2025 Link Type.....Identifier of link type for future conditions. Allows changes to link type from base year to future year.
ScreenLine .....Identifier to denote links utilized in screenline analysis. Not necessary for screenline procedure as later developments utilize COUNT_ID field as primary source of link data.
00_LinkTime.....Year 2000 link travel time using 2000 model speed.
00_CCLinkTime .....Year 2000 centroid connector link travel time. Kept separate since this time is assigned by area type and includes network access and terminal time.
25_LinkTime.....Year 2025 link travel time using 2025 model speed
25_CCLinkTime .....Year 2025 centroid connector link travel time. Kept separate since this time is assigned by area type and includes network access and terminal time.
A Type .....Designator for area type. Primarily utilized for centroid connector travel times/terminal times.
CAP.....Link Capacity. Used for assignment with BPR formula. Data NOT coded directly to link. Data is obtained from link type look-up table. Field must remain for link for assignment and can be used should user want to code a unique capacity value to a specific link.

LINK DATA FIELD DESCRIPTIONS, page 2 of 2

BPRA .....Alpha coefficient for BPR formula. Data NOT coded directly to link. Data is obtained from link type look-up table. Field must remain for link for assignment and can be used should user want to code a unique value to a specific link.

BPRB .....Beta coefficient for BPR formula. Data NOT coded directly to link. Data is obtained from link type look-up table. Field must remain for link for assignment and can be used should user want to code a unique value to a specific link.

LANES.....Number of directional through lanes (excluding auxiliary lanes)

00_Model_Sp.....Field used to utilize a speed other than the posted speed limit for base year modeling. Allows input of "true" link travel speed (free-flow conditions).

2025 Model Sp.....Field used to utilize a speed other than the posted speed limit for future year modeling. Allows input of "true" link travel speed (free-flow conditions).

00_ModelTime.....Field used for calculation of link travel time using "model speed" parameter rather than posted speed limit. Allows input of "true" link travel time (free-flow conditions).

Peak Season Factor ....Factor utilized to convert PSADT count values to AADT values.

AADT .....AADT count values for all links with counts.

Cordon Line .....Established for use with evaluating cordon lines (not used at this time)

00_TravTime.....Field used for final free-flow year 2000 link travel time.

25_TravTime.....Field used for final free-flow year 2025 link travel time.

APPENDIX B

Year 2000 Demographic Data & Final P's & A's

BASE YEAR ZONAL PRODUCTIONS & ATTRACTIONS, page 1 of 4

									ATTRACTIONS			PRODUCTIONS			BALANCED PRODUCTIONS & ATTRACTIONS					
TAZ	AREA	POPULATION	HOUSEHOLDS	AVE HH SIZE	AVG HH INC 02	AVG AUTO OWN	SPGEN	ATYPE	HBW_A	HBO_A	NHB_A	HBW_P	HBO_P	NHB_P	HBW_P	HBW_A	HBO_P	HBO_A	NHB_P	NHB_A
1	0.20	-	-	0.00	36293	1.34	1	1	1,115	2,905	1,643					1,115		2,905		1,643
2	0.02	-	-	0.00	36293	1.34	1	1	87	337	179					87		337		179
3	0.03	6	5	1.20	17841	1.09	0	1	413	526	371	10	25	11	10	576	25	691	11	357
4	0.01	65	47	1.38	7558	0.69	0	1	476	611	425	79	195	87	79	664	195	802	87	409
5	0.03	-	-	0.00	17841	1.09	0	1	264	383	256					368		503		247
6	0.03	19	16	1.19	7558	0.69	0	1	831	939	672	27	66	29	27	1,159	66	1,233	29	647
7	0.03	11	7	1.57	7558	0.69	0	1	724	1,398	859	12	29	13	12	1,010	29	1,836	13	827
8	0.02	-	-	0.00	17841	1.09	0	1	160	220	154					223		289		148
9	0.03	11	4	2.75	17841	1.09	0	1	229	302	211	9	28	12	9	320	28	397	12	203
10	0.03	3	2	1.50	7558	0.69	0	1	571	688	489	3	8	4	3	797	8	903	4	471
11	0.03	142	7	20.29	27569	0.88	0	1	464	428	318	16	59	20	16	647	59	562	20	306
12	0.05	161	69	2.33	36293	1.34	0	1	68	145	93	162	479	214	162	95	479	190	214	90
13	0.03	201	102	1.97	36293	1.34	1	1	203	720	391	212	520	231	212	203	520	720	231	391
14	0.03	47	16	2.94	36293	1.34	1	1	1,206	3,046	1,739	38	111	50	38	1,206	111	3,046	50	1,739
15	0.03	33	21	1.57	36293	1.34	0	1	1,259	2,118	1,328	44	107	48	44	1,757	107	2,781	48	1,279
16	0.03	74	38	1.95	27569	0.88	0	1	450	803	498	64	157	70	64	628	157	1,054	70	480
17	0.02	316	1	316.00	27569	0.88	0	1	554	650	459	2	8	3	2	773	8	853	3	442
18	0.02	239	23	10.39	27569	0.88	1	1	123	760	382	54	195	66	54	123	195	760	66	382
19	0.02	96	45	2.13	27569	0.88	0	1	210	173	130	94	277	123	94	293	277	227	123	125
20	0.04	264	132	2.00	51944	1.65	0	2	-	119	66	274	673	299	274	-	673	156	299	64
21	0.03	141	85	1.66	36293	1.34	0	2	183	446	246	177	433	193	177	255	433	586	193	237
22	0.01	41	16	2.56	36293	1.34	0	2	85	265	135	38	111	50	38	119	111	348	50	130
23	0.01	61	43	1.42	27569	0.88	0	2	83	155	95	73	178	79	73	116	178	204	79	91
24	0.01	17	9	1.89	22885	1.34	0	2	255	96	93	19	46	20	19	356	46	126	20	90
25	0.01	112	34	3.29	27569	0.88	1	2	187	837	436	81	247	98	81	187	247	837	98	436
26	0.07	205	74	2.77	27569	0.88	0	2	57	133	84	154	455	203	154	80	455	175	203	81
27	0.03	-	-	0.00	25370	1.42	0	2	247	1,289	601					345		1,692		579
28	0.06	9	4	2.25	25370	1.42	0	2	197	594	307	9	28	12	9	275	28	780	12	296
29	0.01	5	2	2.50	19018	1.09	1	2	1,080	6,484	3,242	5	14	6	5	1,080	14	6,484	6	3,242
30	0.03	64	29	2.21	19018	1.09	0	2	75	419	196	68	201	90	68	105	201	550	90	189
31	0.04	4	1	4.00	25370	1.42	0	2	191	67	67	3	10	4	3	266	10	88	4	65
32	0.03	419	185	2.26	19018	1.09	0	2	74	237	140	436	1,284	573	436	103	1,284	311	573	135
33	0.50	483	208	2.32	51944	1.65	1	2	145	471	262	490	1,443	644	490	145	1,443	471	644	262
34	0.13	755	370	2.04	34129	1.65	0	2	187	714	392	871	2,567	1,146	871	261	2,567	937	1,146	377
35	0.09	570	268	2.13	22885	1.34	0	2	83	397	218	631	1,859	830	631	116	1,859	521	830	210
36	0.05	235	81	2.90	17155	1.10	0	2	100	124	82	191	562	251	191	140	562	163	251	79
37	0.15	781	356	2.19	32222	1.49	0	2	-	320	178	838	2,470	1,103	838	-	2,470	420	1,103	171
38	0.22	67	30	2.23	19018	1.09	0	2	163	567	289	71	208	93	71	227	208	744	93	278
39	0.07	480	2	240.00	19018	1.09	1	2	595	3,572	1,786	7	25	8	7	595	25	3,572	8	1,786
40	0.11	65	30	2.17	38750	1.57	0	2	25	56	35	71	208	93	71	35	208	74	93	34
41	0.21	1	1	1.00	38750	1.57	0	2	428	1,868	897	1	3	1	1	597	3	2,453	1	864
42	0.08	308	119	2.59	34129	1.65	0	2	116	300	164	280	826	369	280	162	826	394	369	158
43	0.08	459	214	2.14	32386	1.68	0	2	43	435	220	504	1,485	663	504	60	1,485	571	663	212
44	0.07	462	198	2.33	37500	1.90	0	2	12	187	106	466	1,374	613	466	17	1,374	246	613	102
45	0.06	368	170	2.16	32917	1.61	0	2	-	153	85	400	1,180	527	400	-	1,180	201	527	82
46	0.11	153	103	1.49	33152	1.86	0	2	189	850	416	214	525	233	214	264	525	1,116	233	401
47	0.14	292	139	2.10	38750	1.57	0	2	226	887	447	327	964	431	327	315	964	1,165	431	430
48	0.06	150	71	2.11	67279	1.73	0	2	30	168	86	167	493	220	167	42	493	221	220	83
49	0.06	127	63	2.02	32386	1.68	0	2	559	1,147	610	148	437	195	148	780	437	1,506	195	587
50	0.07	457	197	2.32	37500	1.90	0	2	6	213	115	464	1,367	610	464	8	1,367	280	610	111
51	0.08	463	214	2.16	32917	1.61	0	2	17	295	158	504	1,485	663	504	24	1,485	387	663	152
52	0.05	342	139	2.46	33152	1.86	0	2	51	341	171	327	964	431	327	71	964	448	431	165
53	0.08	139	52	2.67	33152	1.86	0	2	328	1,152	580	122	361	161	122	458	361	1,513	161	558
54	0.08	302	115	2.63	17661	1.71	0	2	246	674	348	271	798	356	271	343	798	885	356	335
55	0.10	440	177	2.49	45811	1.99	0	2	78	230	136	417	1,228	548	417	109	1,228	302	548	131
56	0.05	49	19	2.58	45811	1.99	0	2	124	134	88	45	132	59	45	173	132	176	59	85
57	0.08	343	132	2.60	45811	1.99	0	2	8	166	89	311	916	409	311	11	916	218	409	86
58	0.06	292	117	2.50	37794	1.72	0	2	70	129	83	275	812	362	275	98	812	169	362	80
59	0.14	923	343	2.69	49815	2.01	0	2	-	309	172	900	2,652	1,184	900	-	2,652	406	1,184	166
60	0.61	295	116	2.54	51944	1.65	0	3	236	721	366	273	805	359	273	329	805	947	359	352
61	0.03	115	96	1.20	17661	1.71	0	2	95	538	270	199	489	218	199	133	489	706	218	260
62	0.02	-	-	0.00	56692	2.01	0	4	119	169	95					166		222		91
63	0.04	42	20	2.10	54773	2.17	0	2	325	130	122	52	155	69	52	453	155	171	69	117
64	0.11	57	26	2.19	56692	2.01	0	3	2,777	981	971	68	201	90	68	3,874	201	1,288	90	935
65	0.12	527	204	2.58	54773	2.17	0	2	35	378	192	535	1,577	704	535	49	1,577	496	704	185

BASE YEAR ZONAL PRODUCTIONS & ATTRACTIONS, page 2 of 4

									ATTRACTIONS			PRODUCTIONS			BALANCED PRODUCTIONS & ATTRACTIONS					
TAZ	AREA	POPULATION	HOUSEHOLDS	AVE HH SIZE	AVG HH INC 02	AVG AUTO OWN	SPGEN	ATYPE	HBW_A	HBO_A	NHB_A	HBW_P	HBO_P	NHB_P	HBW_P	HBW_A	HBO_P	HBO_A	NHB_P	NHB_A
66	0.14	881	387	2.28	25542	1.79	0	2	14	431	235	911	2,685	1,199	911	20	2,685	566	1,199	226
67	0.45	359	129	2.78	49815	2.01	0	2	328	1,589	770	338	997	445	338	458	997	2,086	445	741
68	1.29	527	205	2.57	33981	1.50	0	2	249	271	189	483	1,422	635	483	347	1,422	356	635	182
69	0.29	1,690	716	2.36	33981	1.50	0	2	530	3,587	1,717	1,686	4,968	2,218	1,686	739	4,968	4,710	2,218	1,653
70	0.27	949	330	2.88	20000	1.46	0	2	471	1,454	766	777	2,290	1,022	777	657	2,290	1,909	1,022	738
71	0.25	1,119	433	2.58	38250	1.59	0	2	283	991	534	1,019	3,004	1,341	1,019	395	3,004	1,301	1,341	514
72	0.52	557	259	2.15	38250	1.59	0	2	1,016	4,977	2,634	610	1,797	802	610	1,418	1,797	6,535	802	2,536
73	0.24	1,398	581	2.41	35733	1.72	0	2	48	649	362	1,368	4,031	1,800	1,368	67	4,031	852	1,800	349
74	0.28	1,699	658	2.58	28250	1.27	0	2	87	656	379	1,549	4,565	2,038	1,549	121	4,565	861	2,038	365
75	0.19	1,277	496	2.57	30682	1.61	0	2	40	504	285	1,168	3,441	1,536	1,168	56	3,441	662	1,536	274
76	0.07	352	159	2.21	27417	1.49	0	2	-	143	80	374	1,103	493	374	-	1,103	188	493	77
77	0.30	285	130	2.19	27417	1.49	0	2	128	748	362	306	902	403	306	179	902	982	403	349
78	0.07	-	-	0.00	17841	1.09	0	2	1,369	472	472					1,910		620		454
79	0.10	-	-	0.00	17841	1.09	1	2	790	3,507	1,791					790		3,507		1,791
80	0.12	333	246	1.35	17841	1.09	1	2	287	1,325	702	511	1,254	557	511	287	1,254	1,325	557	702
81	0.04	240	99	2.42	17422	1.40	0	2	16	188	95	233	687	307	233	22	687	247	307	91
82	0.03	145	39	3.72	30682	1.61	0	2	177	238	148	122	374	148	122	247	374	312	148	143
83	0.05	323	146	2.21	17422	1.40	0	2	106	445	228	344	1,013	452	344	148	1,013	584	452	220
84	0.09	235	95	2.47	27417	1.49	0	2	352	1,342	668	224	659	294	224	491	659	1,762	294	643
85	0.02	-	-	0.00	17841	1.09	0	2	-	-	-					-		-		-
86	0.03	-	-	0.00	17841	1.09	0	2	-	-	-					-		-		-
87	0.04	-	-	0.00	17841	1.09	0	2	97	34	34					135		45		33
88	0.04	-	-	0.00	17841	1.09	0	2	307	1,353	649					428		1,776		625
89	0.26	1,146	491	2.33	25370	1.42	0	2	571	2,190	1,125	1,156	3,407	1,521	1,156	797	3,407	2,875	1,521	1,083
90	0.06	45	19	2.37	27417	1.49	0	2	635	3,080	1,435	45	132	59	45	886	132	4,044	59	1,382
91	0.15	346	155	2.23	38750	1.57	0	2	635	2,214	1,103	365	1,075	480	365	886	1,075	2,907	480	1,062
92	1.32	370	177	2.09	44465	2.25	0	3	-	159	89	464	1,368	611	464	-	1,368	209	611	86
93	0.16	1,034	439	2.36	44465	2.25	0	3	-	395	220	1,152	3,394	1,515	1,152	-	3,394	519	1,515	212
94	0.22	481	226	2.13	44465	2.25	0	3	365	1,839	903	593	1,747	780	593	509	1,747	2,415	780	869
95	0.34	235	86	2.73	71918	2.23	0	3	-	77	43	226	665	297	226	-	665	101	297	41
96	0.39	1,712	604	2.83	71918	2.23	0	3	131	685	397	1,584	4,670	2,085	1,584	183	4,670	899	2,085	382
97	0.21	878	407	2.16	30595	1.67	0	3	190	926	485	958	2,824	1,261	958	265	2,824	1,216	1,261	467
98	0.21	508	247	2.06	17381	1.64	0	2	1,111	3,986	2,016	581	1,714	765	581	1,550	1,714	5,234	765	1,941
99	0.25	1,103	435	2.54	65750	2.05	0	4	90	664	355	1,141	3,363	1,501	1,141	126	3,363	872	1,501	342
100	0.16	8	2	4.00	43387	1.64	0	2	72	184	105	6	19	8	6	100	19	242	8	101
101	0.09	397	217	1.83	43387	1.64	0	2	268	710	404	451	1,106	492	451	374	1,106	932	492	389
102	0.05	-	-	0.00	35595	2.24	0	2	708	3,915	1,858					988		5,140		1,789
103	0.07	95	1	95.00	35595	2.24	0	2	925	4,898	2,274	4	14	5	4	1,291	14	6,431	5	2,190
104	0.13	23	9	2.56	65750	2.05	0	4	86	108	75	24	70	31	24	120	70	142	31	72
105	0.28	362	169	2.14	45909	1.93	0	2	1,246	1,073	759	398	1,173	523	398	1,738	1,173	1,409	523	731
106	0.05	-	-	0.00	43387	1.64	0	2	-	-	-					-		-		-
107	0.08	-	-	0.00	43387	1.64	1	2	81	486	243					81		486		243
108	0.20	566	247	2.29	45909	1.93	0	3	1,048	635	508	581	1,714	765	581	1,462	1,714	834	765	489
109	0.12	2	1	2.00	45833	1.76	0	2	84	100	70	2	5	2	2	117	5	131	2	67
110	0.11	4	2	2.00	48421	2.12	1	2	332	650	385	4	10	5	4	332	10	650	5	385
111	0.15	320	99	3.23	35595	2.24	0	2	571	1,004	586	329	1,003	398	329	797	1,003	1,318	398	564
112	0.21	293	125	2.34	45000	1.98	0	3	49	345	172	294	867	387	294	68	867	453	387	166
113	0.09	596	272	2.19	28359	1.89	1	3	204	1,017	528	640	1,887	843	640	204	1,887	1,017	843	528
114	0.15	1,047	496	2.11	36574	1.70	0	3	88	658	362	1,168	3,441	1,536	1,168	123	3,441	864	1,536	349
115	0.12	436	213	2.05	45833	1.76	0	3	69	296	168	501	1,478	660	501	96	1,478	389	660	162
116	1.61	842	322	2.61	58519	2.18	0	3	461	780	488	845	2,490	1,111	845	643	2,490	1,024	1,111	470
117	1.74	50	18	2.78	76865	2.19	1	4	140	527	550	47	139	62	47	140	139	527	62	550
118	0.23	14	7	2.00	56692	2.01	0	3	25	17	13	15	36	16	15	35	36	22	16	13
119	0.45	457	153	2.99	56692	2.01	0	3	750	711	468	401	1,183	528	401	1,046	1,183	934	528	451
120	0.05	62	19	3.26	56692	2.01	0	4	-	17	10	63	192	76	63	-	192	22	76	10
121	0.53	2,961	1,161	2.55	56692	2.01	0	3	84	1,074	610	3,045	8,976	4,007	3,045	117	8,976	1,410	4,007	587
122	0.41	1,627	544	2.99	52625	1.75	0	3	460	1,236	719	1,281	3,774	1,685	1,281	642	3,774	1,623	1,685	692
123	1.58	543	188	2.89	56692	2.01	0	3	62	267	414	493	1,454	649	493	87	1,454	351	649	399
124	0.71	1,816	675	2.69	52625	1.75	0	3	7	616	344	1,589	4,683	2,091	1,589	10	4,683	809	2,091	331
125	0.79	208	68	3.06	56692	2.01	1	3	71	423	216	226	689	273	226	71	689	423	273	216
126	0.77	-	-	0.00	39583	2.76	0	4	183	224	155					255		294		149
127	0.46	34	13	2.62	39583	2.76	0	4	25	130	64	34	101	45	34	35	101	171	45	62
128	0.10	-	-	0.00	36667	1.90	0	4	248	291	205					346		382		197
129	0.19	1	1	1.00	36667	1.90	0	3	396	1,060	546	1	3	1	1	552	3	1,392	1	526
130	1.92	431	200	2.16	36667	1.90	0	3	1,216	4,895	2,431	471	1,388	620	471	1,697	1,388	6,427	620	2,341

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									ATTRACTIONS			PRODUCTIONS			BALANCED PRODUCTIONS & ATTRACTIONS					
TAZ	AREA	POPULATION	HOUSEHOLDS	AVE HH SIZE	AVG HH INC 02	AVG AUTO OWN	SPGEN	ATYPE	HBW_A	HBO_A	NHB_A	HBW_P	HBO_P	NHB_P	HBW_P	HBW_A	HBO_P	HBO_A	NHB_P	NHB_A
131	0.21	2	1	2.00	36667	1.90	0	2	342	1,236	612	2	5	2	2	477	5	1,623	2	589
132	0.67	286	87	3.29	36667	1.90	0	3	65	101	66	273	834	331	273	91	834	133	331	64
133	0.26	486	164	2.96	36667	1.90	0	3	667	906	1,059	386	1,138	508	386	931	1,138	1,190	508	1,020
134	2.90	1,235	426	2.90	39255	1.99	0	4	-	383	213	1,003	2,956	1,320	1,003	-	2,956	503	1,320	205
135	0.22	1,008	325	3.10	39255	1.99	0	3	-	293	163	1,020	3,114	1,235	1,020	-	3,114	385	1,235	157
136	0.29	392	175	2.24	27990	1.92	0	3	149	629	329	412	1,214	542	412	208	1,214	826	542	317
137	0.42	1,475	507	2.91	41706	2.30	0	3	-	456	254	1,330	3,920	1,750	1,330	-	3,920	599	1,750	245
138	0.57	1,461	455	3.21	41706	2.30	0	3	96	520	295	1,510	4,609	1,828	1,510	134	4,609	683	1,828	284
139	2.11	362	145	2.50	30391	1.96	0	4	19	218	114	341	1,006	449	341	27	1,006	286	449	110
140	2.53	639	187	3.42	32313	1.16	1	3	6,869	3,421	1,447	587	1,792	711	587	6,869	1,792	3,421	711	1,447
141	2.92	600	189	3.17	32982	1.71	0	4	138	957	459	593	1,811	718	593	193	1,811	1,257	718	442
142	1.55	14	5	2.80	30391	1.96	0	4	168	405	207	12	35	15	12	234	35	532	15	199
143	0.89	487	190	2.56	30391	1.96	0	4	-	171	95	447	1,318	589	447	-	1,318	225	589	91
144	0.90	606	180	3.37	34265	1.83	0	4	-	162	90	565	1,725	684	565	-	1,725	213	684	87
145	3.31	709	269	2.64	39255	1.99	0	3	335	948	524	633	1,866	833	633	467	1,866	1,245	833	505
146	1.10	677	248	2.73	34265	1.83	0	3	78	460	242	584	1,721	768	584	109	1,721	604	768	233
147	3.07	235	83	2.83	56389	2.36	0	4	-	75	42	218	642	286	218	-	642	98	286	40
148	1.81	531	168	3.16	34409	1.82	0	4	-	151	84	527	1,610	638	527	-	1,610	198	638	81
149	2.06	360	142	2.54	34409	1.82	0	4	-	128	71	334	985	440	334	-	985	168	440	68
150	1.54	74	33	2.24	34409	1.82	0	3	222	646	329	78	229	102	78	310	229	848	102	317
151	2.01	633	233	2.72	34409	1.82	0	4	138	919	448	549	1,617	722	549	193	1,617	1,207	722	431
152	0.11	-	-	0.00	34409	1.82	0	3	496	740	414					692		972		399
153	0.17	-	-	0.00	34409	1.82	1	3	2,174	12,925	6,448					2,174		12,925		6,448
154	0.07	-	-	0.00	34409	1.82	0	3	418	2,176	1,004					583		2,857		967
155	0.05	-	-	0.00	34409	1.82	0	3	257	157	117					359		206		113
156	1.01	12	4	3.00	34409	1.82	0	3	189	307	168	9	28	12	9	264	28	403	12	162
157	0.78	7	2	3.50	34409	1.82	1	3	213	941	465	6	19	8	6	213	19	941	8	465
158	2.58	536	235	2.28	34409	1.82	0	4	336	1,350	681	553	1,631	728	553	469	1,631	1,773	728	656
159	4.87	215	83	2.59	34409	1.82	0	4	62	248	128	195	576	257	195	87	576	326	257	123
160	0.44	834	285	2.93	34409	1.82	0	3	-	257	143	671	1,977	883	671	-	1,977	337	883	138
161	1.33	-	-	0.00	34409	1.82	0	3	1,322	690	560					1,844		906		539
162	0.61	-	-	0.00	34409	1.82	0	3	1,350	2,305	1,293					1,884		3,026		1,245
163	0.50	-	-	0.00	34409	1.82	0	3	2,031	5,490	2,859					2,834		7,208		2,753
164	0.77	162	56	2.89	34409	1.82	0	3	984	2,127	1,154	132	389	173	132	1,373	389	2,793	173	1,111
165	0.37	981	289	3.39	34409	1.82	0	3	377	2,126	1,013	907	2,769	1,098	907	526	2,769	2,791	1,098	975
166	4.06	422	135	3.13	44465	2.25	0	4	9	176	92	448	1,367	542	448	13	1,367	231	542	89
167	6.34	319	126	2.53	44465	2.25	0	4	-	113	63	331	974	435	331	-	974	148	435	61
168	2.65	196	75	2.61	71918	2.23	0	4	-	68	38	197	580	259	197	-	580	89	259	37
169	2.98	171	72	2.38	45000	1.98	0	4	23	209	102	170	500	223	170	32	500	274	223	98
170	0.38	-	-	0.00	45000	1.98	0	4	-	-	-					-		-		-
171	1.00	66	36	1.83	45000	1.98	0	4	-	32	18	75	184	82	75	-	184	42	82	17
172	10.40	1,013	352	2.88	76865	2.19	0	4	187	1,478	705	923	2,721	1,215	923	261	2,721	1,941	1,215	679
173	6.39	1,683	545	3.09	67727	2.34	0	4	125	1,265	625	1,808	5,520	2,189	1,808	174	5,520	1,661	2,189	602
174	0.68	603	201	3.00	76865	2.19	0	3	-	181	101	527	1,554	694	527	-	1,554	238	694	97
175	0.43	1,138	455	2.50	76865	2.19	0	3	61	587	431	1,194	3,518	1,570	1,194	85	3,518	771	1,570	415
176	0.41	423	166	2.55	93191	2.30	0	3	-	149	83	435	1,283	573	435	-	1,283	196	573	80
177	0.55	899	325	2.77	75587	1.95	0	3	144	444	257	765	2,255	1,007	765	201	2,255	583	1,007	247
178	0.19	1,042	386	2.70	48421	2.12	0	3	27	512	275	1,013	2,984	1,332	1,013	38	2,984	672	1,332	265
179	0.26	799	305	2.62	47188	1.83	0	3	55	584	303	718	2,116	945	718	77	2,116	767	945	292
180	0.38	407	241	1.69	47188	1.83	0	2	769	1,940	1,068	501	1,229	546	501	1,073	1,229	2,547	546	1,028
181	0.37	321	125	2.57	76865	2.19	0	3	-	113	63	328	966	431	328	-	966	148	431	61
182	0.48	486	180	2.70	93191	2.30	0	3	200	231	159	472	1,392	621	472	279	1,392	303	621	153
183	0.73	734	273	2.69	93191	2.30	0	3	125	1,020	489	716	2,111	942	716	174	2,111	1,339	942	471
184	0.11	632	202	3.13	75587	1.95	0	3	-	182	101	634	1,935	768	634	-	1,935	239	768	97
185	0.99	1,227	589	2.08	79787	2.14	0	3	33	632	348	1,545	4,554	2,033	1,545	46	4,554	830	2,033	335
186	4.20	477	167	2.86	37625	1.62	0	4	106	698	1,374	393	1,159	517	393	148	1,159	916	517	1,323
187	7.69	214	91	2.35	37625	1.62	0	4	3	100	54	214	631	282	214	4	631	131	282	52
188	13.15	161	66	2.44	39583	2.76	0	4	6	61	251	173	510	228	173	8	510	80	228	242
189	0.10	-	-	0.00	38750	1.57	0	2	405	1,551	757					565		2,036		729
190	0.08	3	2	1.50	36667	1.90	1	3	486	1,346	702	4	10	5	4	486	10	1,346	5	702
191	0.13	1	1	1.00	38750	1.57	0	2	307	1,690	783	1	3	1	1	428	3	2,219	1	754
192	0.23	42	18	2.33	36667	1.90	0	3	306	412	249	42	125	56	42	427	125	541	56	240
193	0.12	4	2	2.00	36667	1.90	0	3	395	975	535	4	10	5	4	551	10	1,280	5	515
194	0.17	364	202	1.80	27990	1.92	0	2	858	880	581	420	1,030	458	420	1,197	1,030	1,155	458	559
195	2.18	62	20	3.10	27990	1.92	0	3	1,883	2,392	1,418	63	192	76	63	2,627	192	3,141	76	1,365

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									ATTRACTIONS			PRODUCTIONS			BALANCED PRODUCTIONS & ATTRACTIONS					
TAZ	AREA	POPULATION	HOUSEHOLDS	AVE HH SIZE	AVG HH INC 02	AVG AUTO OWN	SPGEN	ATYPE	HBW_A	HBO_A	NHB_A	HBW_P	HBO_P	NHB_P	HBW_P	HBW_A	HBO_P	HBO_A	NHB_P	NHB_A
196	0.29	112	41	2.73	27990	1.92	0	3	30	226	107	97	284	127	97	42	284	297	127	103
197	0.17	61	23	2.65	27990	1.92	0	3	-	21	12	54	160	71	54	-	160	28	71	12
198	0.52	562	216	2.60	27990	1.92	0	3	-	194	108	508	1,499	669	508	-	1,499	255	669	104
199	2.29	394	183	2.15	27990	1.92	1	4	202	1,379	693	431	1,270	567	431	202	1,270	1,379	567	693
200	5.07	18	6	3.00	27990	1.92	0	4	196	319	187	14	42	19	14	273	42	419	19	180
201	1.86	516	202	2.55	42800	2.41	0	4	-	182	101	530	1,562	697	530	-	1,562	239	697	97
202	10.82	68	26	2.62	56389	2.36	0	4	-	23	13	68	201	90	68	-	201	30	90	13
203	20.25	192	74	2.59	56389	2.36	0	4	35	79	49	194	572	255	194	49	572	104	255	47
204	6.96	113	44	2.57	56389	2.36	0	4	6	76	38	115	340	152	115	8	340	100	152	37
205	4.13	151	48	3.15	39255	1.99	0	4	9	53	31	151	460	182	151	13	460	70	182	30
206	14.78	189	67	2.82	56389	2.36	0	4	-	60	34	176	518	231	176	-	518	79	231	33
207	0.73	603	230	2.62	39255	1.99	0	3	17	213	121	541	1,596	712	541	24	1,596	280	712	117
208	1.97	185	88	2.10	42800	2.41	0	4	23	106	63	231	680	304	231	32	680	139	304	61
209	2.89	23	5	4.60	56389	2.36	1	4	560	3,368	1,684	19	70	24	19	560	70	3,368	24	1,684
210	15.55	161	60	2.68	56389	2.36	0	4	-	54	30	157	464	207	157	-	464	71	207	29
211	0.10						1	5	836	1,729	1,424	3,344	2,594	1,426	3,344	836	2,594	1,729	1,426	1,424
212	0.15						1	5	297	410	338	693	615	337	693	297	615	410	337	338
213	0.15						1	5	215	295	245	502	445	224	502	215	445	295	224	245
214	0.16						1	5	23	33	26	55	48	26	55	23	48	33	26	26
215	0.17						1	5	44	60	49	101	90	49	101	44	90	60	49	49
216	0.16						1	5	99	134	110	224	199	109	224	99	199	134	109	110
217	0.14						1	5	23	33	28	55	48	26	55	23	48	33	26	28
218	0.29						1	5	993	1,370	1,129	2,318	2,054	1,129	2,318	993	2,054	1,370	1,129	1,129
219	0.49						1	5	348	480	395	811	719	395	811	348	719	480	395	395
220	0.24						1	5	646	891	734	1,508	1,336	734	1,508	646	1,336	891	734	734
221	0.26						1	5	87	118	98	201	179	98	201	87	179	118	98	98
222	0.21						1	5	909	1,252	1,032	2,119	1,879	1,032	2,119	909	1,879	1,252	1,032	1,032
223	0.30						1	5	77	107	88	179	159	88	179	77	159	107	88	88
224	0.29						1	5	556	767	632	1,297	1,149	631	1,297	556	1,149	767	631	632
225	0.28						1	5	147	204	167	343	304	168	343	147	304	204	168	167
226	0.03						1	5	392	811	668	1,569	1,217	668	1,569	392	1,217	811	668	668
TOTALS:	**231.60**	**79,006**	**30,860**						**72,697**	**196,627**	**109,584**	**92,399**	**239,660**	**106,745**	**92,399**	**92,399**	**239,660**	**239,660**	**106,745**	**106,745**

SPECIAL GENERATOR TRIPS AND DECISION TABLE, page 1 of 3

	Regression Results				Special Generators (ITE Results)							
TAZ	HBW_A	HBO_A	NHB_A	Total	SpHBW_A	Sp_HBO_A	Sp_NHB_A	SpTotal	TOTAL	SpGen %	SpGenZone?	Comments
1	774	860	620	2254	341	2045	1023	3409	5663	60%	Yes	Amusement Center
2	39	51	36	126	48	286	143	477	603	79%	Yes	Museum/Childrens Science Center
3	413	526	371	1310	0	0	0	0	1310	0%		
4	476	611	425	1512	0	0	0	0	1512	0%		
5	254	321	225	800	10	62	31	103	903	11%		
6	831	939	672	2442	0	0	0	0	2442	0%		
7	624	799	560	1983	100	599	299	998	2981	33%		VFW
8	160	220	154	534	0	0	0	0	534	0%		
9	229	302	211	742	0	0	0	0	742	0%		
10	571	688	489	1748	0	0	0	0	1748	0%		
11	464	428	318	1210	0	0	0	0	1210	0%		
12	68	145	93	306	0	0	0	0	306	0%		
13	116	197	129	442	87	523	262	872	1314	66%	Yes	Health Club
14	874	1055	744	2673	332	1991	995	3318	5991	55%	Yes	YMCA
15	1114	1247	892	3253	145	871	436	1452	4705	31%		
16	396	476	335	1207	54	327	163	545	1752	31%		
17	554	650	459	1663	0	0	0	0	1663	0%		
18	0	21	12	33	123	739	370	1232	1265	97%	Yes	National American University
19	210	173	130	513	0	0	0	0	513	0%		
20	0	119	66	185	0	0	0	0	185	0%		
21	183	446	246	875	0	0	0	0	875	0%		
22	71	183	94	348	14	82	41	137	485	28%		
23	75	106	71	252	8	49	24	81	333	24%		
24	255	96	93	444	0	0	0	0	444	0%		
25	65	107	71	243	122	730	365	1217	1460	83%	Yes	Knights of Columbus
26	57	133	84	274	0	0	0	0	274	0%		
27	247	1289	601	2137	0	0	0	0	2137	0%		
28	197	594	307	1098	0	0	0	0	1098	0%		
29	0	2	1	3	1080	6482	3241	10803	10806	100%	Yes	US Post Office
30	75	419	196	690	0	0	0	0	690	0%		
31	191	67	67	325	0	0	0	0	325	0%		
32	74	237	140	451	0	0	0	0	451	0%		
33	113	277	165	555	32	194	97	323	878	37%	Yes	Church
34	170	612	341	1123	17	102	51	170	1293	13%		
35	83	397	218	698	0	0	0	0	698	0%		
36	100	124	82	306	0	0	0	0	306	0%		
37	0	320	178	498	0	0	0	0	498	0%		
38	128	359	185	672	35	208	104	347	1019	34%		Gymnastics Center
39	0	2	1	3	595	3570	1785	5950	5953	100%	Yes	SDSM&T
40	25	56	35	116	0	0	0	0	116	0%		
41	428	1868	897	3193	0	0	0	0	3193	0%		
42	116	300	164	580	0	0	0	0	580	0%		
43	39	414	209	662	4	21	11	35	697	5%		
44	12	187	106	305	0	0	0	0	305	0%		
45	0	153	85	238	0	0	0	0	238	0%		
46	167	716	349	1232	22	134	67	223	1455	15%		
47	226	887	447	1560	0	0	0	0	1560	0%		
48	30	168	86	284	0	0	0	0	284	0%		
49	542	1043	558	2143	17	104	52	173	2316	7%		
50	6	213	115	334	0	0	0	0	334	0%		
51	0	193	107	300	17	102	51	170	470	36%		Church
52	51	341	171	563	0	0	0	0	563	0%		
53	328	1152	580	2060	0	0	0	0	2060	0%		
54	244	664	343	1251	2	10	5	17	1268	1%		
55	70	183	113	366	8	47	23	78	444	18%		
56	112	64	53	229	12	70	35	116	345	34%		Church
57	0	119	66	185	8	47	23	78	263	30%		
58	70	129	83	282	0	0	0	0	282	0%		
59	0	309	172	481	0	0	0	0	481	0%		
60	236	721	366	1323	0	0	0	0	1323	0%		
61	48	256	129	433	47	282	141	470	903	52%		Church
62	119	169	95	383	0	0	0	0	383	0%		
63	325	130	122	577	0	0	0	0	577	0%		
64	2777	981	971	4729	0	0	0	0	4729	0%		
65	35	378	192	605	0	0	0	0	605	0%		
66	0	348	194	542	14	83	41	138	680	20%		
67	294	1385	668	2347	34	204	102	339	2686	13%		
68	249	271	189	709	0	0	0	0	709	0%		
69	506	3442	1644	5592	24	145	73	242	5834	4%		
70	445	1300	689	2434	26	154	77	257	2691	10%		
71	260	852	465	1577	23	139	69	231	1808	13%		
72	1016	4977	2634	8627	0	0	0	0	8627	0%		
73	33	562	318	913	15	87	44	145	1058	14%		
74	87	656	379	1122	0	0	0	0	1122	0%		
75	36	482	274	792	4	22	11	37	829	4%		
76	0	143	80	223	0	0	0	0	223	0%		
77	128	748	362	1238	0	0	0	0	1238	0%		
78	1369	472	472	2313	0	0	0	0	2313	0%		
79	218	75	75	368	572	3432	1716	5720	6088	94%	Yes	Civic Center
80	122	337	208	667	165	988	494	1647	2314	71%	Yes	Museum

SPECIAL GENERATOR TRIPS AND DECISION TABLE, page 2 of 3

	Regression Results				Special Generators (ITE Results)							
TAZ	HBW_A	HBO_A	NHB_A	Total	SpHBW_A	Sp_HBO_A	Sp_NHB_A	SpTotal	TOTAL	SpGen %	SpGenZone?	Comments
81	16	188	95	299	0	0	0	0	299	0%		
82	177	238	148	563	0	0	0	0	563	0%		
83	106	445	228	779	0	0	0	0	779	0%		
84	348	1318	656	2322	4	24	12	41	2363	2%		
85	0	0	0	0	0	0	0	0	0	#DIV/0!		
86	0	0	0	0	0	0	0	0	0	#DIV/0!		
87	97	34	34	165	0	0	0	0	165	0%		
88	307	1353	649	2309	0	0	0	0	2309	0%		
89	571	2190	1125	3886	0	0	0	0	3886	0%		
90	635	3080	1435	5150	0	0	0	0	5150	0%		
91	635	2214	1103	3952	0	0	0	0	3952	0%		
92	0	159	89	248	0	0	0	0	248	0%		
93	0	395	220	615	0	0	0	0	615	0%		
94	293	1407	687	2387	72	432	216	720	3107	23%		
95	0	77	43	120	0	0	0	0	120	0%		
96	120	621	365	1106	11	64	32	107	1213	9%		
97	183	884	464	1531	7	42	21	69	1600	4%		
98	1037	3543	1795	6375	74	443	221	738	7113	10%		
99	90	664	355	1109	0	0	0	0	1109	0%		
100	52	63	44	159	20	121	61	202	361	56%		Church
101	268	710	404	1382	0	0	0	0	1382	0%		
102	522	2797	1299	4618	186	1118	559	1863	6481	29%		
103	909	4800	2225	7934	16	98	49	163	8097	2%		
104	86	108	75	269	0	0	0	0	269	0%		
105	1204	819	632	2655	42	254	127	423	3078	14%		
106	0	0	0	0	0	0	0	0	0	#DIV/0!		
107	0	0	0	0	81	486	243	810	810	100%	Yes	Pool/Waterpark
108	1043	607	494	2144	5	28	14	47	2191	2%		
109	84	100	70	254	0	0	0	0	254	0%		
110	267	258	189	714	65	392	196	653	1367	48%	Yes	Storybook Island
111	551	884	526	1961	20	120	60	201	2162	9%		
112	44	315	157	516	5	30	15	49	565	9%		
113	109	444	242	795	95	573	286	954	1749	55%	Yes	Health Club
114	83	630	348	1061	5	28	14	46	1107	4%		
115	55	211	126	392	14	85	42	141	533	26%		
116	422	548	372	1342	39	232	116	387	1729	22%		
117	64	72	322	458	76	455	228	758	1216	62%	Yes	Amusement Park
118	25	17	13	55	0	0	0	0	55	0%		
119	750	711	468	1929	0	0	0	0	1929	0%		
120	0	17	10	27	0	0	0	0	27	0%		
121	84	1074	610	1768	0	0	0	0	1768	0%		
122	415	968	585	1968	45	268	134	447	2415	19%		
123	49	186	374	609	13	81	40	134	743	18%		
124	7	616	344	967	0	0	0	0	967	0%		
125	19	110	59	188	52	313	157	522	710	74%	Yes	Amusement Park
126	181	213	150	544	2	11	5	18	562	3%		
127	22	110	54	186	3	20	10	33	219	15%		
128	248	291	205	744	0	0	0	0	744	0%		
129	396	1060	546	2002	0	0	0	0	2002	0%		
130	1085	4110	2038	7233	131	785	393	1309	8542	15%		
131	342	1236	612	2190	0	0	0	0	2190	0%		
132	65	101	66	232	0	0	0	0	232	0%		
133	667	906	1059	2632	0	0	0	0	2632	0%		
134	0	383	213	596	0	0	0	0	596	0%		
135	0	293	163	456	0	0	0	0	456	0%		
136	136	554	291	981	13	75	38	125	1106	11%		
137	0	456	254	710	0	0	0	0	710	0%		
138	96	520	295	911	0	0	0	0	911	0%		
139	19	218	114	351	0	0	0	0	351	0%		
140	1170	572	497	2239	5699	2849	950	9498	11737	81%	Yes	Ellsworth Air Force Base
141	132	923	442	1497	6	34	17	57	1554	4%		
142	168	405	207	780	0	0	0	0	780	0%		
143	0	171	95	266	0	0	0	0	266	0%		
144	0	162	90	252	0	0	0	0	252	0%		
145	335	948	524	1807	0	0	0	0	1807	0%		
146	78	460	242	780	0	0	0	0	780	0%		
147	0	75	42	117	0	0	0	0	117	0%		
148	0	151	84	235	0	0	0	0	235	0%		
149	0	128	71	199	0	0	0	0	199	0%		
150	222	646	329	1197	0	0	0	0	1197	0%		
151	138	919	448	1505	0	0	0	0	1505	0%		
152	496	740	414	1650	0	0	0	0	1650	0%		
153	103	500	236	839	2071	12425	6212	20708	21547	96%	Yes	Rushmore Mall
154	418	2176	1004	3598	0	0	0	0	3598	0%		
155	257	157	117	531	0	0	0	0	531	0%		
156	189	307	168	664	0	0	0	0	664	0%		
157	122	392	191	705	91	549	274	915	1620	56%	Yes	Visitor Information Center
158	336	1350	681	2367	0	0	0	0	2367	0%		
159	62	248	128	438	0	0	0	0	438	0%		
160	0	257	143	400	0	0	0	0	400	0%		

SPECIAL GENERATOR TRIPS AND DECISION TABLE, page 3 of 3

	Regression Results				Special Generators (ITE Results)							
TAZ	HBW_A	HBO_A	NHB_A	Total	SpHBW_A	Sp_HBO_A	Sp_NHB_A	SpTotal	TOTAL	SpGen %	SpGenZone?	Comments
161	1322	690	560	2572	0	0	0	0	2572	0%		
162	1350	2305	1293	4948	0	0	0	0	4948	0%		
163	2031	5490	2859	10380	0	0	0	0	10380	0%		
164	969	2034	1108	4111	15	93	46	155	4266	4%		
165	377	2126	1013	3516	0	0	0	0	3516	0%		
166	9	176	92	277	0	0	0	0	277	0%		
167	0	113	63	176	0	0	0	0	176	0%		
168	0	68	38	106	0	0	0	0	106	0%		
169	23	209	102	334	0	0	0	0	334	0%		
170	0	0	0	0	0	0	0	0	0	#DIV/0!		
171	0	32	18	50	0	0	0	0	50	0%		
172	187	1478	705	2370	0	0	0	0	2370	0%		
173	125	1265	625	2015	0	0	0	0	2015	0%		
174	0	181	101	282	0	0	0	0	282	0%		
175	57	565	420	1042	4	22	11	36	1078	3%		
176	0	149	83	232	0	0	0	0	232	0%		
177	144	444	257	845	0	0	0	0	845	0%		
178	0	347	193	540	27	165	82	275	815	34%		Assisted Living Center & Church
179	22	388	205	615	33	196	98	327	942	35%		Cemetary
180	764	1912	1054	3730	5	28	14	47	3777	1%		
181	0	113	63	176	0	0	0	0	176	0%		
182	200	231	159	590	0	0	0	0	590	0%		
183	125	1020	489	1634	0	0	0	0	1634	0%		
184	0	182	101	283	0	0	0	0	283	0%		
185	29	608	336	973	4	24	12	40	1013	4%		
186	106	698	1374	2178	0	0	0	0	2178	0%		
187	3	100	54	157	0	0	0	0	157	0%		
188	6	61	251	318	0	0	0	0	318	0%		
189	352	1236	599	2187	53	315	158	525	2712	19%		
190	376	689	373	1438	110	657	329	1096	2534	43%	Yes	Retired Enlisted Center
191	307	1690	783	2780	0	0	0	0	2780	0%		
192	306	412	249	967	0	0	0	0	967	0%		
193	349	698	396	1443	46	277	139	462	1905	24%		
194	858	880	581	2319	0	0	0	0	2319	0%		
195	1856	2228	1336	5420	27	164	82	274	5694	5%		
196	30	226	107	363	0	0	0	0	363	0%		
197	0	21	12	33	0	0	0	0	33	0%		
198	0	194	108	302	0	0	0	0	302	0%		
199	22	300	153	475	180	1079	540	1799	2274	79%	Yes	Elks Club
200	196	319	187	702	0	0	0	0	702	0%		
201	0	182	101	283	0	0	0	0	283	0%		
202	0	23	13	36	0	0	0	0	36	0%		
203	35	79	49	163	0	0	0	0	163	0%		
204	6	76	38	120	0	0	0	0	120	0%		
205	9	53	31	93	0	0	0	0	93	0%		
206	0	60	34	94	0	0	0	0	94	0%		
207	17	213	121	351	0	0	0	0	351	0%		
208	23	106	63	192	0	0	0	0	192	0%		
209	0	5	3	8	560	3363	1681	5605	5613	100%	Yes	Regional Airport
210	0	54	30	84	0	0	0	0	84	0%		

APPENDIX C

Year 2025 Demographic Data and Final P's & A's

YEAR 2025 ZONAL PRODUCTIONS & ATTRACTIONS, page 1 of 5

								PRODUCTIONS			ATTRACTIONS			BALANCED PRODUCTIONS & ATTRACTIONS					
TAZ	AREA	AVE HH SIZE	AVG AUTO OWN	SPGEN	ATYPE	2025 HH	2025 POP	HBW_P	HBO_P	NHB_P	HBW_A	HBO_A	NHB_A	HBW_P	HBW_A	HBO_P	HBO_A	NHB_P	NHB_A
1	0.20	0.00	1.34	1	1	-	-				900	1,138	785		900		1,138		785
2	0.02	0.00	1.34	1	1	-	-				110	363	197		110		363		197
3	0.03	1.20	1.09	0	1	5	6	11	23	10	454	621	434	11	746	23	490	10	242
4	0.01	1.38	0.69	0	1	47	65	86	179	79	392	406	293	86	644	179	320	79	163
5	0.03	0.00	1.09	0	1	-	-				352	367	261		578		290		145
6	0.03	1.19	0.69	0	1	16	19	29	61	27	790	865	623	29	1,298	61	682	27	347
7	0.03	1.57	0.69	0	1	7	11	13	27	12	670	1,340	819	13	1,101	27	1,057	12	456
8	0.02	0.00	1.09	0	1	-	-				207	283	198		340		223		110
9	0.03	2.75	1.09	0	1	4	11	12	24	11	286	388	271	12	470	24	306	11	151
10	0.03	1.50	0.69	0	1	2	3	4	8	3	613	739	525	4	1,007	8	583	3	292
11	0.03	20.29	0.88	0	1	7	142	24	78	24	573	554	410	24	941	78	437	24	228
12	0.05	2.33	1.34	0	1	74	173	214	445	197	106	203	133	214	174	445	160	197	74
13	0.03	1.97	1.34	1	1	102	201	229	476	210	202	758	414	229	202	476	758	210	414
14	0.03	2.94	1.34	1	1	16	47	46	96	43	1,363	3,238	1,873	46	1,363	96	3,238	43	1,873
15	0.03	1.57	1.34	0	1	21	33	47	98	43	1,019	1,846	1,135	47	1,674	98	1,456	43	632
16	0.03	1.95	0.88	0	1	38	74	70	145	64	830	1,367	889	70	1,363	145	1,078	64	495
17	0.02	316.00	0.88	0	1	1	316	3	11	3	667	231	231	3	1,096	11	182	3	129
18	0.02	10.39	0.88	1	1	23	239	79	257	79	315	1,087	570	79	315	257	1,087	79	570
19	0.02	2.13	0.88	0	1	45	96	115	240	106	194	197	142	115	319	240	155	106	79
20	0.04	2.00	1.65	0	2	132	264	296	616	272	-	119	66	296	-	616	94	272	37
21	0.03	1.66	1.34	0	2	85	141	191	396	175	157	501	268	191	258	396	395	175	149
22	0.01	2.56	1.34	0	2	17	44	49	102	45	127	413	216	49	209	102	326	45	120
23	0.01	1.42	0.88	0	2	44	62	80	167	74	27	108	60	80	44	167	85	74	33
24	0.01	1.89	1.34	0	2	10	19	22	47	21	426	156	152	22	700	47	123	21	85
25	0.01	3.29	0.88	1	2	36	119	100	281	95	171	810	418	100	171	281	810	95	418
26	0.07	2.77	0.88	0	2	76	211	195	406	179	46	123	76	195	76	406	97	179	42
27	0.03	0.00	1.42	0	2	-	-				309	1,547	723		508		1,220		402
28	0.06	2.25	1.42	0	2	5	11	14	30	13	162	549	275	14	266	30	433	13	153
29	0.01	2.50	1.09	1	2	2	5	6	12	5	1,108	6,575	3,288	6	1,108	12	6,575	5	3,288
30	0.03	2.21	1.09	0	2	29	64	84	174	77	102	499	237	84	168	174	394	77	132
31	0.04	4.00	1.42	0	2	1	4	3	9	3	289	100	100	3	475	9	79	3	56
32	0.03	2.26	1.09	0	2	185	419	535	1,112	492	58	293	164	535	95	1,112	231	492	91
33	0.50	2.32	1.65	1	2	232	539	671	1,395	617	131	587	312	671	131	1,395	587	617	312
34	0.13	2.04	1.65	0	2	382	779	1,104	2,297	1,016	185	894	480	1,104	304	2,297	705	1,016	267
35	0.09	2.13	1.34	0	2	271	576	783	1,630	721	139	556	303	783	228	1,630	439	721	169
36	0.05	2.90	1.10	0	2	88	255	254	529	234	102	246	145	254	168	529	194	234	81
37	0.15	2.19	1.49	0	2	369	810	1,067	2,219	981	-	332	184	1,067	-	2,219	262	981	102
38	0.22	2.23	1.09	0	2	35	78	101	210	93	334	1,516	730	101	549	210	1,196	93	406
39	0.07	240.00	1.09	1	2	2	480	7	23	7	833	5,000	2,500	7	833	23	5,000	7	2,500
40	0.11	2.17	1.57	0	2	30	65	87	180	80	46	81	53	87	76	180	64	80	30
41	0.21	1.00	1.57	0	2	1	1	1	3	1	1,028	2,473	1,276	1	1,689	3	1,951	1	710
42	0.08	2.59	1.65	0	2	123	318	356	740	327	171	475	254	356	281	740	375	327	141
43	0.08	2.14	1.68	0	2	224	480	648	1,347	596	84	544	277	648	138	1,347	429	596	154
44	0.07	2.33	1.90	0	2	198	462	572	1,191	527	17	257	137	572	28	1,191	203	527	76
45	0.06	2.16	1.61	0	2	174	377	503	1,046	463	12	229	120	503	20	1,046	181	463	67
46	0.11	1.49	1.86	0	2	110	163	247	513	227	282	1,011	507	247	463	513	798	227	282
47	0.14	2.10	1.57	0	2	143	300	413	860	380	286	1,188	585	413	470	860	937	380	326
48	0.06	2.11	1.73	0	2	75	158	217	451	199	52	311	153	217	85	451	245	199	85
49	0.06	2.02	1.68	0	2	68	137	197	409	181	522	1,649	855	197	857	409	1,301	181	476
50	0.07	2.32	1.90	0	2	201	466	581	1,209	535	12	253	133	581	20	1,209	200	535	74
51	0.08	2.16	1.61	0	2	219	474	633	1,317	582	20	300	161	633	33	1,317	237	582	90
52	0.05	2.46	1.86	0	2	145	357	419	872	386	64	446	221	419	105	872	352	386	123
53	0.08	2.67	1.86	0	2	59	158	171	355	157	380	1,366	682	171	624	355	1,078	157	380
54	0.08	2.63	1.71	0	2	119	313	344	716	317	312	1,678	796	344	512	716	1,324	317	443
55	0.10	2.49	1.99	0	2	182	452	526	1,094	484	134	267	165	526	220	1,094	211	484	92

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								PRODUCTIONS			ATTRACTIONS			BALANCED PRODUCTIONS & ATTRACTIONS					
TAZ	AREA	AVE HH SIZE	AVG AUTO OWN	SPGEN	ATYPE	2025 HH	2025 POP	HBW_P	HBO_P	NHB_P	HBW_A	HBO_A	NHB_A	HBW_P	HBW_A	HBO_P	HBO_A	NHB_P	NHB_A
56	0.05	2.58	1.99	0	2	20	52	58	120	53	216	172	123	58	355	120	136	53	68
57	0.08	2.60	1.99	0	2	137	356	396	824	364	12	172	93	396	20	824	136	364	52
58	0.06	2.50	1.72	0	2	119	297	344	716	317	133	153	105	344	218	716	121	317	58
59	0.14	2.69	2.01	0	2	350	942	1,012	2,105	931	-	315	175	1,012	-	2,105	249	931	97
60	0.61	2.54	1.65	0	3	187	476	541	1,124	497	750	3,360	1,615	541	1,232	1,124	2,651	497	899
61	0.03	1.20	1.71	0	2	96	115	215	448	198	159	845	415	215	261	448	667	198	231
62	0.02	0.00	2.01	0	4	-	-				102	243	133		168		192		74
63	0.04	2.10	2.17	0	2	43	90	124	259	114	320	149	132	124	526	259	118	114	73
64	0.11	2.19	2.01	0	3	100	219	289	601	266	1,853	2,263	1,584	289	3,044	601	1,785	266	882
65	0.12	2.58	2.17	0	2	207	535	598	1,245	551	68	529	264	598	112	1,245	417	551	147
66	0.14	2.28	1.79	0	2	392	892	1,133	2,357	1,043	52	604	317	1,133	85	2,357	476	1,043	176
67	0.45	2.78	2.01	0	2	450	1,252	1,301	2,706	1,197	713	3,776	1,824	1,301	1,171	2,706	2,979	1,197	1,015
68	1.29	2.57	1.50	0	2	281	722	812	1,690	747	418	702	418	812	687	1,690	554	747	233
69	0.29	2.36	1.50	0	2	718	1,695	2,076	4,318	1,910	691	4,128	1,981	2,076	1,135	4,318	3,257	1,910	1,103
70	0.27	2.88	1.46	0	2	339	975	980	2,039	902	871	2,965	1,489	980	1,431	2,039	2,339	902	829
71	0.25	2.58	1.59	0	2	442	1,142	1,278	2,658	1,176	620	2,158	1,098	1,278	1,018	2,658	1,702	1,176	611
72	0.52	2.15	1.59	0	2	616	1,325	1,781	3,704	1,638	2,904	15,773	7,654	1,781	4,770	3,704	12,443	1,638	4,260
73	0.24	2.41	1.72	0	2	593	1,427	1,714	3,566	1,577	327	2,183	1,072	1,714	537	3,566	1,722	1,577	597
74	0.28	2.58	1.27	0	2	663	1,712	1,917	3,987	1,763	173	733	436	1,917	284	3,987	578	1,763	243
75	0.19	2.57	1.61	0	2	500	1,287	1,446	3,007	1,330	94	699	383	1,446	154	3,007	551	1,330	213
76	0.07	2.21	1.49	0	2	159	352	460	956	423	-	143	80	460	-	956	113	423	45
77	0.30	2.19	1.49	0	2	293	642	847	1,762	779	1,037	4,906	2,331	847	1,703	1,762	3,870	779	1,297
78	0.07	0.00	1.09	0	2	-	-				880	304	304		1,445		240		169
79	0.10	0.00	1.09	1	2	-	-				932	5,664	2,733		932		5,664		2,733
80	0.12	1.35	1.09	1	2	246	333	552	1,147	507	332	1,395	749	552	332	1,147	1,395	507	749
81	0.04	2.42	1.40	0	2	103	250	298	619	274	25	245	121	298	41	619	193	274	67
82	0.03	3.72	1.61	0	2	41	152	129	363	123	220	386	233	129	361	363	305	123	130
83	0.05	2.21	1.40	0	2	150	332	434	902	399	167	1,034	489	434	274	902	816	399	272
84	0.09	2.47	1.49	0	2	116	287	335	698	309	475	1,847	916	335	780	698	1,457	309	510
85	0.02	0.00	1.09	0	2	-	-				-	-	-		-		-		-
86	0.03	0.00	1.09	0	2	-	-				-	-	-		-		-		-
87	0.04	0.00	1.09	0	2	-	-				102	35	35		168		28		19
88	0.04	0.00	1.09	0	2	-	-				394	1,667	805		647		1,315		448
89	0.26	2.33	1.42	0	2	495	1,155	1,431	2,977	1,317	1,866	4,728	2,453	1,431	3,065	2,977	3,730	1,317	1,365
90	0.06	2.37	1.49	0	2	26	62	75	156	69	758	3,834	1,784	75	1,245	156	3,025	69	993
91	0.15	2.23	1.57	0	2	168	375	486	1,010	447	745	3,238	1,544	486	1,224	1,010	2,554	447	859
92	1.32	2.09	2.25	0	3	290	606	838	1,744	771	716	1,265	721	838	1,176	1,744	998	771	401
93	0.16	2.36	2.25	0	3	444	1,046	1,284	2,670	1,181	-	399	222	1,284	-	2,670	315	1,181	124
94	0.22	2.13	2.25	0	3	261	555	755	1,569	694	385	2,143	1,046	755	632	1,569	1,691	694	582
95	0.34	2.73	2.23	0	3	97	265	280	583	258	-	87	48	280	-	583	69	258	27
96	0.39	2.83	2.23	0	3	604	1,712	1,746	3,632	1,606	186	707	417	1,746	306	3,632	558	1,606	232
97	0.21	2.16	1.67	0	3	409	882	1,182	2,459	1,088	268	1,367	687	1,182	440	2,459	1,078	1,088	382
98	0.21	2.06	1.64	0	2	250	514	723	1,503	665	1,163	4,032	2,059	723	1,910	1,503	3,181	665	1,146
99	0.25	2.54	2.05	0	4	444	1,126	1,284	2,670	1,181	110	770	409	1,284	181	2,670	607	1,181	228
100	0.16	4.00	1.64	0	2	2	8	6	18	6	79	143	83	6	130	18	113	6	46
101	0.09	1.83	1.64	0	2	218	399	489	1,017	450	251	972	508	489	412	1,017	767	450	283
102	0.05	0.00	2.24	0	2	-	-				743	4,260	2,009		1,220		3,361		1,118
103	0.07	95.00	2.24	0	2	1	95	3	11	3	408	2,368	1,093	3	670	11	1,868	3	608
104	0.13	2.56	2.05	0	4	20	51	58	120	53	102	53	45	58	168	120	42	53	25
105	0.28	2.14	1.93	0	2	173	371	500	1,040	460	966	1,026	683	500	1,587	1,040	809	460	380
106	0.05	0.00	1.64	0	2	-	-				26	9	9		43		7		5
107	0.08	0.00	1.64	1	2	-	-				104	494	251		104		494		251
108	0.20	2.29	1.93	0	3	287	658	830	1,726	763	816	710	498	830	1,340	1,726	560	763	277
109	0.12	2.00	1.76	0	2	1	2	2	5	2	67	24	24	2	110	5	19	2	13
110	0.11	2.00	2.12	1	2	2	4	4	9	4	301	654	383	4	301	9	654	4	383

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								PRODUCTIONS			ATTRACTIONS			BALANCED PRODUCTIONS & ATTRACTIONS					
TAZ	AREA	AVE HH SIZE	AVG AUTO OWN	SPGEN	ATYPE	2025 HH	2025 POP	HBW_P	HBO_P	NHB_P	HBW_A	HBO_A	NHB_A	HBW_P	HBW_A	HBO_P	HBO_A	NHB_P	NHB_A
111	0.15	3.23	2.24	0	2	100	323	315	884	300	368	949	523	315	604	884	749	300	291
112	0.21	2.34	1.98	0	3	144	338	416	866	383	96	417	216	416	158	866	329	383	120
113	0.09	2.19	1.89	1	3	282	618	815	1,696	750	244	972	539	815	244	1,696	972	750	539
114	0.15	2.11	1.70	0	3	502	1,060	1,451	3,019	1,335	117	782	423	1,451	192	3,019	617	1,335	235
115	0.12	2.05	1.76	0	3	214	438	619	1,287	569	133	319	190	619	218	1,287	252	569	106
116	1.61	2.61	2.18	0	3	486	1,271	1,405	2,922	1,293	786	2,110	1,138	1,405	1,291	2,922	1,665	1,293	633
117	1.74	2.78	2.19	1	4	232	644	671	1,395	617	1,211	4,762	2,623	671	1,211	1,395	4,762	617	2,623
118	0.23	2.00	2.01	0	3	100	200	224	466	206	64	406	199	224	105	466	320	206	111
119	0.45	2.99	2.01	0	3	345	1,030	997	2,075	918	638	1,782	988	997	1,048	2,075	1,406	918	550
120	0.05	3.26	2.01	0	4	29	95	91	256	87	16	44	27	91	26	256	35	87	15
121	0.53	2.55	2.01	0	3	1,169	2,981	3,380	7,030	3,109	171	1,179	672	3,380	281	7,030	930	3,109	374
122	0.41	2.99	1.75	0	3	680	2,034	1,966	4,089	1,809	770	1,951	1,090	1,966	1,265	4,089	1,539	1,809	607
123	1.58	2.89	2.01	0	3	1,224	3,535	3,539	7,360	3,256	568	2,905	1,776	3,539	933	7,360	2,292	3,256	989
124	0.71	2.69	1.75	0	3	977	2,628	2,825	5,875	2,599	394	2,546	1,293	2,825	647	5,875	2,009	2,599	720
125	0.79	3.06	2.01	1	3	148	453	466	1,309	444	470	2,104	1,037	466	470	1,309	2,104	444	1,037
126	0.77	0.00	2.76	0	4	-	-				366	1,003	502		601		791		279
127	0.46	2.62	2.76	0	4	108	282	312	649	287	322	1,201	593	312	529	649	947	287	330
128	0.10	0.00	1.90	0	4	-	-				439	895	473		721		706		263
129	0.19	1.00	1.90	0	3	1	1	1	3	1	564	1,726	864	1	926	3	1,362	1	481
130	1.92	2.16	1.90	0	3	379	817	1,096	2,279	1,008	2,582	8,334	4,207	1,096	4,241	2,279	6,575	1,008	2,342
131	0.21	2.00	1.90	0	2	1	2	2	5	2	842	2,501	1,243	2	1,383	5	1,973	2	692
132	0.67	3.29	1.90	0	3	284	934	894	2,511	851	381	1,492	750	894	626	2,511	1,177	851	417
133	0.26	2.96	1.90	0	3	167	495	483	1,004	444	928	2,128	1,628	483	1,524	1,004	1,679	444	906
134	2.90	2.90	1.99	0	4	890	2,580	2,573	5,352	2,367	1,198	3,514	1,863	2,573	1,968	5,352	2,772	2,367	1,037
135	0.22	3.10	1.99	0	3	339	1,051	1,067	2,997	1,016	-	305	169	1,067	-	2,997	241	1,016	94
136	0.29	2.24	1.92	0	3	186	417	538	1,118	495	594	1,974	1,000	538	976	1,118	1,557	495	557
137	0.42	2.91	2.30	0	3	538	1,565	1,555	3,235	1,431	-	484	269	1,555	-	3,235	382	1,431	150
138	0.57	3.21	2.30	0	3	542	1,740	1,706	4,792	1,624	361	1,369	737	1,706	593	4,792	1,080	1,624	410
139	2.11	2.50	1.96	0	4	231	577	668	1,389	614	226	580	320	668	371	1,389	458	614	178
140	2.53	3.42	1.16	1	3	196	670	617	1,733	587	6,433	3,436	1,370	617	6,433	1,733	3,436	587	1,370
141	2.92	3.17	1.71	0	4	198	629	623	1,751	593	152	981	473	623	250	1,751	774	593	263
142	1.55	2.80	1.96	0	4	50	140	145	301	133	329	902	460	145	540	301	712	133	256
143	0.89	2.56	1.96	0	4	206	528	596	1,239	548	64	501	251	596	105	1,239	395	548	140
144	0.90	3.37	1.83	0	4	202	680	636	1,786	605	64	498	250	636	105	1,786	393	605	139
145	3.31	2.64	1.99	0	3	362	954	1,047	2,177	963	838	2,979	1,512	1,047	1,376	2,177	2,350	963	842
146	1.10	2.73	1.83	0	3	270	737	781	1,624	718	149	588	313	781	245	1,624	464	718	174
147	3.07	2.83	2.36	0	4	112	317	324	673	298	-	101	56	324	-	673	80	298	31
148	1.81	3.16	1.82	0	4	400	1,264	1,259	3,537	1,199	42	468	258	1,259	69	3,537	369	1,199	144
149	2.06	2.54	1.82	0	4	298	755	862	1,792	793	109	475	262	862	179	1,792	375	793	146
150	1.54	2.24	1.82	0	3	236	529	682	1,419	628	1,006	4,843	2,292	682	1,652	1,419	3,821	628	1,276
151	2.01	2.72	1.82	0	4	376	1,021	1,087	2,261	1,000	1,025	1,635	957	1,087	1,684	2,261	1,290	1,000	533
152	0.11	0.00	1.82	0	3	-	-				947	3,145	1,522		1,556		2,481		847
153	0.17	0.00	1.82	1	3	-	-				2,429	14,495	7,164		2,429		14,495		7,164
154	0.07	0.00	1.82	0	3	-	-				957	5,940	2,706		1,572		4,686		1,506
155	0.05	0.00	1.82	0	3	-	-				479	2,970	1,353		787		2,343		753
156	1.01	3.00	1.82	0	3	4	12	12	24	11	1,088	4,611	2,174	12	1,787	24	3,638	11	1,210
157	0.78	3.50	1.82	1	3	2	7	6	18	6	1,061	3,716	1,812	6	1,061	18	3,716	6	1,812
158	2.58	2.28	1.82	0	4	282	643	815	1,696	750	1,054	2,275	1,248	815	1,731	1,696	1,795	750	695
159	4.87	2.59	1.82	0	4	200	518	578	1,203	532	854	2,711	1,362	578	1,403	1,203	2,139	532	758
160	0.44	2.93	1.82	0	3	345	1,010	997	2,075	918	196	1,445	694	997	322	2,075	1,140	918	386
161	1.33	0.00	1.82	0	3	-	-				294	820	408		483		647		227
162	0.61	0.00	1.82	0	3	-	-				1,573	2,906	1,584		2,584		2,293		882
163	0.50	0.00	1.82	0	3	-	-				2,336	7,182	3,629		3,837		5,666		2,020
164	0.77	2.89	1.82	0	3	290	839	838	1,744	771	1,453	3,469	1,878	838	2,387	1,744	2,737	771	1,045
165	0.37	3.39	1.82	0	3	293	995	922	2,591	878	811	4,827	2,253	922	1,332	2,591	3,808	878	1,254

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								PRODUCTIONS			ATTRACTIONS			BALANCED PRODUCTIONS & ATTRACTIONS					
TAZ	AREA	AVE HH SIZE	AVG AUTO OWN	SPGEN	ATYPE	2025 HH	2025 POP	HBW_P	HBO_P	NHB_P	HBW_A	HBO_A	NHB_A	HBW_P	HBW_A	HBO_P	HBO_A	NHB_P	NHB_A
166	4.06	3.13	2.25	0	4	148	463	466	1,309	444	64	449	222	466	105	1,309	354	444	124
167	6.34	2.53	2.25	0	4	174	441	503	1,046	463	41	329	170	503	67	1,046	260	463	95
168	2.65	2.61	2.23	0	4	96	251	278	577	255	-	87	48	278	-	577	69	255	27
169	2.98	2.38	1.98	0	4	95	226	275	571	253	36	310	150	275	59	571	245	253	83
170	0.38	0.00	1.98	0	4	-	-				-	-	-		-		-	-	-
171	1.00	1.83	1.98	0	4	38	70	85	177	78	-	34	19	85	-	177	27	78	11
172	10.40	2.88	2.19	0	4	975	2,806	2,819	5,863	2,593	270	2,398	1,189	2,819	443	5,863	1,892	2,593	662
173	6.39	3.09	2.34	0	4	788	2,433	2,480	6,967	2,362	210	1,861	928	2,480	345	6,967	1,468	2,362	517
174	0.68	3.00	2.19	0	3	217	651	627	1,305	577	-	195	108	627	-	1,305	154	577	60
175	0.43	2.50	2.19	0	3	464	1,161	1,341	2,790	1,234	104	967	599	1,341	171	2,790	763	1,234	333
176	0.41	2.55	2.30	0	3	172	438	497	1,034	457	-	155	86	497	-	1,034	122	457	48
177	0.55	2.77	1.95	0	3	334	924	966	2,008	888	254	546	323	966	417	2,008	431	888	180
178	0.19	2.70	2.12	0	3	386	1,042	1,116	2,321	1,027	50	530	289	1,116	82	2,321	418	1,027	161
179	0.26	2.62	1.83	0	3	307	804	888	1,846	817	49	622	318	888	80	1,846	491	817	177
180	0.38	1.69	1.83	0	2	244	412	547	1,138	503	733	2,285	1,205	547	1,204	1,138	1,803	503	671
181	0.37	2.57	2.19	0	3	135	347	390	812	359	-	121	67	390	-	812	95	359	37
182	0.48	2.70	2.30	0	3	204	551	590	1,227	543	347	303	222	590	570	1,227	239	543	124
183	0.73	2.69	2.30	0	3	365	981	1,055	2,195	971	144	1,220	589	1,055	237	2,195	962	971	328
184	0.11	3.13	1.95	0	3	207	648	651	1,830	620	-	186	103	651	-	1,830	147	620	57
185	0.99	2.08	2.14	0	3	598	1,246	1,729	3,596	1,591	48	670	369	1,729	79	3,596	529	1,591	205
186	4.20	2.86	1.62	0	4	178	508	515	1,070	473	133	912	1,469	515	218	1,070	719	473	818
187	7.69	2.35	1.62	0	4	126	296	364	758	335	12	185	96	364	20	758	146	335	53
188	13.15	2.44	2.76	0	4	176	429	509	1,058	468	123	507	480	509	202	1,058	400	468	267
189	0.10	0.00	1.57	0	2	-	-				652	2,640	1,264		1,071		2,083		704
190	0.08	1.50	1.90	1	3	2	3	4	9	4	747	2,030	1,053	4	747	9	2,030	4	1,053
191	0.13	1.00	1.57	0	2	4	4	5	11	6	445	2,317	1,078	5	731	11	1,828	6	600
192	0.23	2.33	1.90	0	3	24	56	69	144	64	548	737	440	69	900	144	581	64	245
193	0.12	2.00	1.90	0	3	2	4	4	9	4	670	1,908	999	4	1,101	9	1,505	4	556
194	0.17	1.80	1.92	0	2	212	382	475	989	437	1,180	1,431	887	475	1,938	989	1,129	437	494
195	2.18	3.10	1.92	0	3	87	270	274	769	261	2,446	3,440	2,001	274	4,018	769	2,714	261	1,114
196	0.29	2.73	1.92	0	3	48	131	139	289	128	48	340	159	139	79	289	268	128	89
197	0.17	2.65	1.92	0	3	28	74	81	168	74	-	25	14	81	-	168	20	74	8
198	0.52	2.60	1.92	0	3	283	736	818	1,702	753	41	426	224	818	67	1,702	336	753	125
199	2.29	2.15	1.92	1	4	237	510	685	1,425	630	268	1,761	877	685	268	1,425	1,761	630	877
200	5.07	3.00	1.92	0	4	17	51	49	102	45	434	999	532	49	713	102	788	45	296
201	1.86	2.55	2.41	0	4	216	552	624	1,299	575	-	194	108	624	-	1,299	153	575	60
202	10.82	2.62	2.36	0	4	72	188	208	433	192	-	65	36	208	-	433	51	192	20
203	20.25	2.59	2.36	0	4	94	244	272	565	250	57	104	66	272	94	565	82	250	37
204	6.96	2.57	2.36	0	4	50	128	145	301	133	12	117	58	145	20	301	92	133	32
205	4.13	3.15	1.99	0	4	277	871	872	2,449	830	25	402	208	872	41	2,449	317	830	116
206	14.78	2.82	2.36	0	4	100	282	289	601	266	-	90	50	289	-	601	71	266	28
207	0.73	2.62	1.99	0	3	291	763	841	1,750	774	45	278	161	841	74	1,750	219	774	90
208	1.97	2.10	2.41	0	4	116	244	335	698	309	41	118	72	335	67	698	93	309	40
209	2.89	4.60	2.36	1	4	5	23	17	56	17	932	5,036	2,535	17	932	56	5,036	17	2,535
210	15.55	2.68	2.36	0	4	94	252	272	565	250	-	84	47	272	-	565	66	250	26

YEAR 2025 ZONAL PRODUCTIONS & ATTRACTIONS, page 5 of 5

								PRODUCTIONS			ATTRACTIONS			BALANCED PRODUCTIONS & ATTRACTIONS					
TAZ	AREA	AVE HH SIZE	AVG AUTO OWN	SPGEN	ATYPE	2025 HH	2025 POP	HBW_P	HBO_P	NHB_P	HBW_A	HBO_A	NHB_A	HBW_P	HBW_A	HBO_P	HBO_A	NHB_P	NHB_A
211	0.10			1	5			16,544	12,831	7,050	4,136	8,554	7,050	16,544	4,136	12,831	8,554	7,050	7,050
212	0.15			1	5			1,764	1,564	859	757	1,044	860	1,764	757	1,564	1,044	859	860
213	0.15			1	5			739	655	360	317	437	360	739	317	655	437	360	360
214	0.16			1	5			385	342	187	165	228	188	385	165	342	228	187	188
215	0.17			1	5			616	546	300	264	364	300	616	264	546	364	300	300
216	0.16			1	5			477	424	233	205	282	233	477	205	424	282	233	233
217	0.14			1	5			123	109	60	53	73	60	123	53	109	73	60	60
218	0.29			1	5			6,080	5,389	2,962	2,606	3,593	2,960	6,080	2,606	5,389	3,593	2,962	2,960
219	0.49			1	5			2,858	2,534	1,392	1,225	1,689	1,392	2,858	1,225	2,534	1,689	1,392	1,392
220	0.24			1	5			1,817	1,611	886	779	1,074	884	1,817	779	1,611	1,074	886	884
221	0.26			1	5			370	328	180	158	218	180	370	158	328	218	180	180
222	0.21			1	5			4,734	4,196	2,305	2,028	2,798	2,306	4,734	2,028	4,196	2,798	2,305	2,306
223	0.30			1	5			524	464	256	224	309	254	524	224	464	309	256	254
224	0.29			1	5			1,478	1,310	720	634	874	720	1,478	634	1,310	874	720	720
225	0.28			1	5			1,932	1,712	941	827	1,141	941	1,932	827	1,712	1,141	941	941
226	0.03			1	5			4,386	3,402	1,870	1,097	2,267	1,868	4,386	1,097	3,402	2,267	1,870	1,868
TOTALS:						**39,339**	**101,998**	**158,401**	**283,719**	**125,502**	**110,547**	**335,286**	**182,425**	**158,401**	**158,401**	**283,719**	**283,719**	**125,502**	**125,502**

APPENDIX D

Screen Line Adjustment Procedure Example Spreadsheet
&
Year 2025 Traffic Projections

Example Screen Line Adjustment Spreadsheet (NCHRP #255 Procedure)

***--User Specified Input**
Ab--Base Year Assignment
Af--Future Year Assignment
RAf--Adjusted Future Year Assignment
Cb--Base Year Capacity (at LOS D)
Cf--Future Year Capacity (at LOS D)
FAf--Final Refined Future Year Traffic Forecast
TFAf/TCf--Ratio of Total Screenline Refined Future Year Traffic to Total Future Year Screenline Capacity
Forecast to Total Future Year Screenline Capacity

SCREENLINE #2

Project: Rapid City Travel Demand Model Update
Screenline Description: N-S screenline west of Mountain View Blvd.
Analyst: CBS

...ADJUSTMENTS...

Count ID #	LINK DESCRIPTION	COUNT*	%TOT COUNT	Ab* (2000) (Calib. 31)	Af* (2000) (Year 2000)	%DEV	RATIO ADJ	DIFF ADJ	RAf	Cb*	Cf*	% TCf	RAf/Cf	CAP ADJ	BASE COUNT	FAf NEW	FAf	FAf/Cf	COUNT/Cb
83	N ELK VALE RD	750	60%	732	1,551	-2%	1,589	1,569	1,579	22,000	22,000	44%	0.07	430	2,308	0	2,700	0.12	0.03
500	W NIKE RD	177	14%	177	1,251	0%	1,254	1,251	1,253	11,000	11,000	22%	0.11	215	545	0	800	0.07	0.02
501	DYESS AVE	329	26%	329	2,000	0%	2,001	2,000	2,000	16,500	16,500	33%	0.12	322	1,013	0	1,300	0.08	0.02
	0	-		-	0					-	0	--	--	0	0	0	0	--	--
	0	-		-	0					-	0	--	--	0	0	0	0	--	--
	0	-		-	0					-	0	--	--	0	0	0	0	--	--
	0	-		-	0					-	0	--	--	0	0	0	0	--	--
	0	-		-	0					-	0	--	--	0	0	0	0	--	--
	0	-		-	0					-	0	--	--	0	0	0	0	--	--
	0	-		-	0					-	0	--	--	0	0	0	0	--	--
																		--	--
														FCAP*=	0.20				
	TOTALS:	**1,256**		**1,238**	**4,802**	-1%			4,832	49,500	49,500		0.10	FCOUNT*=	0.80	0	**4,800**	0.10	0.03
		TCOUNT		TAb	TAf	Tot. Assign. Error vs. Ct.			TRAf	TCb	TCf		TRAf/TCf			TFAf NEW	TFAf	TFAf/TCf	TCOUNT/ TCb

YEAR 2025 TRAFFIC PROJECTIONS – SCREEN LINE PROCEDURE RESULTS, Page 1 of 3

Count_ID	Screenline	Street Name	Link Type	Facility Type	Projected AADT	00 AADT	Growth (%)
2	SCREENLINE #31	5 ST	208	5-lane Urban Principal Arterial, 2-way	23,500	18333	28%
3	SCREENLINE #46	5 ST	208	5-lane Urban Principal Arterial, 2-way	18,100	16666	9%
8	SCREENLINE #4	N 5 ST	208	5-lane Urban Principal Arterial, 2-way	25,600	20833	23%
12	SCREENLINE #32	5 ST	220	5-lane CBD Principal Arterial, 2-way	24,400	25000	-2%
13	SCREENLINE #45	5 ST	208	5-lane Urban Principal Arterial, 2-way	22,600	20000	13%
14	SCREENLINE #36	5 ST	213	5-lane Suburban Principal Arterial, 2-wa	6,600	4083	62%
15	SCREENLINE #4	N 8 ST	404	4-lane Urban Collector, 2-way	12,300	7500	64%
21	SCREENLINE #29	ANAMOSA ST	300	2-lane Urban Minor Arterial, 2-way	8,900	4166	114%
22	SCREENLINE #33	ANAMOSA ST	302	4-lane Urban Minor Arterial, 2-way	13,900	9166	52%
22	SCREENLINE #41	ANAMOSA ST	302	4-lane Urban Minor Arterial, 2-way	18,500	9166	102%
24	SCREENLINE #24	CAMBELL ST	208	5-lane Urban Principal Arterial, 2-way	24,000	25833	-7%
26	SCREENLINE #25	S HIGHWAY 79	213	5-lane Suburban Principal Arterial, 2-wa	17,900	25000	-28%
26	SCREENLINE #36	S HIGHWAY 79	213	5-lane Suburban Principal Arterial, 2-wa	24,500	25000	-2%
27	SCREENLINE #46	CAMBELL ST	209	6-lane Urban Principal Arterial, 2-way	23,700	20833	14%
28	SCREENLINE #22	E ST JOSEPH ST	208	5-lane Urban Principal Arterial, 2-way	17,100	15000	14%
28	SCREENLINE #24	E ST JOSEPH ST	208	5-lane Urban Principal Arterial, 2-way	16,300	15000	9%
28	SCREENLINE #40	E ST JOSEPH ST	208	5-lane Urban Principal Arterial, 2-way	22,200	15000	48%
29	SCREENLINE #20	S HIGHWAY 79	215	2-lane Rural Principal Arterial, 1-way	8,100	9250	-12%
30	SCREENLINE #20	S HIGHWAY 79	211	3-lane Suburban Principal Arterial, 1-wa	10,600	11250	-6%
32	SCREENLINE #39	CANYON LAKE DR	305	4-lane Suburban Minor Arterial, 2-way	7,400	6166	20%
34	SCREENLINE #28	CANYON LAKE DR	300	2-lane Urban Minor Arterial, 2-way	10,000	9166	9%
36	SCREENLINE #16	CANYON LAKE DR	300	2-lane Urban Minor Arterial, 2-way	10,500	10833	-3%
38	SCREENLINE #7	CATHEDRAL DR	304	3-lane Suburban Minor Arterial, 2-way	9,700	11666	-17%
47	SCREENLINE #46	CREEK DR	303	2-lane Suburban Minor Arterial, 2-way	4,400	3333	32%
48	SCREENLINE #40	CREEK DR	303	2-lane Suburban Minor Arterial, 2-way	4,500	1250	260%
55	SCREENLINE #35	DEADWOOD AVE	213	5-lane Suburban Principal Arterial, 2-wa	34,200	12500	174%
56	SCREENLINE #41	DISK DR	408	4-lane Suburban Collector, 2-way	14,000	8333	68%
58	SCREENLINE #22	E ANAMOSA ST	302	4-lane Urban Minor Arterial, 2-way	10,500	7000	50%
59	SCREENLINE #42	E DISK DR	408	4-lane Suburban Collector, 2-way	9,400	7500	25%
60	SCREENLINE #19	E HIGHWAY 44	229	4-lane Rural Principal Arterial, 2-way	24,700	15000	65%
60	SCREENLINE #20	E HIGHWAY 44	229	4-lane Rural Principal Arterial, 2-way	14,300	15000	-5%
61	SCREENLINE #11	E HIGHWAY 44	229	4-lane Rural Principal Arterial, 2-way	14,900	5000	198%
62	SCREENLINE #25	E HIGHWAY 44	213	5-lane Suburban Principal Arterial, 2-wa	13,900	18333	-24%
62	SCREENLINE #40	E HIGHWAY 44	213	5-lane Suburban Principal Arterial, 2-wa	27,600	18333	51%
63	SCREENLINE #24	E HIGHWAY 44	213	5-lane Suburban Principal Arterial, 2-wa	22,600	21666	4%
64	SCREENLINE #5	E MAIN ST	206	3-lane Urban Principal Arterial, 1-way	9,400	6250	50%
66	SCREENLINE #22	E NORTH ST	208	5-lane Urban Principal Arterial, 2-way	24,600	25000	-2%
70	SCREENLINE #26	E ST JOSEPH ST	206	3-lane Urban Principal Arterial, 1-way	10,100	9166	10%
71	SCREENLINE #5	E ST JOSEPH ST	206	3-lane Urban Principal Arterial, 1-way	10,600	7500	41%
74	SCREENLINE #9	E ST PATRICK ST	208	5-lane Urban Principal Arterial, 2-way	20,100	10833	86%
77	SCREENLINE #25	E ST PATRICK ST	213	5-lane Suburban Principal Arterial, 2-wa	13,400	17500	-23%
83	SCREENLINE #2	N ELK VALE RD	227	2-lane Rural Principal Arterial, 2-way	2,700	750	260%
84	SCREENLINE #18	N ELK VALE RD	225	3-lane Suburban Principal Arterial, 2-wa	24,200	9166	164%
87	SCREENLINE #21	ELM AVE	303	2-lane Suburban Minor Arterial, 2-way	3,500	2750	27%
87	SCREENLINE #36	ELM AVE	303	2-lane Suburban Minor Arterial, 2-way	3,300	2750	20%
90	SCREENLINE #45	ELM AVE	300	2-lane Urban Minor Arterial, 2-way	6,800	5416	26%
91	SCREENLINE #9	E FAIRMONT BLVD	301	3-lane Urban Minor Arterial, 2-way	14,500	9166	58%
93	SCREENLINE #38	FAIRMONT BLVD	300	2-lane Urban Minor Arterial, 2-way	7,200	8333	-14%
94	SCREENLINE #37	FAIRMONT BLVD	301	3-lane Urban Minor Arterial, 2-way	7,200	8333	-14%
95	SCREENLINE #7	FLORMANN ST	402	2-lane Urban Collector, 2-way	2,700	1833	47%
99	SCREENLINE #17	HAINES AVE	208	5-lane Urban Principal Arterial, 2-way	24,300	20833	17%
100	SCREENLINE #43	HAINES AVE	226	4-lane Suburban Principal Arterial, 2-wa	29,200	20000	46%
106	SCREENLINE #17	I-190	101	2-lane Urban Interstate	11,900	8500	40%
107	SCREENLINE #17	I-190	101	2-lane Urban Interstate	10,500	7083	48%
108	SCREENLINE #4	I-190	101	2-lane Urban Interstate	13,400	8583	56%
109	SCREENLINE #4	I-190	101	2-lane Urban Interstate	12,100	7250	67%
110	SCREENLINE #1	I-90	104	2-lane Rural Interstate	30,600	11666	162%
111	SCREENLINE #1	I-90	104	2-lane Rural Interstate	29,600	10833	173%
112	SCREENLINE #11	I-90	103	2-lane Suburban Interstate	20,600	11166	84%
113	SCREENLINE #11	I-90	103	2-lane Suburban Interstate	22,400	12416	80%
114	SCREENLINE #29	I-90	103	2-lane Suburban Interstate	26,500	15333	73%
115	SCREENLINE #29	I-90	103	2-lane Suburban Interstate	28,700	17333	66%
116	SCREENLINE #35	I-90	103	2-lane Suburban Interstate	17,700	14499	22%
117	SCREENLINE #35	I-90	103	2-lane Suburban Interstate	15,300	12583	22%
118	SCREENLINE #41	I-90	101	2-lane Urban Interstate	22,500	13333	69%
119	SCREENLINE #41	I-90	101	2-lane Urban Interstate	24,500	14999	63%
120	SCREENLINE #10	I-90	103	2-lane Suburban Interstate	17,400	11583	50%
121	SCREENLINE #10	I-90	103	2-lane Suburban Interstate	21,300	15916	34%
122	SCREENLINE #23	I-90	103	2-lane Suburban Interstate	18,300	10916	68%
123	SCREENLINE #23	I-90	103	2-lane Suburban Interstate	19,900	12750	56%
124	SCREENLINE #39	JACKSON BLVD	226	4-lane Suburban Principal Arterial, 2-wa	17,500	15833	11%
127	SCREENLINE #28	JACKSON BLVD	209	6-lane Urban Principal Arterial, 2-way	33,500	27500	22%
130	SCREENLINE #16	JACKSON BLVD	208	5-lane Urban Principal Arterial, 2-way	20,800	20000	4%
131	SCREENLINE #3	JACKSON BLVD	209	6-lane Urban Principal Arterial, 2-way	28,000	20000	40%
134	SCREENLINE #44	N LACROSSE ST	208	5-lane Urban Principal Arterial, 2-way	26,900	25833	4%

YEAR 2025 TRAFFIC PROJECTIONS – SCREEN LINE PROCEDURE RESULTS, Page 2 of 3

Count_ID	Screenline	Street Name	Link Type	Facility Type	Projected AADT	00 AADT	Growth (%)
137	SCREENLINE #17	N LACROSSE ST	209	6-lane Urban Principal Arterial, 2-way	24,300	18333	33%
138	SCREENLINE #43	N LACROSSE ST	214	6-lane Suburban Principal Arterial, 2-wa	26,300	15000	75%
141	SCREENLINE #8	MAIN ST	201	3-lane CBD Principal Arterial, 1-way	13,900	11666	19%
142	SCREENLINE #6	MAIN ST	201	3-lane CBD Principal Arterial, 1-way	15,000	14166	6%
143	SCREENLINE #33	MAIN ST	201	3-lane CBD Principal Arterial, 1-way	13,200	10833	22%
144	SCREENLINE #27	MAIN ST	201	3-lane CBD Principal Arterial, 1-way	20,300	18333	11%
148	SCREENLINE #42	E MALL DR	224	2-lane Suburban Principal Arterial, 2-wa	3,200	1833	75%
149	SCREENLINE #41	MALL DR	224	2-lane Suburban Principal Arterial, 2-wa	8,100	2250	260%
151	SCREENLINE #44	N MAPLE AVE	402	2-lane Urban Collector, 2-way	5,800	4000	45%
155	SCREENLINE #10	E ST PATRICK ST	213	5-lane Suburban Principal Arterial, 2-wa	28,800	20000	44%
161	SCREENLINE #21	S HIGHWAY 16	210	2-lane Suburban Principal Arterial, 1-wa	9,000	7833	15%
162	SCREENLINE #21	S HIGHWAY 16	210	2-lane Suburban Principal Arterial, 1-wa	9,400	8250	14%
163	SCREENLINE #31	MT RUSHMORE RD	208	5-lane Urban Principal Arterial, 2-way	32,600	31666	3%
164	SCREENLINE #46	MT RUSHMORE RD	213	5-lane Suburban Principal Arterial, 2-wa	24,800	23333	6%
167	SCREENLINE #15	S HIGHWAY 16	210	2-lane Suburban Principal Arterial, 1-wa	10,100	7916	28%
167	SCREENLINE #20	S HIGHWAY 16	210	2-lane Suburban Principal Arterial, 1-wa	7,400	7916	-7%
167	SCREENLINE #36	S HIGHWAY 16	210	2-lane Suburban Principal Arterial, 1-wa	8,300	7916	5%
168	SCREENLINE #15	S HIGHWAY 16	210	2-lane Suburban Principal Arterial, 1-wa	9,600	7416	29%
168	SCREENLINE #20	S HIGHWAY 16	210	2-lane Suburban Principal Arterial, 1-wa	7,000	7416	-6%
168	SCREENLINE #36	S HIGHWAY 16	210	2-lane Suburban Principal Arterial, 1-wa	7,900	7416	7%
169	SCREENLINE #40	MT RUSHMORE RD	208	5-lane Urban Principal Arterial, 2-way	33,000	27500	20%
170	SCREENLINE #32	MT RUSHMORE RD	204	6-lane CBD Principal Arterial, 2-way	28,900	25000	16%
171	SCREENLINE #45	MT RUSHMORE RD	208	5-lane Urban Principal Arterial, 2-way	25,400	23333	9%
172	SCREENLINE #14	S HIGHWAY 16	215	2-lane Rural Principal Arterial, 1-way	12,900	8500	52%
172	SCREENLINE #19	S HIGHWAY 16	215	2-lane Rural Principal Arterial, 1-way	12,500	8500	47%
173	SCREENLINE #14	S HIGHWAY 16	215	2-lane Rural Principal Arterial, 1-way	12,900	8500	52%
173	SCREENLINE #19	S HIGHWAY 16	215	2-lane Rural Principal Arterial, 1-way	12,500	8500	47%
174	SCREENLINE #17	N MAPLE AVE	403	3-lane Urban Collector, 2-way	8,300	6916	20%
176	SCREENLINE #1	SOUTH CANYON RD	227	2-lane Rural Principal Arterial, 2-way	14,400	3583	302%
178	SCREENLINE #29	NORTH ST	404	4-lane Urban Collector, 2-way	11,900	2916	308%
179	SCREENLINE #30	NORTH ST	402	2-lane Urban Collector, 2-way	3,300	2583	28%
179	SCREENLINE #33	NORTH ST	402	2-lane Urban Collector, 2-way	4,700	2583	82%
180	SCREENLINE #8	OMAHA ST	209	6-lane Urban Principal Arterial, 2-way	32,700	25833	27%
181	SCREENLINE #6	OMAHA ST	209	6-lane Urban Principal Arterial, 2-way	34,800	30833	13%
182	SCREENLINE #33	OMAHA ST	209	6-lane Urban Principal Arterial, 2-way	33,700	27500	23%
183	SCREENLINE #5	E NORTH ST	208	5-lane Urban Principal Arterial, 2-way	27,400	23333	17%
184	SCREENLINE #27	OMAHA ST	209	6-lane Urban Principal Arterial, 2-way	40,000	28333	41%
195	SCREENLINE #23	E NORTH ST	210	2-lane Suburban Principal Arterial, 1-wa	25,000	20833	20%
195.1	SCREENLINE #23	E NORTH ST	210	2-lane Suburban Principal Arterial, 1-wa	17,100	11749	46%
196	SCREENLINE #5	E OMAHA ST	208	5-lane Urban Principal Arterial, 2-way	13,800	9083	52%
198	SCREENLINE #18	E NORTH ST	210	2-lane Suburban Principal Arterial, 1-wa	22,500	7999	181%
198.1	SCREENLINE #18	E NORTH ST	210	2-lane Suburban Principal Arterial, 1-wa	17,400	4499	287%
199	SCREENLINE #26	E OMAHA ST	208	5-lane Urban Principal Arterial, 2-way	21,200	21666	-2%
200	SCREENLINE #22	E OMAHA ST	208	5-lane Urban Principal Arterial, 2-way	24,000	24166	-1%
201	SCREENLINE #14	S HIGHWAY 79	215	2-lane Rural Principal Arterial, 1-way	7,300	3583	104%
201	SCREENLINE #19	S HIGHWAY 79	215	2-lane Rural Principal Arterial, 1-way	6,900	3583	93%
202	SCREENLINE #14	S HIGHWAY 79	215	2-lane Rural Principal Arterial, 1-way	8,000	4166	92%
202	SCREENLINE #19	S HIGHWAY 79	215	2-lane Rural Principal Arterial, 1-way	7,500	4166	80%
204	SCREENLINE #23	SEGER DR	307	2-lane Rural Minor Arterial, 2-way	6,800	3250	109%
205	SCREENLINE #42	SEGER DR	303	2-lane Suburban Minor Arterial, 2-way	1,300	499	161%
208	SCREENLINE #15	SHERIDAN LAKE RD	225	3-lane Suburban Principal Arterial, 2-wa	9,900	7666	29%
210	SCREENLINE #39	SHERIDAN LAKE RD	226	4-lane Suburban Principal Arterial, 2-wa	11,300	9166	23%
211	SCREENLINE #16	SHERIDAN LAKE RD	226	4-lane Suburban Principal Arterial, 2-wa	19,400	16666	16%
222	SCREENLINE #8	ST JOSEPH ST	201	3-lane CBD Principal Arterial, 1-way	15,900	14166	12%
223	SCREENLINE #6	ST JOSEPH ST	201	3-lane CBD Principal Arterial, 1-way	16,600	16666	0%
224	SCREENLINE #33	ST JOSEPH ST	201	3-lane CBD Principal Arterial, 1-way	14,600	12500	17%
225	SCREENLINE #27	ST JOSEPH ST	201	3-lane CBD Principal Arterial, 1-way	21,400	20000	7%
228	SCREENLINE #7	ST PATRICK ST	222	3-lane Urban Principal Arterial, 2-way	6,300	6500	-3%
229	SCREENLINE #38	E ST PATRICK ST	223	4-lane Urban Principal Arterial, 2-way	10,000	10000	0%
231	SCREENLINE #37	ST PATRICK ST	223	4-lane Urban Principal Arterial, 2-way	9,800	10000	-2%
232	SCREENLINE #1	STURGIS RD	225	3-lane Suburban Principal Arterial, 2-wa	25,900	10833	139%
232	SCREENLINE #35	STURGIS RD	225	3-lane Suburban Principal Arterial, 2-wa	13,200	10833	22%
238	SCREENLINE #9	E CATRON BLVD	226	4-lane Suburban Principal Arterial, 2-wa	14,900	5916	152%
244	SCREENLINE #26	E MAIN ST	206	3-lane Urban Principal Arterial, 1-way	9,100	7916	15%
245	SCREENLINE #46	S VALLEY DR	412	2-lane Suburban Collector, 2-way	3,400	2833	20%
251	SCREENLINE #16	W CHICAGO ST	210	2-lane Suburban Principal Arterial, 1-wa	6,500	4416	47%
252	SCREENLINE #16	W CHICAGO ST	210	2-lane Suburban Principal Arterial, 1-wa	7,900	6166	28%
253	SCREENLINE #39	W CHICAGO ST	210	2-lane Suburban Principal Arterial, 1-wa	8,000	7083	13%
254	SCREENLINE #39	W CHICAGO ST	210	2-lane Suburban Principal Arterial, 1-wa	7,700	6750	14%
257	SCREENLINE #3	W MAIN ST	208	5-lane Urban Principal Arterial, 2-way	27,700	25000	11%
258	SCREENLINE #28	W MAIN ST	208	5-lane Urban Principal Arterial, 2-way	29,900	29166	3%
259	SCREENLINE #16	W MAIN ST	208	5-lane Urban Principal Arterial, 2-way	20,800	20000	4%
262	SCREENLINE #34	W MAIN ST	204	6-lane CBD Principal Arterial, 2-way	43,100	44166	-2%
263	SCREENLINE #3	W OMAHA ST	204	6-lane CBD Principal Arterial, 2-way	30,300	26666	14%
264	SCREENLINE #34	W OMAHA ST	204	6-lane CBD Principal Arterial, 2-way	38,300	34166	12%
265	SCREENLINE #28	W OMAHA ST	226	4-lane Suburban Principal Arterial, 2-wa	30,200	25833	17%

YEAR 2025 TRAFFIC PROJECTIONS – SCREEN LINE PROCEDURE RESULTS, Page 3 of 3

Count_ID	Screenline	Street Name	Link Type	Facility Type	Projected AADT	00 AADT	Growth (%)
268	SCREENLINE #31	WEST BLVD	401	1-lane Urban Collector, 1-way	4,100	3000	37%
269	SCREENLINE #31	WEST BLVD	401	1-lane Urban Collector, 1-way	4,000	2833	41%
270	SCREENLINE #40	WEST BLVD	401	1-lane Urban Collector, 1-way	4,200	2916	44%
271	SCREENLINE #40	WEST BLVD	401	1-lane Urban Collector, 1-way	4,200	2916	44%
272	SCREENLINE #32	WEST BLVD	400	2-lane CBD Collector, 1-way	7,600	7583	0%
273	SCREENLINE #32	WEST BLVD	400	2-lane CBD Collector, 1-way	6,300	5416	16%
274	SCREENLINE #45	WEST BLVD	401	1-lane Urban Collector, 1-way	1,500	416	261%
275	SCREENLINE #45	WEST BLVD	401	1-lane Urban Collector, 1-way	1,700	666	155%
290	SCREENLINE #33	NEW YORK ST	513	2-lane Urban Local Street, 2-way	6,700	5833	15%
291	SCREENLINE #45	PRAIRIE AVE	513	2-lane Urban Local Street, 2-way	2,700	1416	91%
300	SCREENLINE #44	WEST BLVD N	402	2-lane Urban Collector, 2-way	5,900	4166	42%
301	SCREENLINE #9	E MINNESOTA ST	304	3-lane Suburban Minor Arterial, 2-way	7,300	3916	86%
302	SCREENLINE #21	5 ST	226	4-lane Suburban Principal Arterial, 2-wa	12,600	10000	26%
306	SCREENLINE #46	ELM AVE	300	2-lane Urban Minor Arterial, 2-way	6,300	0	#DIV/0!
313	SCREENLINE #40	5 ST	208	5-lane Urban Principal Arterial, 2-way	27,900	21666	29%
314	SCREENLINE #30	ANAMOSA ST	302	4-lane Urban Minor Arterial, 2-way	10,900	9200	18%
500	SCREENLINE #2	W NIKE RD	409	2-lane Rural Collector, 2-way	800	177	352%
501	SCREENLINE #2	DYESS AVE	307	2-lane Rural Minor Arterial, 2-way	1,300	329	295%
503	SCREENLINE #12	I-90	104	2-lane Rural Interstate	22,300	8783	154%
504	SCREENLINE #12	I-90	104	2-lane Rural Interstate	22,300	8783	154%
505	SCREENLINE #12	E HIGHWAY 44	1	2-lane Rural Non-Standard, 2-way	7,600	3233	135%
600	SCREENLINE #20	ELK VALE RD	226	4-lane Suburban Principal Arterial, 2-wa	14,700	5496	167%
601	SCREENLINE #22	EGLIN ST	300	2-lane Urban Minor Arterial, 2-way	7,300	5496	33%
601	SCREENLINE #23	EGLIN ST	300	2-lane Urban Minor Arterial, 2-way	9,900	5496	80%
602	SCREENLINE #23	E MALL DR	224	2-lane Suburban Principal Arterial, 2-wa	16,900	5496	207%
604	SCREENLINE #24	E ANAMOSA ST	301	3-lane Urban Minor Arterial, 2-way	7,200	5496	31%
604	SCREENLINE #25	E ANAMOSA ST	301	3-lane Urban Minor Arterial, 2-way	4,400	5496	-20%
605	SCREENLINE #25	CREEK DR	303	2-lane Suburban Minor Arterial, 2-way	4,400	5496	-20%
605	SCREENLINE #36	CREEK DR	303	2-lane Suburban Minor Arterial, 2-way	4,500	5496	-18%

Duplicated Link Output - Use caution when "joining" table to TransCAD layer.

Screenline assignment out of acceptable range (+/-20%) - Use caution when using values for reporting projections.