traffic
services

Bridger Canyon Partners
Base Area Development Plan
Traffic Impact Study
Bozeman, Montana

Prepared For:

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I. EXECUTIVE SUMMARY

Currently Bridger Canyon Road is operating well under peak design conditions. Crash statistics within the canyon are within normal ranges and do not appear to be directly related to traffic volumes. The Bridger Bowl EIS identified several roadway improvements that will need to be taken as part of the ski area expansion. Most of these improvements will eventually need to be made regardless of any development at the base area.

The Bridger Canyon Partners development includes up to 452 overnight accommodations, 75 single family residential units, and a variety of supporting commercial facilities in the Bridger Bowl Base Area. The development would produce up to 3,000 new daily trip ends, of which 40% are estimated to remain within the base area.

Traffic volumes will increase along Bridger Canyon Road due to skier growth and the proposed ski area expansion. This change would be closely related to the increase in skier visits at the ski area. As traffic volumes within the canyon continue to increase, some improvements will need to be made. These improvements include the installation of a left-turn deceleration lane at Jackson Creek Road and a right-turn acceleration lane at the existing exit from Bridger Bowl. These improvements will eventually be required regardless of the construction of the proposed development.

Ultimately the traffic volumes along Bridger Canyon Road will be closely related to the total skier visits at the mountain. The proposed base area development will not significantly change the current rate of one vehicle trip per skier visit within the canyon. However, the trip patterns of the proposed development will create an improved directional balance for traffic flow within the canyon and spread out the daily traffic flow to allow the roadway to carry more daily traffic with better operations than without the development.

II. BACKGROUND

In 2005 the U.S. Department of Agriculture Forest Service approved the *Final Environmental Impact Statement for the Bridger Bowl Special Use Permit and Master Development Plan*. The EIS evaluated the possible impacts of expanding the boundaries of Bridger Bowl and providing additional guest services. The purpose of this study is to review the anticipated traffic impacts from a proposed residential and lodging development at the base Bridger Bowl.

III. EXISTING CONDITIONS

Bridger Bowl Ski Area is accessed from the City of Bozeman by Montana Highway 86 and Forest Service Road 3200. MT Highway 86 was improved by the Montana Department of Transportation in 1998. The roadway has a posted speed limit of 70 MPH. See **Figure 1** for a map of Bridger Canyon Road.

The base area at Bridger Bowl Ski Area currently consists of two day lodges, ski rental and retail shops, and mountain operations and maintenance facilities. The base area has no overnight accommodations or services. The Bridger Pines Subdivision located to the north of the base area contains the only residential and rental units in the area and has 20 residential units. The ski area serves 970 skiers on an average weekday and 2,220 skiers on an average weekend (Source: Bridger Bowl Skier Visits 2000-2006).

IV. BRIDGER BOWL EIS

The Bridger Bowl EIS includes several sections that provide ski area use projections though 2010 with and without an expansion of the base area. Most of the projections contained in the EIS were made prior to 2000. The projected 2010 'No-Build' (no new lifts or accommodations) values provide a good starting point to compare the existing 2006 conditions. The EIS projects a peak skier day in 2010 of 3,389 skier visits under no-build conditions. The EIS also contains projected roadway volumes for 2010 with and without the ski area expansion. These values are shown in **Table 1**. The EIS projected that the Bridger Bowl base area would be fully developed by 2010. Current estimates indicate that development in the base area will not be completed until 2015 to 2020.

Table 1 – EIS Traffic Data

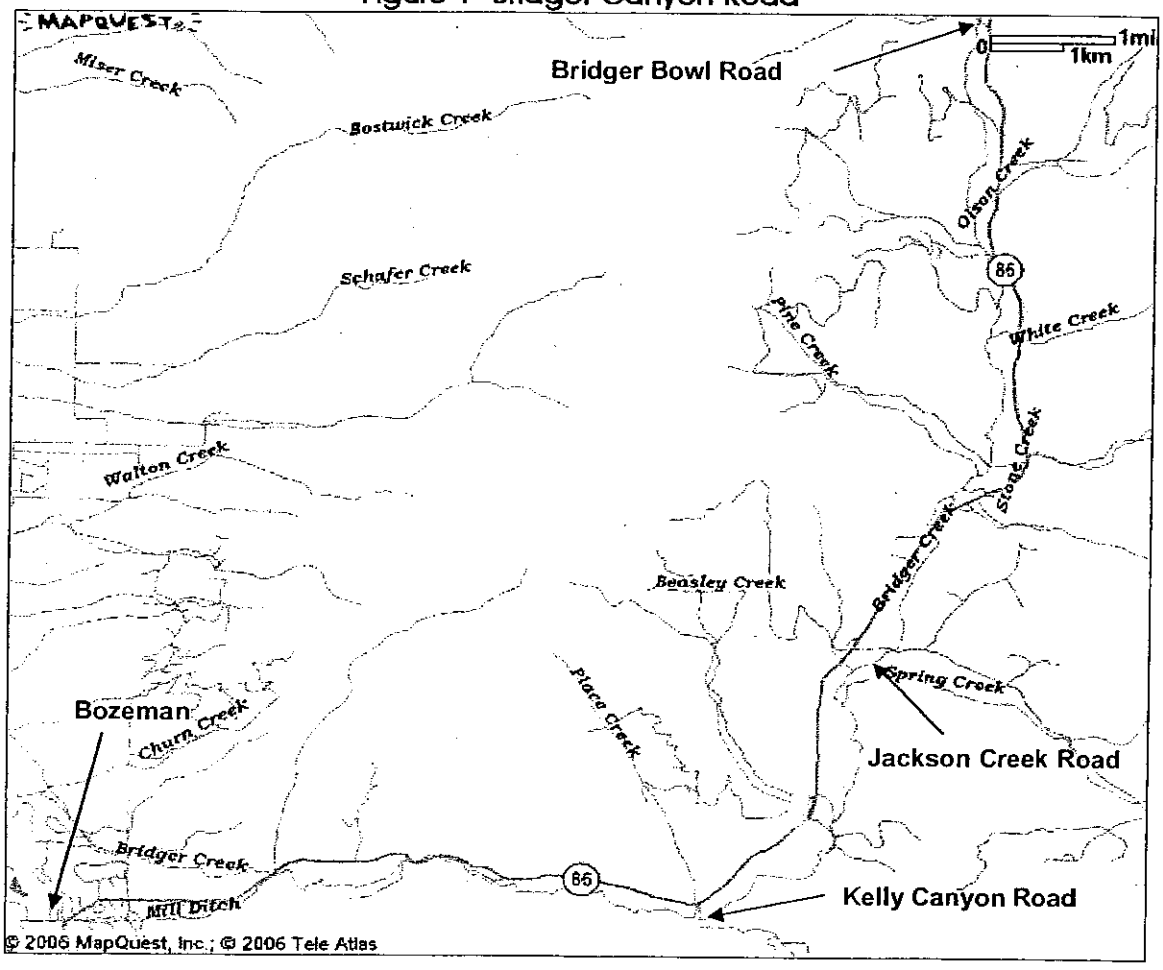
Bridger Canyon Road	2010 Projected 'No-build' Traffic Volume Data		2010 Traffic Volumes With New Lifts and Base Area Development	
	Peak Hour Weekday	Peak Hour Weekend	Peak Hour Weekday	Peak Hour Weekend
West of Kelly Canyon	489	708	864	1,390
South of Bridger Bowl Entrance	370	607	764	1,325

The EIS also states that *"The majority of the development that could occur would likely serve to reduce traffic along Bridger Canyon Road and the Bridger Bowl access road as well as the demand for parking as it would be designed to accommodate guests in closer proximity to the ski area, thereby decreasing the need to travel between the resort and Bozeman."*

The Bridger Canyon Zoning Guidelines have several objectives relating to traffic within the Canyon. These objectives include:

- Maintaining a balance between recreational and residential traffic,
- Encourage ride-sharing programs,
- Allow the expansion of recreational facilities to their ultimate capacity without exceeding vehicular capacity of two-lane road,
- Allow the construction of bus parking needs.

Figure 1 - Bridger Canyon Road



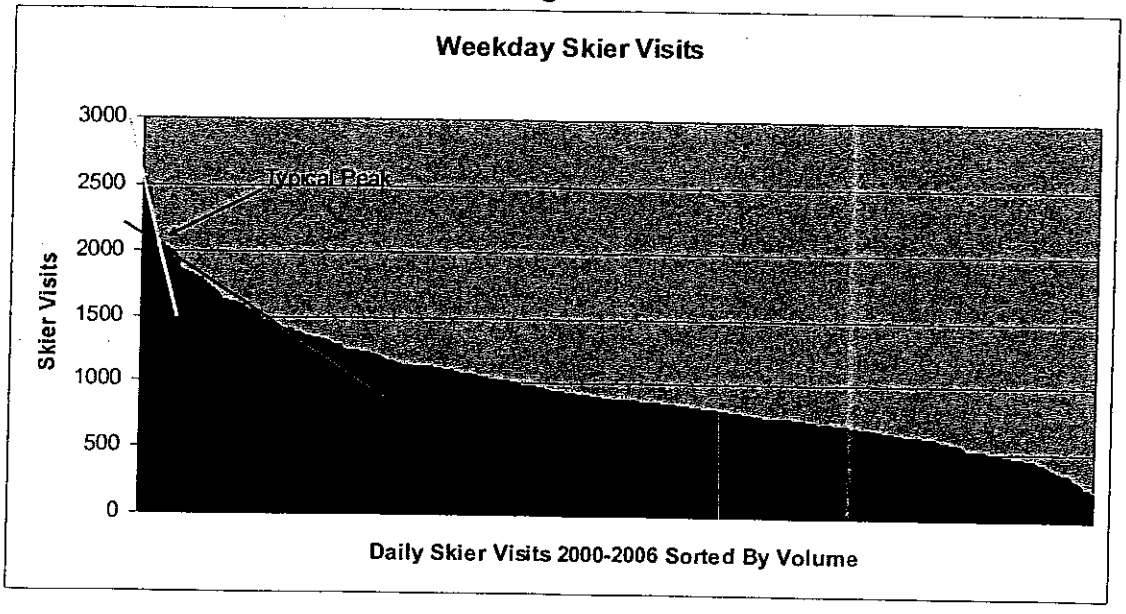
V. HISTORIC DATA

Abelin Traffic Services (ATS) obtained skier visit data from Bridger Bowl for 2000-2006 to compare with the values projected by the EIS. This data was used to determine the average daily weekday and weekend skier visits at the ski resort and determine appropriate "design day" volumes.

Roadway designs are not generally based on the highest daily traffic volumes observed at a location. Designing to the highest days observed would not be practical. The best practice is to design to the highest "typical" peak traffic day and exclude the maximum peak days which can be significantly higher than the "typical" peak. The Montana Department of Transportation generally uses the 30th highest hour for roadway construction projects. The MDT technique requires that hourly roadway volumes be available for an entire year on or near the roadway in question.

Another method for establishing a "typical" peak day volume is by examining the daily data over a period of years. ATS calculated peak "design day" volumes by analyzing the daily skier visit data for regular weekday traffic (non-holiday) and weekend and holiday traffic for the last six seasons. **Figure 2** shows the weekday skier visit data and **Figure 3** shows the weekend/holiday skier visit data sorted from greatest to least. To identify a "typical" peak, the sorted skier visit data is examined to locate an upper end "break" or "knuckle". A "break" or "knuckle" is a location along a graph of data where a significant slope change occurs. These locations can be identified on a graph by drawing straight lines along groups of in-line data points. Locations where the slopes of two adjacent lines change quickly are "breaks". The "typical" peak is the point along the graph where the highest "break" occurs. The "breaks" used for this study are identified on **Figures 2 & 3**.

Figure 2



The weekday traffic data shows a typical peak of 2,100 skier visits and the weekend/holiday data shows a typical peak at 3,350 skier visits. Using these numbers it would be anticipated that skier traffic would exceed the design traffic volume one weekday per year and two weekend-day/holiday-days per year. **Table 2** shows the typical skier visit data for average and peak weekdays and weekend days. The table indicates that the peak weekday traffic is 90% higher than the average weekday traffic and that the peak weekend day traffic is 50% higher than the average weekend day

traffic. The peak design day of 3,350 skiers calculated for this report is almost identical to the average peak skier day of 3,389 calculated for the Bridger Bowl EIS.

Figure 3

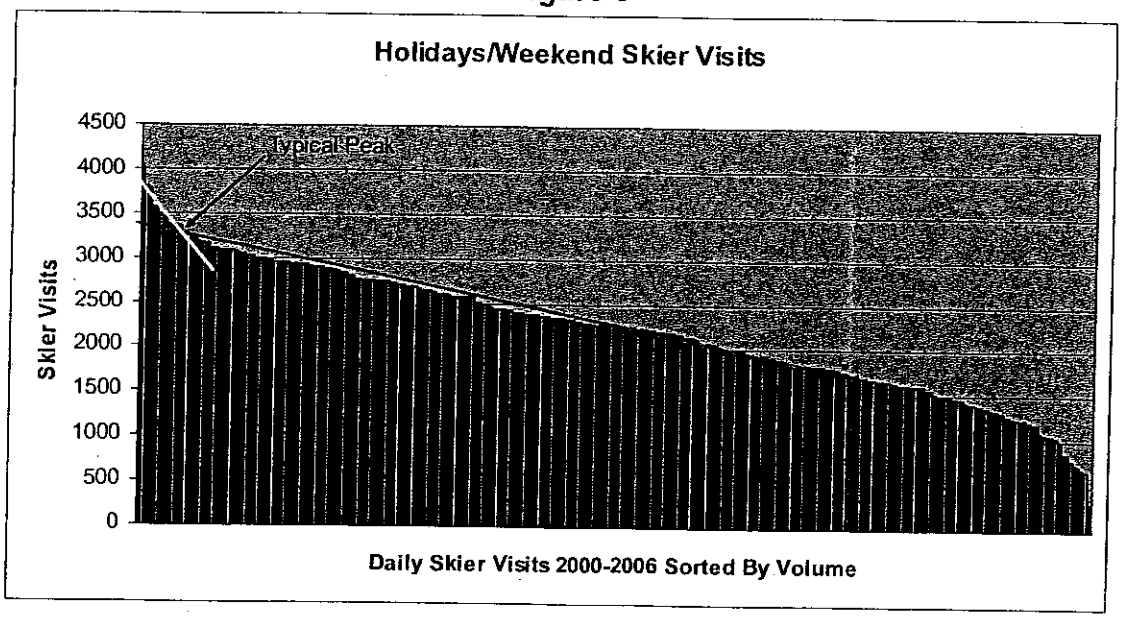


Table 2- Average and Typical Peak Design Day Skier Visits

Average Day		
Weekday	**Weekend**	**All Days**
970	2,220	1,410
Typical Peak Design Day		
Weekday	**Weekend**	**All Days**
2,100	3,350	3,350

Additional data was assembled from the EIS, MDT, and Bridger Bowl Ski Area to determine an appropriate traffic volume growth rate for Bridger Canyon Road. The historic roadway traffic volumes for the last eight years are shown in **Table 3**. The data shows that traffic volumes have varied considerably over the past eight years. The MDT data was collected during the summer months and does not represent skier traffic.

Table 3 – Bridger Canyon Road Average Daily Traffic Data

Location	1997	1998	1999	2000	2001	2002	2003	2004
MP-8, Near Kelly Canyon	2,090	2,580	NA	1,770	2,670	2,400	1880	1930
MP-15, South of Bridger Bowl	NA	730	810	820	820	910	910	950
MP-17, North of Bridger Bowl	NA	540	570	620	590	650	460	510

Average daily skier traffic data collected from Bridger Bowl indicates that skier traffic at the ski area has been increasing at an annual rate of four percent over the last six years. However, this is a relatively small sample of data and portions of the data contain known

errors. ATS contacted Bridger Bowl to ask for earlier skier history data and find out what information Bridger Bowl is currently using to create their own long-range projections. Bridger Bowl staff indicated that the skier data collected prior to 1996 is unreliable due to daily estimates used for season pass skiers and that overall skier use characteristics have changed considerably over the past 10-15 years. Bridger Bowl does not use historic skier traffic data for its own projections. Rather, the ski area uses data from the Bridger Bowl EIS and the current growth rates for the Gallatin County (3-4%). The 4% growth rate used for this study is likely high, but reasonable based on the current population growth rates within the Bozeman area.

VI. DATA COLLECTION

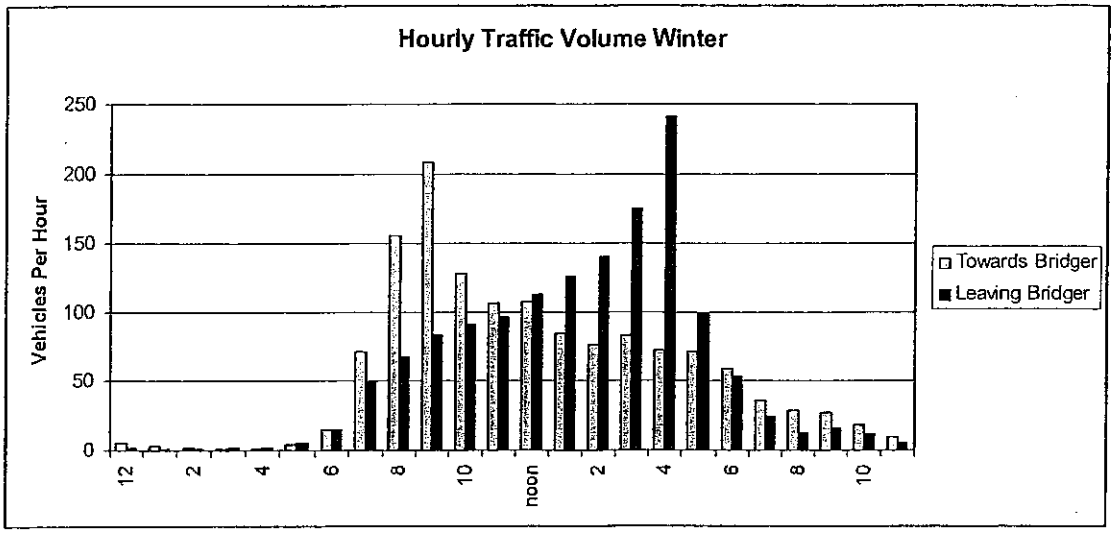
In February and March of 2006 ATS collected traffic data along MT Highway 86 to obtain winter traffic data in the area. The data collected included 24-hour hose count volumes along the roadway on several weekdays and weekend days over a period of two weeks. Peak-hour turning movement data was also collected at major intersections between Bridger Bowl and Bozeman. This traffic data collection effort was repeated in May.

Traffic data for MT Highway 86 was also collected from the Montana Department of Transportation (MDT). MDT performs quarterly traffic counts along the highway just west of Kelly Canyon Road. ATS obtained the hourly traffic data for this location for the past three years. The data included winter, spring, summer, and fall traffic count data over the last three years. This data indicates that Bridger Canyon Road currently carries 2,000 vehicles per day when the ski area is not in operation. The daily MDT traffic data is included in **Appendix A**.

The traffic collected by MDT and ATS indicates that typical peak design day winter weekend traffic volumes along Bridger Canyon Road west of Kelly Canyon Road are 700 Vehicles Per Hour (VPH). Peak-hour design day winter weekday traffic volumes are 450 VPH. This matches closely with the 708 VPH weekend and 489 VPH weekday volumes from the 2010 no-build data contained in the Bridger Bowl EIS.

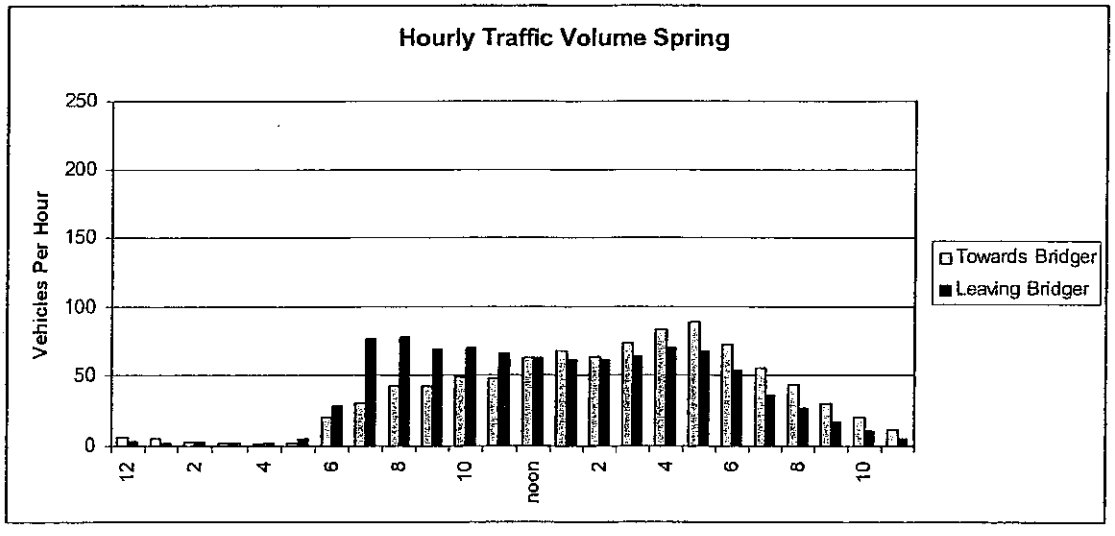
Directional traffic volume data for MT Highway 86 was analyzed to evaluate the typical weekend traffic patterns on the roadway for winter conditions. This data shows a spike in vehicles going up the canyon in the morning and a spike of vehicles going down the canyon in the afternoon. This data is shown graphically in **Figure 4 & 5**. This pattern is typical for a ski resort and is consistent for both weekdays and weekend days. The data shows that peak hour traffic volumes account for 11% of the daily total volume.

Figure 4



The data also provides information for off-peak season roadway traffic conditions. This figures show the change in peak hour volumes and directional splits between peak winter season and off-peak season traffic.

Figure 5



ATS also collected speed data for the highway during the spring traffic count. Highway speed limits are generally set by monitoring actual vehicle speeds on a roadway and determining the speed at which most drivers are traveling. The data collected on Bridger Canyon Road west of Kelly Canyon Road shows that the 85th percentile speed (the speed which is generally recommended for setting the speed limit) was 73 MPH. This speed closely matches the exiting posted 70 MPH speed limit on the roadway at this location. From the single site selected for this study is clear that most vehicles are traveling at or

above the posted speed limit. This trend will likely continue the rest of the way up the canyon.

Using the data collected for this project, ATS conducted a Level of Service (LOS) analysis at the critical intersections along the roadway. This evaluation was conducted in accordance with the procedures outlined in the Transportation Research Board's *Highway Capacity Manual (HCM) - Special Report 209* and the Highway Capacity Software (HCS) version 4.1e. Intersections are graded from A to F representing the average delay that a vehicle entering an intersection can expect. Typically, a LOS of C or better is considered acceptable for peak-hour conditions.

Table 4 shows the AM and PM weekday and weekend peak-hour LOS for the intersections along Bridger Canyon Road for peak winter traffic conditions. The tables show that most of the intersections in the canyon are currently operating at good levels of service even under peak traffic condition. All of the intersections within the canyon maintain considerable reserve capacity. A review of the spring traffic volumes indicated that all of the intersections function at better levels of service when the ski area is not in operation.

Table – 4
Winter Level of Service 2006

Bridger Canyon Intersection	Design Weekdays		Design Weekends	
	AM	PM	AM	PM
Bridger Bowl	B (10.4)	A (9.7)	B (14.9)	C (16.4)
Jackson Creek	B (10.1)	B (10.6)	B (12.6)	B (14.6)
Kelly Canyon	B (11.5)	A (9.9)	B (12.7)	B (13.2)

LOS (Delay in Seconds)

Table 5 shows that the entrance to Bridger Bowl will experience a poor level of service under 2015 weekend conditions without intersection improvements. The Bridger Bowl EIS identified the operational problems at the Bridger Bowl exit and recommended the installation of a right-turn acceleration lane to improve the intersection operations.

Table – 5
Projected Winter Level of Service 2015 – No Build

Bridger Canyon Intersection	Weekdays		Weekends	
	AM	PM	AM	PM
Bridger Bowl	B (11.8)	B (10.7)	E (35.6)	F (84.0)
Jackson Creek	B (11.1)	B (12.1)	C (17.2)	C (21.0)
Kelly Canyon	B (13.8)	B (11.0)	C (16.2)	C (17.2)

Intersection LOS (Delay in Seconds)

ATS reviewed the left- and right-turn lane warrants for the three intersections along Bridger Canyon Road based on the requirement from the *MDT Road Design Manual.* This analysis showed that the intersection of Bridger Canyon Road and Jackson Creek Road currently meets the minimum volume requirements to warrant a left-turn

deceleration lane during peak design winter weekend traffic conditions. The turn lane analysis is included in **Appendix D**.

VII. BUS TRANSIT

Bridger Bowl operates a bus on weekends and holidays that delivers skiers from Bozeman to the ski area once in the morning and returns in the afternoon. In 2006 the bus averaged 23 riders per day (1% of skier traffic) and costs $5 for a round trip ticket. The ski area also operates a hotel shuttle from Bozeman. That shuttle averages one trip per day and is free to hotel guests.

Bridger Bowl also pays a fee to the Gallatin County Fairgrounds off of Tamarack Street for a portion of their parking area during the winter months. This area is used as a parking-and-ride lot for ski area employees and visitors. The ski bus stops at the Fairgrounds on its route prior to heading towards the ski area in the morning and is the first stop in Bozeman in the afternoon.

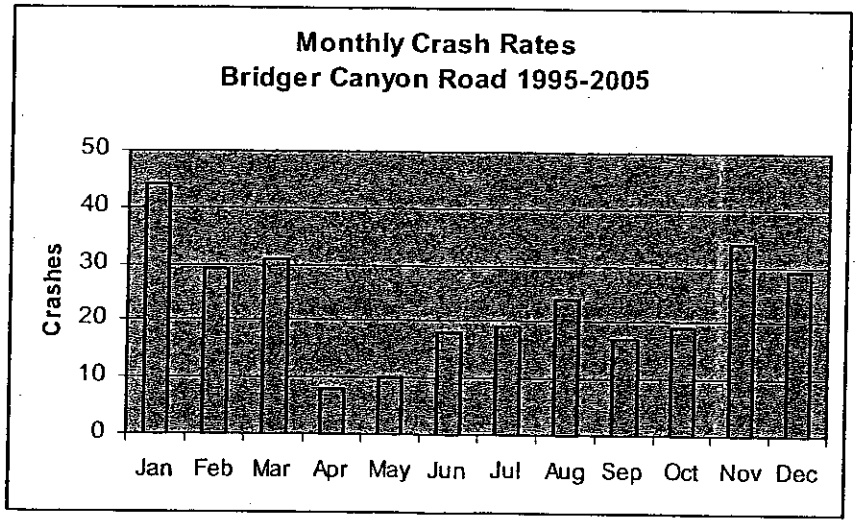
The City of Bozeman has recently begun operating the Stream Line fixed-route bus transit system. The system operates Monday thru Saturday and provides service throughout the Bozeman area. The planners are currently in discussions with Bridger Bowl to create a route to serve the ski area using the Bozeman transit busses. Bridger Bowl is also planning to operate a daily AM and PM employee bus. The exact details of this new transit system have not yet been developed. It is likely that the transit system could ultimately provide service to 5%-10% of skier traffic.

VIII. CRASH DATA

ATS contacted the Montana Department of Transportation to collect crash statistics for MT Highway 86 from the intersection with Griffin Drive to the turn off to Bridger Bowl. Crash data for this roadway was obtained for the last ten years and analyzed to determine the crash trends.

Traffic engineers are generally more interested in the rate at which crashes occur than the actual number of crashes as the crash rate generally gives a better indication of how a roadway is operating. Routes with high traffic volumes will generally have higher numbers of crashes. A total of 282 crashes have been reported along Bridger Canyon Road over the past ten years. This equates to a rate of 2.10 crashes per million vehicle miles traveled, which is slightly higher than the statewide average of 1.68 for secondary highways. Crash rates are highest in January and lowest in April. In general the winter months have higher crash rates than summer. This data is shown in **Figure 6**.

Figure 6



An attempt was made to determine what effect the ski area operations have on crash rates in the canyon. Although crash rates are higher in the winter months corresponding to the ski area operations, this trend is consistent with most secondary highways in Montana. Generally the poor road conditions and fewer hours of daylight in the winter months contribute to increased accident rates. It is also significant to note that the Bridger Bowl is not generally in operation in November, which has the second highest crash rate for the year.

An additional analysis was performed on the crashes that occur during the months when Bridger Bowl is in operation. ATS analyzed both the skier visitor data and the crash data by day of week to determine if there was a correlation between skier traffic and crash rates. This information is shown in **Table 6**. The table shows that the highest number of crashes (32) occurred on Saturdays, which is also the day of highest skier volume at Bridger Bowl. The day with the lowest number of crashes (Wednesday) also correlates with the lowest amount of skier traffic. However the days with the next highest skier visitation, Sundays and Fridays, have the second and third lowest crash rates for the week and Monday and Tuesday, which have the second and third highest number of crashes, have the second and third lowest skier volumes. While skier traffic likely has some effect on traffic conditions within the Bridger Canyon, the data available does not support a direct link between skier traffic at Bridger Bowl and crash rates along Bridger Canyon Road.

Table 6 –
Crash Rates vs. Skier Visits

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Crashes*	21	24	10	19	13	32	14
Average Skier Visits	1,060	1,010	991	1,100	1,440	2,230	2,020

*December-March

Of the 282 accidents which occurred between Griffin Drive and Bridger Bowl over the last ten years, 132 (47%) occurred on wet, snow, or icy roads. Most (57%) occurred in daylight conditions and 60 (21%) involved animals. Of the 282 crashes, 79 resulted in injuries and three resulted in fatalities

A total of 76 accidents occurred in the more urban section of the roadway between Griffin Drive and the end of the existing residential area (MP 1.3-2.3). Past the residential areas where the speed limit increases to 70 MPH 206 crashes occurred. Only 33 (16%) of the crashes that occurred past the houses were multi-vehicle collisions.

The most noted contributing factors noted in police reports where were 'Inattentive or Careless Driving' (107 occurrences) and 'Too Fast for Conditions' (88 occurrences). Twenty-six of the crashes listed alcohol as a contributing factor.

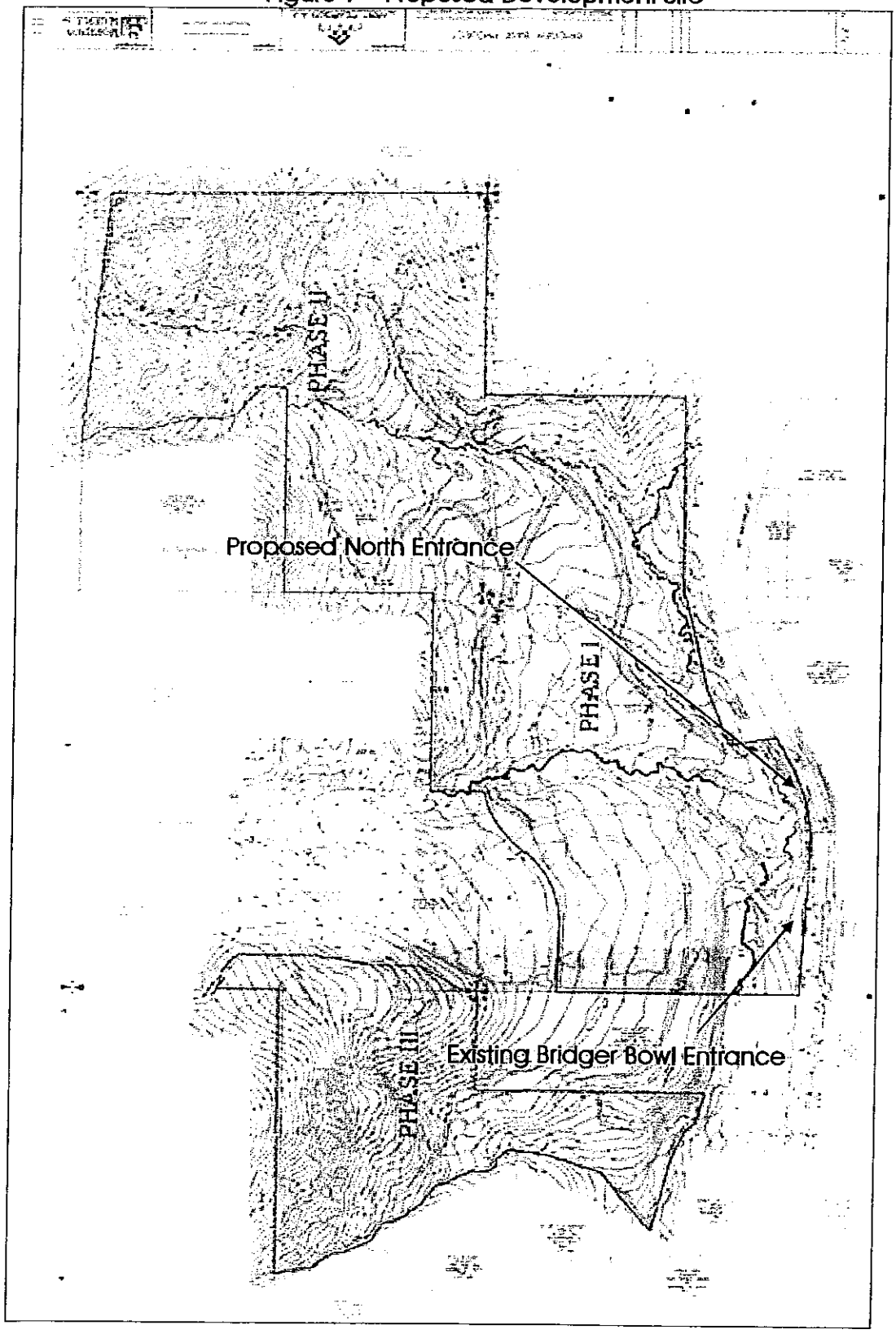
Twenty-eight crashes occurred in the curved section towards the bottom of the canyon with nine of the crashes occurring at the tight curve at MP 5.1. Three crashes occurred at the intersection with Jackson Creek Road, all of which were run-off-the road or overturn crashes from a vehicle trying to make a turn at the intersection. Excessive speed was a contributing factor to all of the crashes at Jackson Creek Road.

The *Manual on Uniform Traffic Control Devices* recommends that a traffic signal be erected at an intersection if five or more crashes occur at the intersection over a 12 month time period (Warrant #7). The only location with a high numbers of crashes is the intersection of Rouse Avenue and Griffin Drive. This intersection experienced more than five crashes per year in both 1996 and 1999. Since 2000 the crash rates at the intersection have fallen to only two per year.

IX. PROPOSED BASE AREA DEVELOPMENT

The proposed base area development consists of a variety of lodging, cabins, and commercial uses. Up to 452 overnight accommodations would be constructed in lodges or cabins along with 75 single family residential units. Primary access to the development would be provided through a new roadway connection with Bridger Canyon Road 1,600 feet north of the existing Bridger Bowl access. The development would be constructed in three phases at three locations. Phase I would include the construction of single family homes, attached chalets, and cabins with a small central lodge, a bar/restaurant, a general store, and a ski shop. Phase II of the development would see the construction of additional single-family residential units, a lodge, and additional retail and commercial areas. The commercial areas could include another restaurant and a spa along with a bar, coffee shop, ski shop, real estate offices, ski school and ski patrol buildings, offices, and daycare facilities. Phase III would include additional single family residential lots, a hotel lodge, and other overnight accommodations. See **Figure 7** for a map of the proposed development site.

Figure 7 – Proposed Development Site



A breakdown of the proposed lodging types and commercial space is shown in **Table 7**. Each phase of development will take approximately three years to complete. Full build-out of this development would likely occur by 2015.

Table 7-Proposed Development*

Total Phase I (2009)	
Recreational Homes	20
Overnight Accommodations	102
Commercial Total	7,900 Square Feet
Total Phase II (2012)	
Recreational Homes	30
Overnight Accommodations	233
Commercial Total	31,000 Square Feet
Total Phase III (2015)	
Recreational Homes	25
Overnight Accommodations	117
Commercial Total	None
TOTAL PHASES I, II, & III	
Recreational Homes	75
Overnight Accommodations	452
Commercial Total	38,900 Square Feet

*As of July 2006, subject to final PUD approval.

X. TRIP GENERATION

In January 2006 ATS collected traffic volume information for peak weekday and peak weekend conditions at the entrances at three residential subdivisions at Big Mountain Resort in Whitefish. The three residential subdivisions studied were Ptarmigan Village, Ridge Run, and Wood Run. These three residential areas were chosen because they have single access and egress points. Ptarmigan Village has 124 multi-plex lodging units and 16 single units, Wood Run had 48 multi-plex units, and Ridge Run has 34 single homes. These three subdivisions have similar characteristics to the proposed residential developments at Bridger Bowl. While the proposed development at Bridger Bowl does include a retail and commercial component, these facilities already exist at the Big Mountain near the residential area. ATS also collected data from the Bridger Pines subdivision at Bridger Bowl for use as a further comparison.

Using the data collected at these locations for weekday and weekend traffic, ATS was able to calculate the average trip generation from these four residential areas. ATS calculated a total daily trip generation rate (total trips per unit) of 2.1 on weekdays and 2.2 on weekend days. A vehicle "trip" is defined as any trip that either begins or ends at the development site.

ATS also reviewed the trip generation rates contained in *Trip Generation* (Institute of Transportation Engineers, Seventh Edition). These rates are the national standard and are based on the most current information available to planners. The type of land use selected for this analysis is the Recreational Home (Land Use 260). A recreational home is usually located in a resort containing local services and recreational facilities. These dwellings are often second homes used by the owner periodically or rented on a seasonal basis. This type of land use accurately describes the proposed dwelling units. When compared to the information gathered for this project, the daily trip generation rates are similar and the peak hour generation rates are nearly identical. In order to be slightly more conservative the values contained in the *Trip Generation* manual were used for the calculations in this report. This information is shown in **Table 8**.

Table 8 shows that the trip generation numbers used for this report are slightly more conservative (slightly higher) than those for the exclusively residential areas monitored for this study on a daily basis. In order to account for employees and service providers at the new base area, these more conservative values were used to produce an overall daily trip generation rate for the base area development. The trip generation numbers used have almost identical peak-hour volume numbers and larger daily totals. This profile is in line with what would be expected for the new base area. Generally employees will arrive before and leave after the main rush of customers. Service providers will arrive regularly throughout the day.

Table 8- Residential Trip Generation Study

	Weekday			Weekend		
	AM	PM	Daily	AM	PM	Daily
Observed Values (Big Mountain)*	0.16	0.24	1.84	0.16	0.33	2.30
Observed Values (Bridger Pines)**	0.30	0.25	2.20	0.10	0.40	2.10
Trip Generation Manual	0.16	0.26	3.16	NA	0.36	3.07
Rates Used for Study	**0.16**	**0.26**	**3.16**	**0.16**	**0.36**	**3.07**

*Data Collected January 25-29, 2006.
**Data Collected March 4-6, 2006.

The proposed development includes commercial areas and restaurants that will also generate trips. These facilities are intended to serve the needs of the visitors to the ski area and the proposed development.

Using these trip generation rates ATS calculated the total trip generation from the development. At full build-out the proposed development would produce 179 AM peak hour trips, 241 PM peak hour trips, and 2,949 daily trips on weekdays. The trip generation rates and totals for each phase are shown in **Tables 9 & 10**.

Table 9 – Weekday Trip Generation Rates

Land Use	Units	AM Peak Hour Trip Ends per Unit	Total AM Peak Hour Trip Ends	PM Peak Hour Trip Ends per Unit	Total PM Peak Hour Trip Ends	Weekday Trip Ends per Unit	Total Weekday Trip Ends
Phase I							
Recreational Homes	20	0.16	3	0.26	5	3.16	63
Overnight Accommodations	102	0.37	38	0.49	50	6.00*	612
Subtotal	122		41		55		675
Phase II							
Recreational Homes	30	0.16	5	0.26	8	3.16	95
Overnight Accommodations	233	0.37	86	0.49	114	6.00*	1,398
Subtotal	263		91		122		2,168
Phase III							
Recreational Homes	**25**	0.16	**4**	0.26	**7**	3.16	**79**
Overnight Accommodations	**117**	0.37	**43**	0.49	**57**	6.00*	**702**
Subtotal	**142**		**47**		**64**		**781**
TOTAL	**527**		**179**		**241**		**2,949**

- **Estimated From ITE Trip Generation Rates Land Use 330 (Resort Hotel)**

Table 10 – Weekend Trip Generation Rates

Land Use	Units	AM Peak Hour Trip Ends per Unit	Total AM Peak Hour Trip Ends	PM Peak Hour Trip Ends per Unit	Total PM Peak Hour Trip Ends	Weekend Trip Ends per Unit	Total Weekend Trip Ends
Phase I							
Recreational Homes	20	0.16	3	0.36	7	3.07	61
Overnight Accommodations	102	0.37*	38	0.49	50	6.00*	612
Subtotal	122		41		57		673
Phase II							
Recreational Homes	30	0.16	5	0.36	11	3.07	92
Overnight Accommodations	233	0.37*	86	0.49	114	6.00*	1,398
Subtotal	263		91		125		1490
Phase III							
Recreational Homes	**25**	0.16	**4**	0.36	**9**	3.07	**77**
Overnight Accommodations	**117**	0.37*	**43**	0.49	**57**	6.00*	**702**
Subtotal	**142**		**47**		**66**		**779**
TOTAL	**527**		**179**		**248**		**2,942**

- **Estimated From ITE Trip Generation Rates Land Use 330 (Resort Hotel)**

It may seem counterintuitive that trip generation from lodging units at a ski resort would be the same on weekdays and weekend days. However, a comparison of traffic patters at Big Sky Resort shows that U.S. 191 north of Big Sky and MT 64 to Big Sky both experience similar traffic volumes on weekdays and weekend days during the ski season (Source- MDT Automatic Traffic Counters, 2005).

It is likely that the accommodations at the new development site will attract some of the visitors currently staying in the Bozeman area. With more visitors staying at the mountain, less traffic will need to use Bridger Canyon Road on a daily basis. However, the exact proportion of these visitors is difficult to identify. It is also possible that the additional terrain opened as part of the ski area expansion will draw sufficient new skiers to the area to utilize all of the on-mountain accommodations without taking any visitors from the Bozeman area. In order to provide a more conservative estimate of traffic conditions within the area it was assumed that no traffic would be taken from the canyon due to the development of the base area.

XI. MONTANA SKI RESORT DATA

Under typical peak weekend traffic conditions at Bridger Bowl 3,350 skiers utilize the mountain facilities and 5,400 vehicles use Bridger Canyon Road (Source: MDT traffic counter data). Using the MDT off-season traffic data it was assumed that 1,800 of these vehicles are not associated with Bridger Bowl. Using this information ATS calculated a peak weekend trip generation rate of 1.07 daily vehicle trips (up and down) per skier.

A similar analysis performed for Big Mountain Resort in Whitefish indicates that on a peak day with 4,500 skier visits, 4,400 vehicles utilize the road to Big Mountain. This equates to 0.98 vehicle trips (up and down) per skier.

On an average winter day 4,200 vehicles utilize Highway 64 to the Big Sky area. Big Sky Resort has 2,000 skiers on an average day and Moonlight Basin has an additional 400 skiers (2004). MT Highway 191 currently carries over 4,000 VPD north of Big Sky in the winter months. This equate to 2.1 vehicle trips per skier. However, the Big Sky area also has over 3,000 existing or under construction residential units with another 5,000 proposed and can not be directly compared to the Bridger Bowl and Big Mountain which have comparatively few on-mountain accommodations.

XII. TRIP DISTRIBUTION

The new Bridger Bowl base area amenities will be a large draw for people staying in and around the area. The new base area will provide shopping, dining, and other essential services. Observations made at Big Mountain indicated that 60% of the trips generated by the existing residential areas remained within the base area and only 40% of that traffic went towards Whitefish (only six miles away). It is likely that a similar internal capture rate will apply to the Bridger Bowl base area with the city of Bozeman 17 miles

away. However, in order to be slightly more conservative an internal capture rate of only 40% was assumed for the Bridger Bowl development.

Judging from the layout of the proposed development relative to the existing Bridger Bowl area access road it was estimated that 70% of the traffic from BCP development would utilize the new northern access and only 30% would enter or exit though the existing Bridger Bowl access road.

Winter field observations indicate that 6% of the traffic from the ski area goes to/from the north from the ski area on Bridger Canyon Road from the entrance to the ski area. Farther down the canyon, 11% of the skier traffic goes to/from the east on Jackson Creek.

XIII. PROJECTED TRAFFIC VOLUMES AND LEVEL OF SERVICE

Using the trip generation and trip distribution numbers, ATS determined the future Level of Service for the intersections along Bridger Canyon Road on weekdays and weekend days for each phase of the development. These calculations are based on the projected model volumes included in **Appendix B** of this report. The anticipated LOS for the three phases is shown in **Tables 11-13**. The LOS calculations are shown in **Appendix C**.

Table – 11
Winter Level of Service Phase I 2009 Design Day

Bridger Canyon Intersection	Weekdays		Weekends	
	AM	PM	AM	PM
New Entrance	A (8.6)	A (8.7)	A (8.5)	A (8.9)
Bridger Bowl	A (9.5)	B (10.2)	C (19.6)	D (28.3)
Jackson Creek	B (10.6)	B (11.2)	B (14.0)	C (16.8)
Kelly Canyon	B (12.3)	B (10.2)	B (13.8)	B (14.7)

Table 11 shows that with Phase I of the development most of the intersections along Bridger Canyon Road will continue to operate at acceptable levels of service. By 2012 peak winter weekend traffic conditions at the entrance to Bridger Bowl will worsen to the point that some mitigation measures will be needed. These mitigation measures should include the installation of a free right-turn acceleration lane onto Bridger Canyon Road as identified in the Bridger Bowl EIS.

Table –12
Winter Level of Service Phase II 2012 Design Day

Bridger Canyon Intersection	Weekdays		Weekends	
	AM	PM	AM	PM
New Entrance	A (8.8)	A (8.9)	A (8.7)	A (9.1)
Bridger Bowl*	A (9.3)	B (11.3)	C (19.2)**	B (12.1)
Jackson Creek	B (11.5)	B (12.4)	C (16.7)	C (15.9)
Kelly Canyon	B (13.9)	B (11.1)	C (15.7)	C (17.5)

*With right-turn acceleration lane.
**Assuming two vehicles cut though the north base area to turn left onto Bridger Canyon Road.

Table – 13
Winter Level of Service Phase III 2015 Design Day

Bridger Canyon Intersection	Weekdays		Weekends	
	AM	PM	AM	PM
New Entrance	A (8.9)	A (9.1)	A (8.7)	A (9.4)
Bridger Bowl*	A (9.4)	B (12.3)	C (24.8)**	B (13.2)
Jackson Creek	B (12.3)	B (13.3)	C (20.0)	C (17.2)
Kelly Canyon	C (15.6)	B (11.9)	C (17.9)	C (20.3)

*With right-turn acceleration lane.
**Assuming four vehicles cut though the north base area to turn left onto Bridger Canyon Road.

The acceleration lane on Bridger Canyon Road at the exit to Bridger Bowl will mitigate the PM peak-hour operational problems at this location though 2015. The few left-turning vehicles trying to leave the ski area in the AM peak hour could experience excessive delay due to the conflicts with the heavy stream of vehicles turning left into the ski area under peak traffic conditions without the BCP development. The new north access will likely draw a few left-turning vehicles off of the existing entrance and allow better operations. The projected left-turning traffic volume out of the ski area is very low (less than 10 in the 2015 AM peak hour). If only four of these vehicles use the northern exit, the existing intersection will operate with minimal congestion under peak winter weekend morning traffic conditions through 2015.

The intersection of Bridger Canyon Road and Jackson Creek currently meets warrants for the installation of a left-turn deceleration lane under peak weekend traffic conditions. By 2015 the intersection will meet the volume warrants for the turn lane under peak weekday traffic conditions without the development. With the traffic from the proposed development, this need will be increased. A designated left-turn deceleration lane is warranted at this location regardless of the construction of the proposed development.

Consideration was given to the installation of a separated left-turn deceleration lane on Bridger Canyon Road at the existing entrance to Bridger Bowl. Although the minimum traffic volume warrant would be met, a left-turn deceleration lane is not recommended at this location at this time. The vast majority of drivers (90%) on the roadway turn left into Bridger Bowl at this location. Of the remaining vehicles going straight through the intersection (100 vehicles) during the AM peak-hour, half will slow and turn left into the new development less that one-quarter mile to the north. This fact combined with the low number of opposing vehicles reduces the need for a designated left-turning lane. In order to provide a well operating left-turn lane to meet 2015 peak winter traffic demands at this location, the lane would have to be extremely long (about 2,000 feet for storage, deceleration, and taper). There have been no reported crashes at this intersection in the past five years. Therefore, a left-turn lane is not recommended at this location.

XIV. BRIDGER CANYON TRAFFIC IMPACTS

The traffic information presented in this report assumes that all of the development trips to the area will be new and that none of the traffic from the proposed development will be redirected from accommodations in Bozeman. This creates a conservative "worst case"

scenario for the traffic calculations.

The traffic volumes along Bridger Canyon Road will ultimately remain closely related to the total number of daily skier visits at Bridger Bowl. This rate will remain close to one vehicle trip per skier visit regardless of the construction of the proposed development. However, the peak-hour the directional split of traffic in the canyon will become more balanced. A lower proportion of traffic will flow in the heavy directions during the peak hours with the development of the base area. Traffic would also be spread out more evenly during the day. A less severe directional split and spreading out the daily traffic will improve the traffic conditions along the roadway and allow the road to carry more traffic without degrading the LOS. The construction of the proposed development will improve the traffic conditions along Bridger Canyon Road with respect to the total skier visits at Bridger Bowl ski area.

XV. CONCLUSIONS

Traffic volumes within Bridger Canyon will increase due to the proposed BCP development, continued Bridger Bowl skier growth, and the anticipated ski area expansion. Currently Bridger Canyon Road is operating well under peak design conditions. As traffic volumes within canyon continue to increase, some improvements will be needed. These improvements include the installation of a left-turn deceleration lane at Jackson Creek Road and a right-turn acceleration lane at the existing entrance to Bridger Bowl. These improvements will be required regardless of the construction of the proposed BCP development.

Ultimately the traffic volumes along Bridger Canyon Road will be related to the total skier visits at the mountain. The proposed development will not significantly change the current rate of one vehicle trip per skier visit. However, the trip pattern of the proposed development will help balance the directional traffic within the canyon and allow the roadway to carry more daily traffic with better operations than without the development.

XVI. RECOMMENDATIONS

The following recommendations are supplied to address the traffic generated by the BCP development and help improve traffic circulation within the Bridger Bowl Base Area to help improve traffic circulation. These recommendations include:

- All internal roadways should be constructed to meet Gallatin County road standards.
- The BCP should develop and operate an internal shuttle service between the two base areas.
- The BCP should provide designated bus transit stops where appropriate.

While the BCP development will influence traffic conditions throughout Bridger Canyon., none of the following recommended improvements are directly related to the development. These improvements will be needed regardless of the proposed BCP

development due to the continued growth in skier traffic and the expansion of the Bridger Bowl Ski Area. These recommendations include:

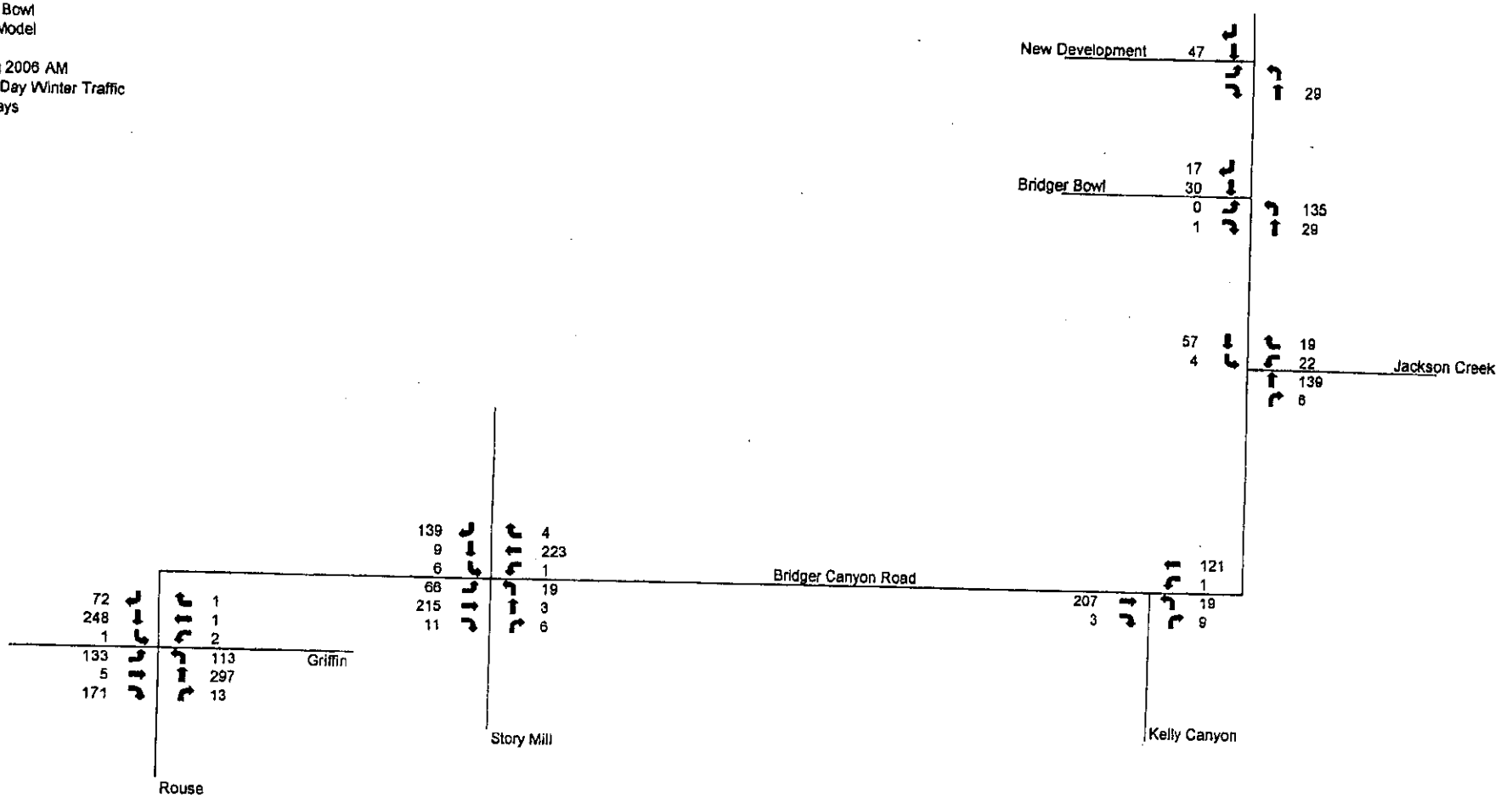
- Install a right-turn acceleration lane on Bridger Canyon Road for vehicles leaving Bridger Bowl.
- Install a left-turn deceleration lane at the intersection of Bridger Canyon Road and Jackson Creek Road.

APPENDIX B

Traffic Model

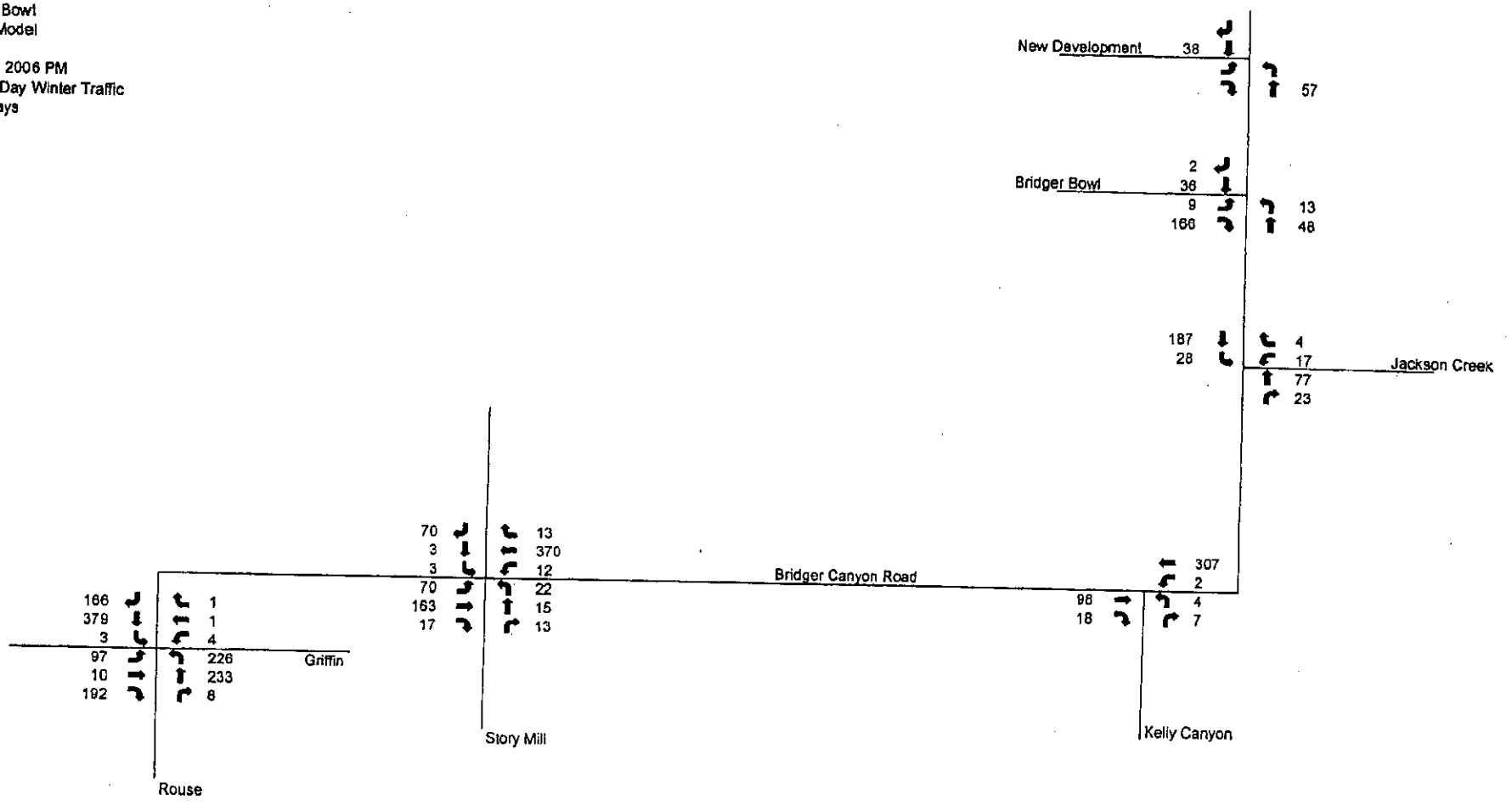
Bridger Bowl
Traffic Model

Existing 2006 AM
Design Day Winter Traffic
Weekdays

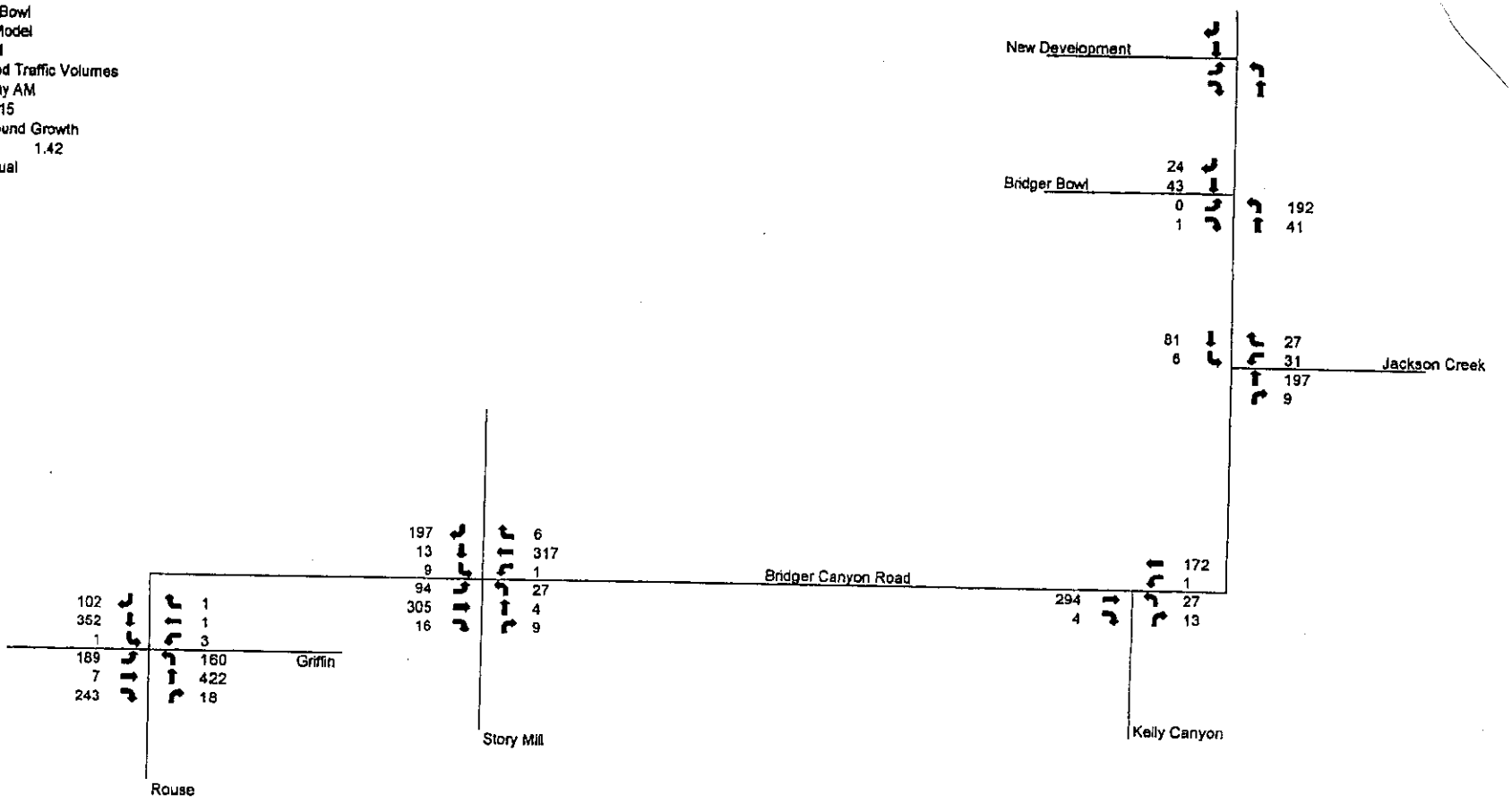


Bridger Bowl
Traffic Model

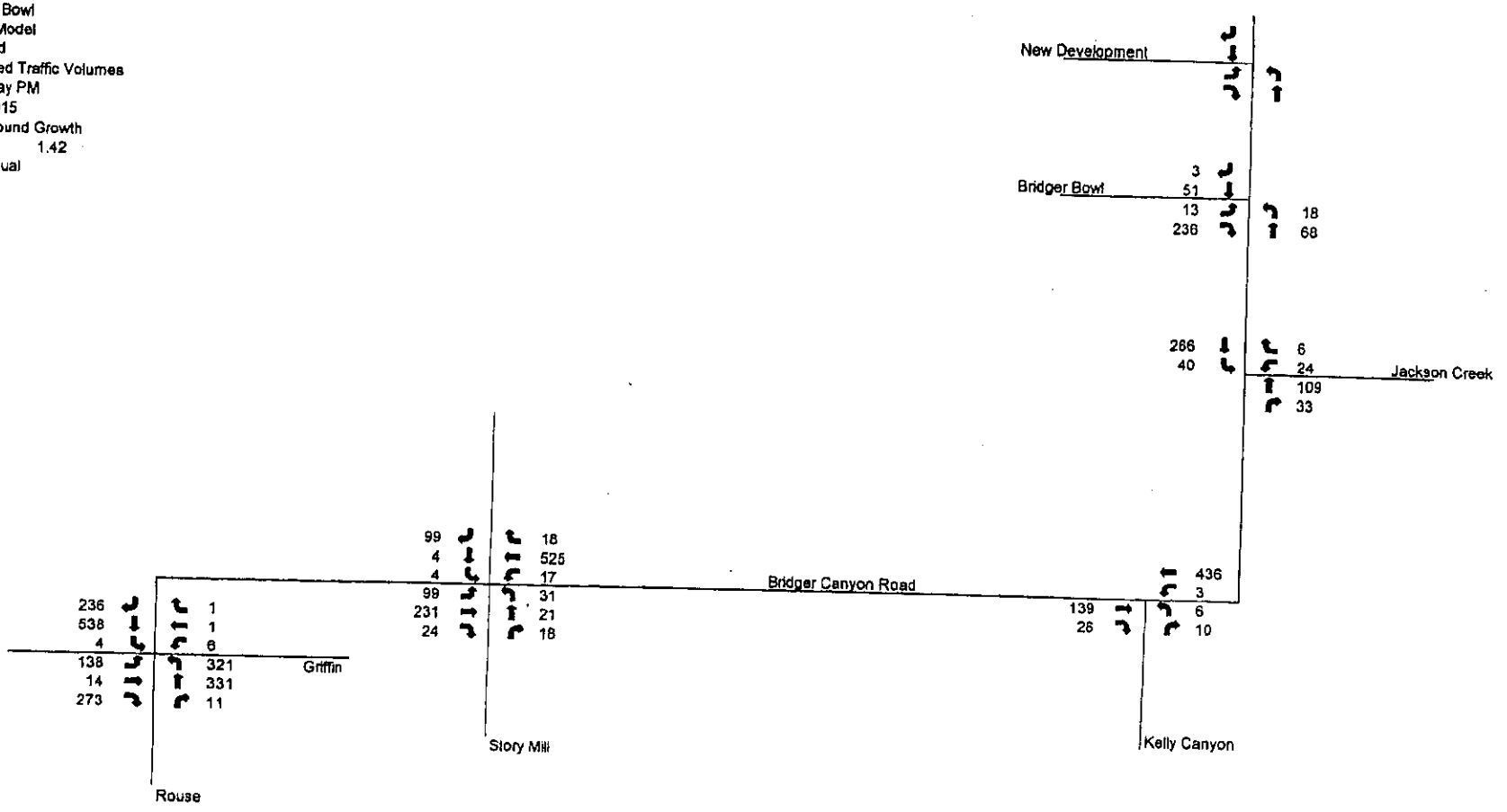
Existing 2006 PM
Design Day Winter Traffic
Weekdays



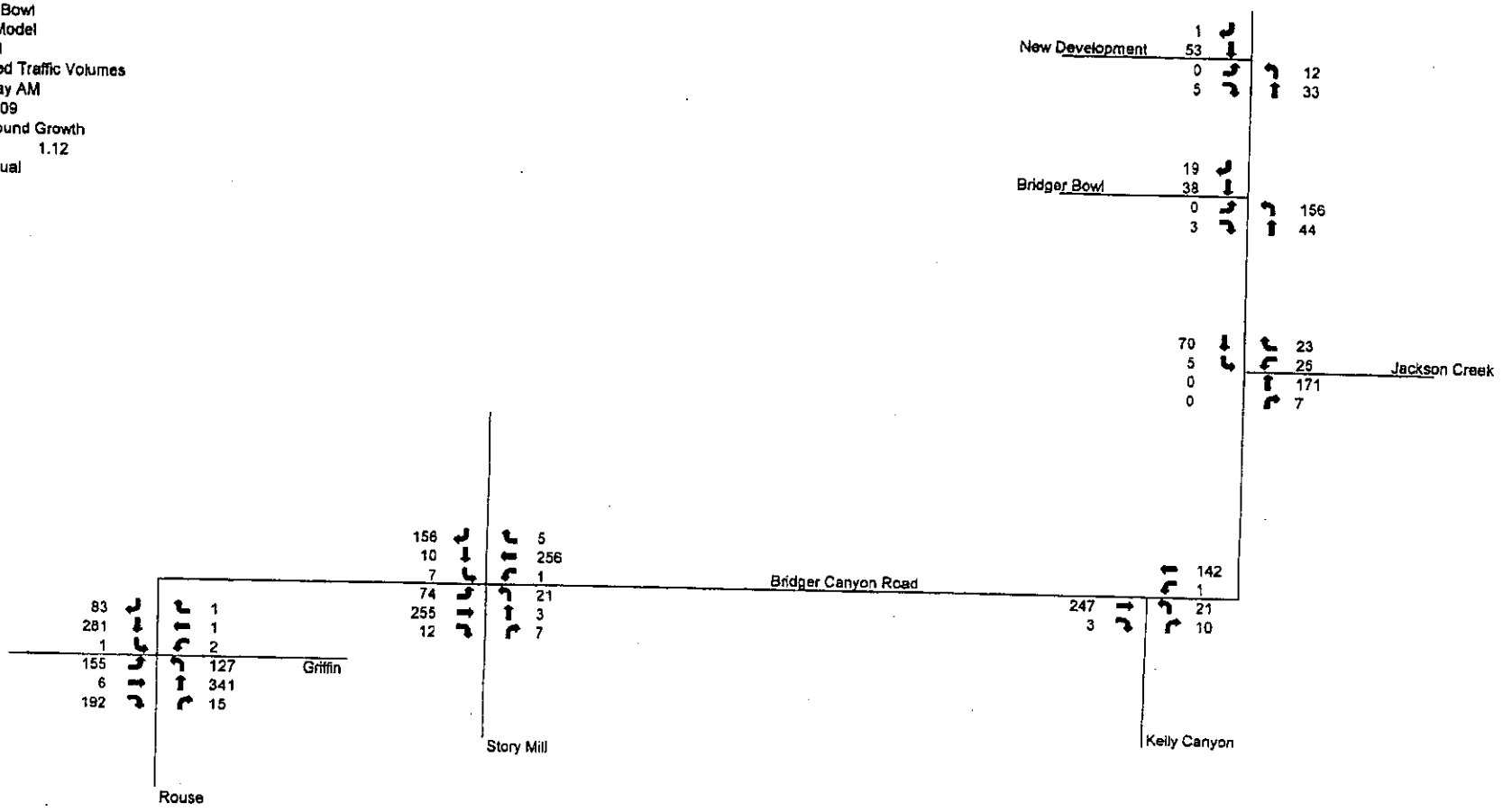
Bridger Bowl
Traffic Model
No Build
Projected Traffic Volumes
Weekday AM
2015
Background Growth
Factor= 1.42
4% Annual



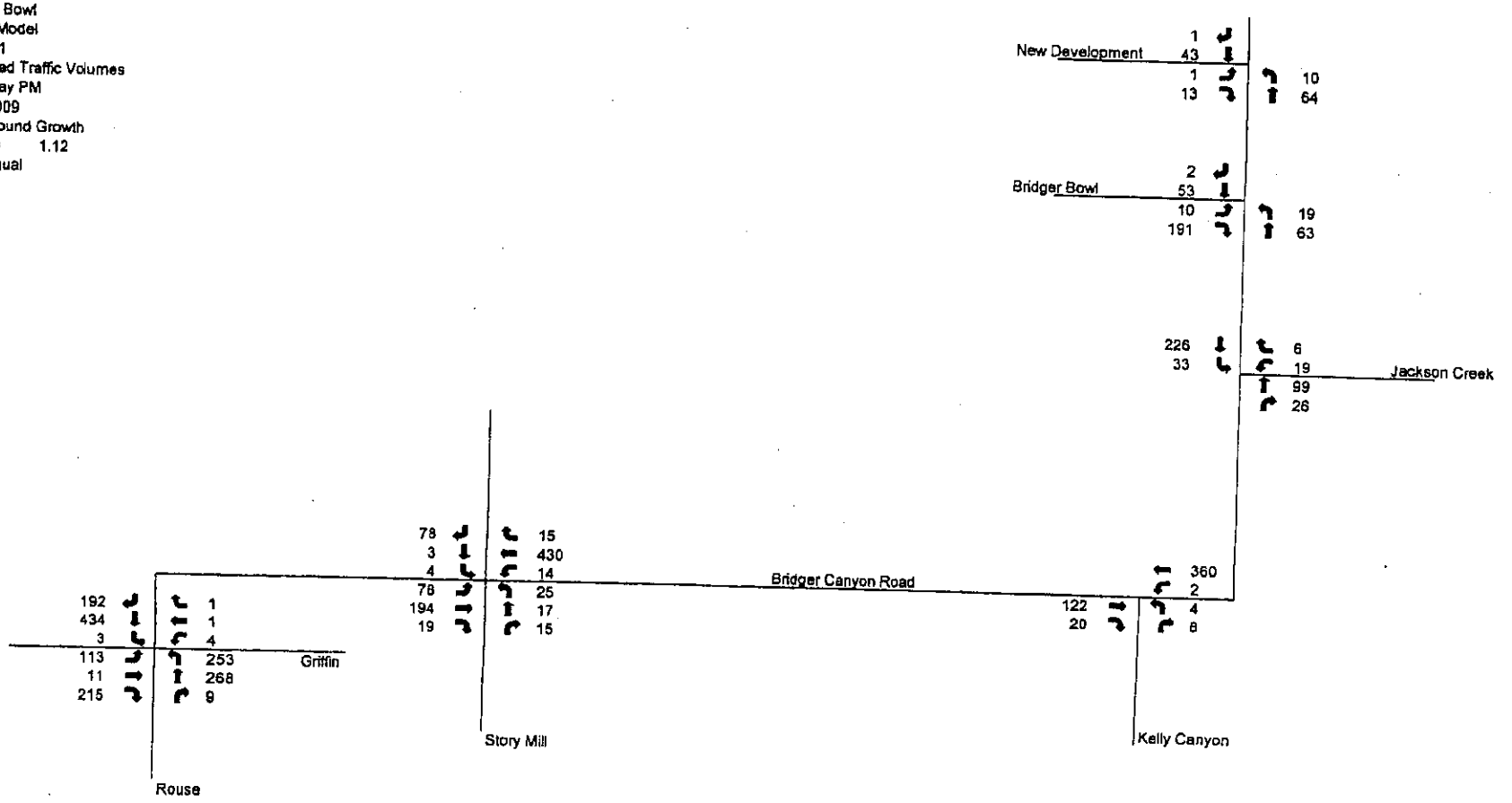
Bridger Bowl
Traffic Model
No Build
Projected Traffic Volumes
Weekday PM
2015
Background Growth
Factor= 1.42
4% Annual



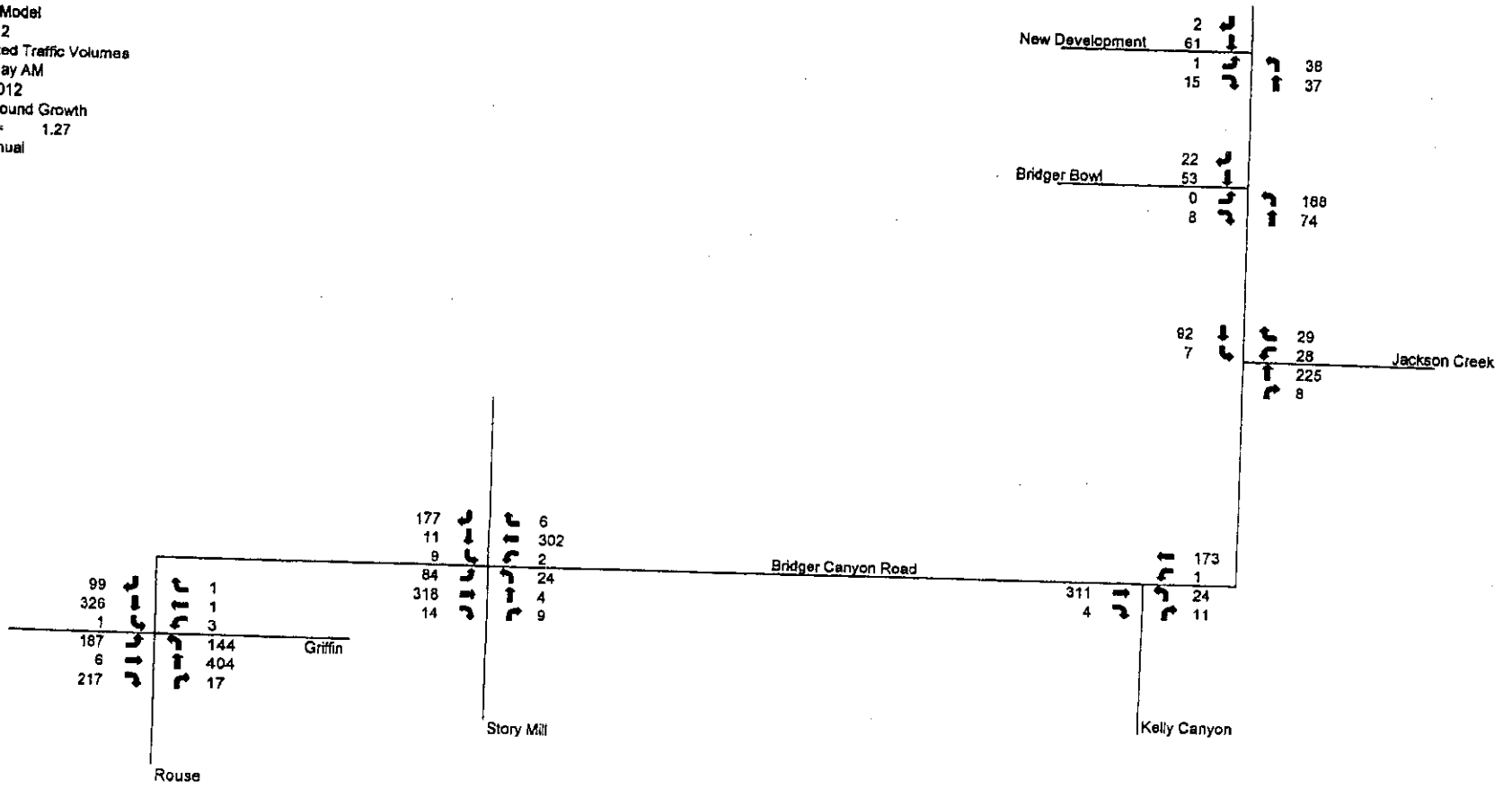
Bridger Bowl
Traffic Model
Phase 1
Projected Traffic Volumes
Weekday AM
2009
Background Growth
Factor= 1.12
4% Annual



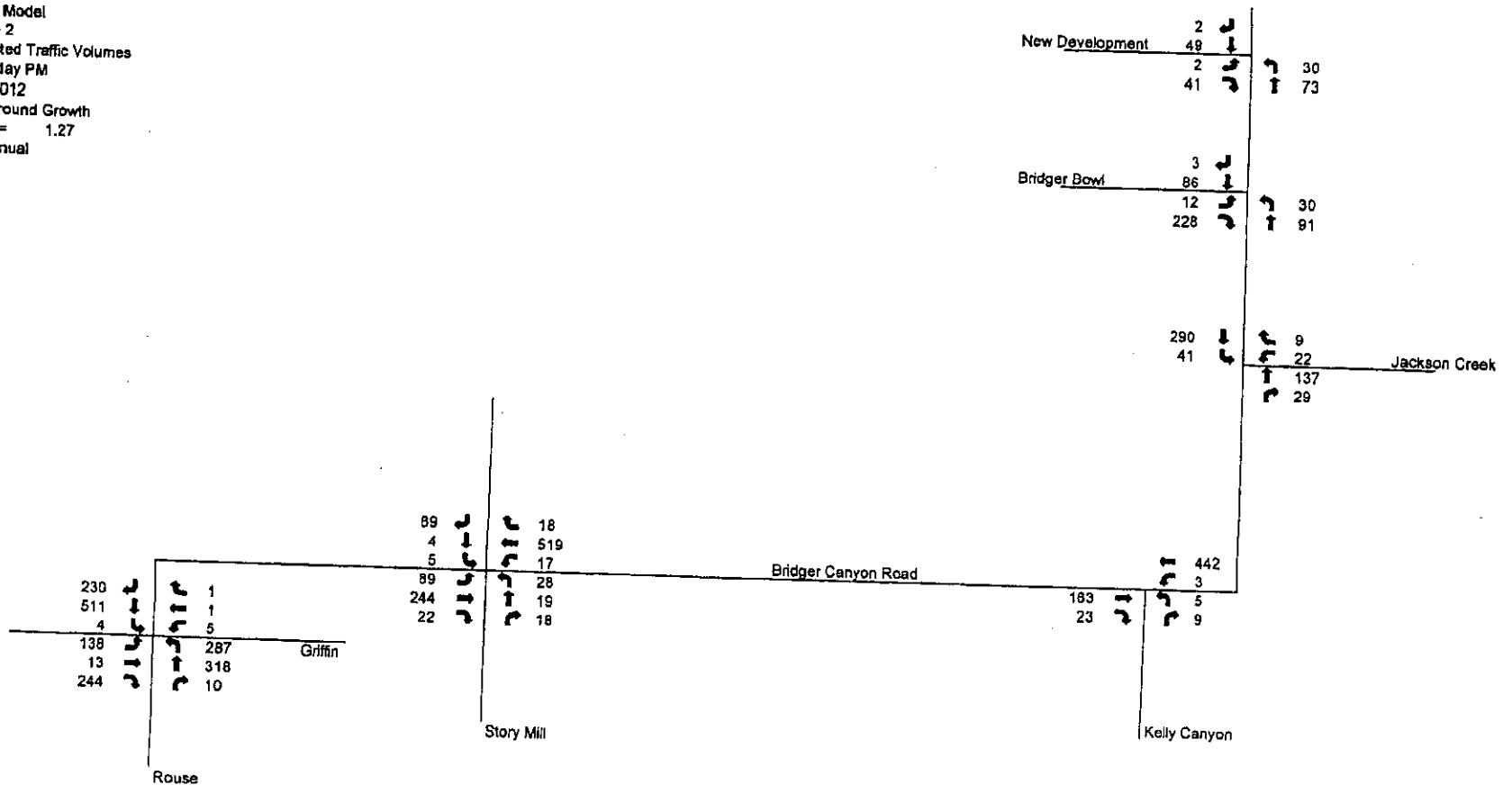
Bridger Bowl
Traffic Model
Phase 1
Projected Traffic Volumes
Weekday PM
2009
Background Growth
Factor= 1.12
4% Annual



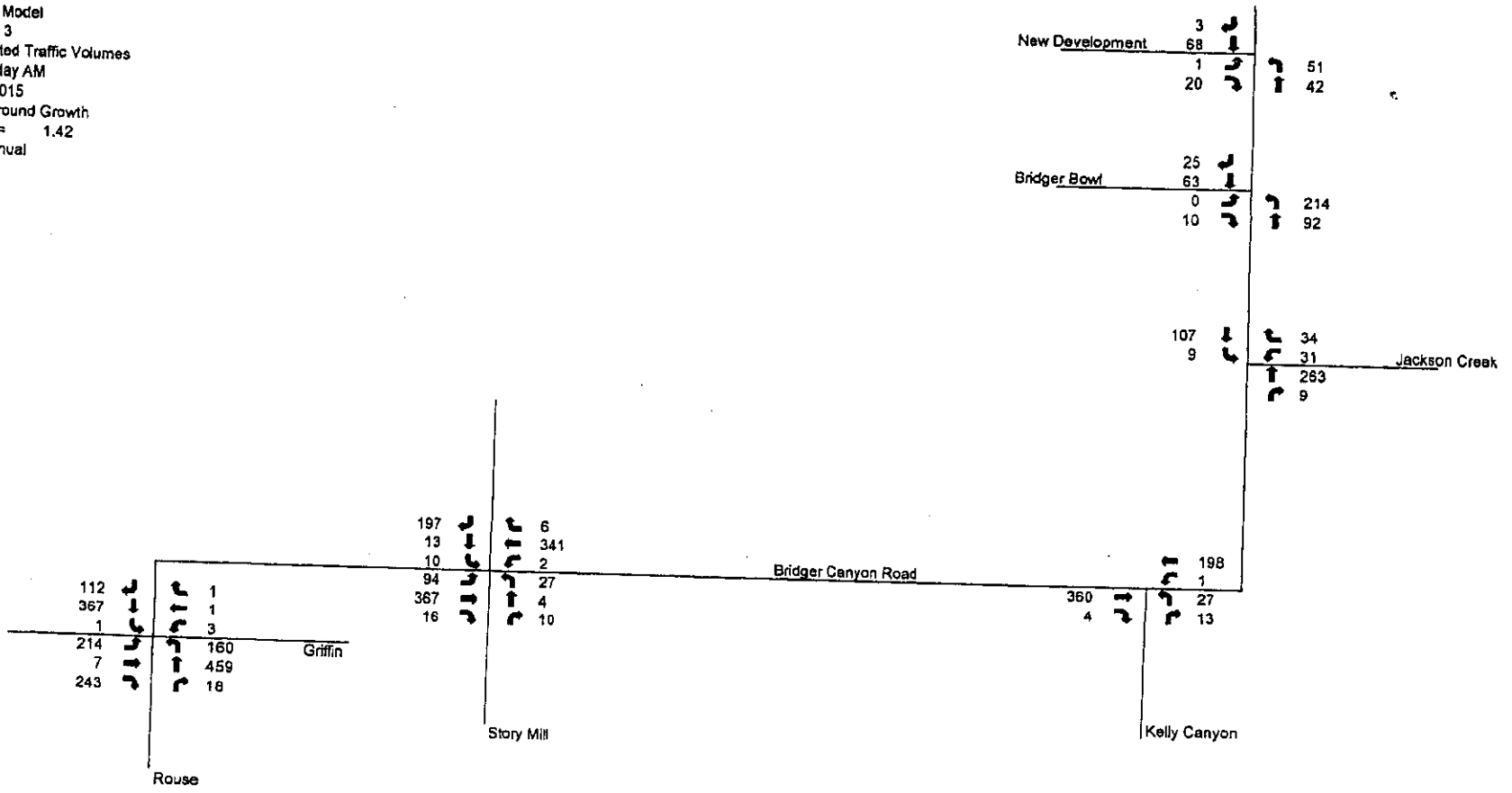
Bridger Bowl
Traffic Model
Phase 2
Projected Traffic Volumes
Weekday AM
2012
Background Growth
Factor= 1.27
4% Annual



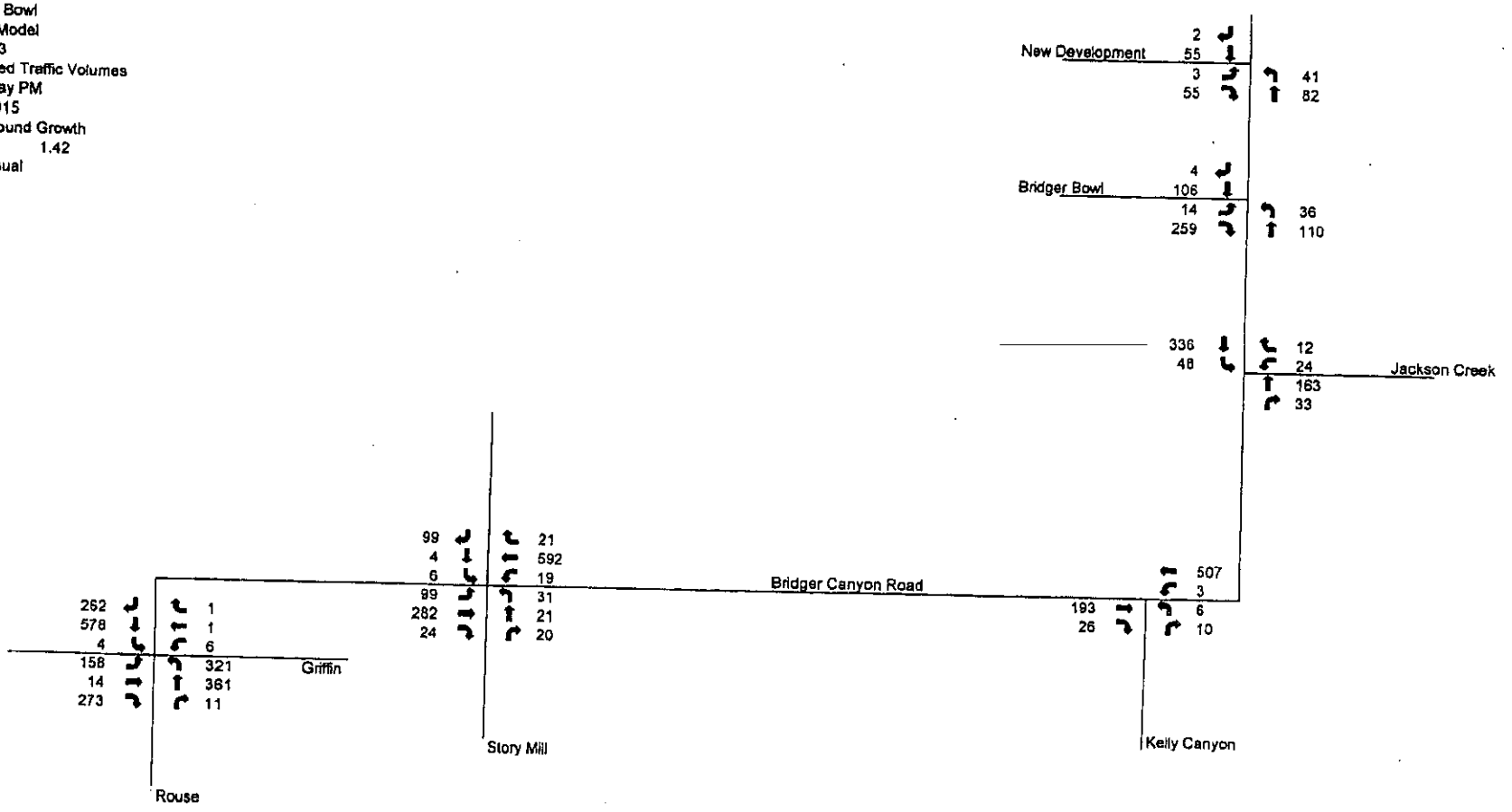
Bridger Bowl
Traffic Model
Phase 2
Projected Traffic Volumes
Weekday PM
2012
Background Growth
Factor= 1.27
4% Annual



Bridger Bowl
Traffic Model
Phase 3
Projected Traffic Volumes
Weekday AM
2015
Background Growth
Factor= 1.42
4% Annual

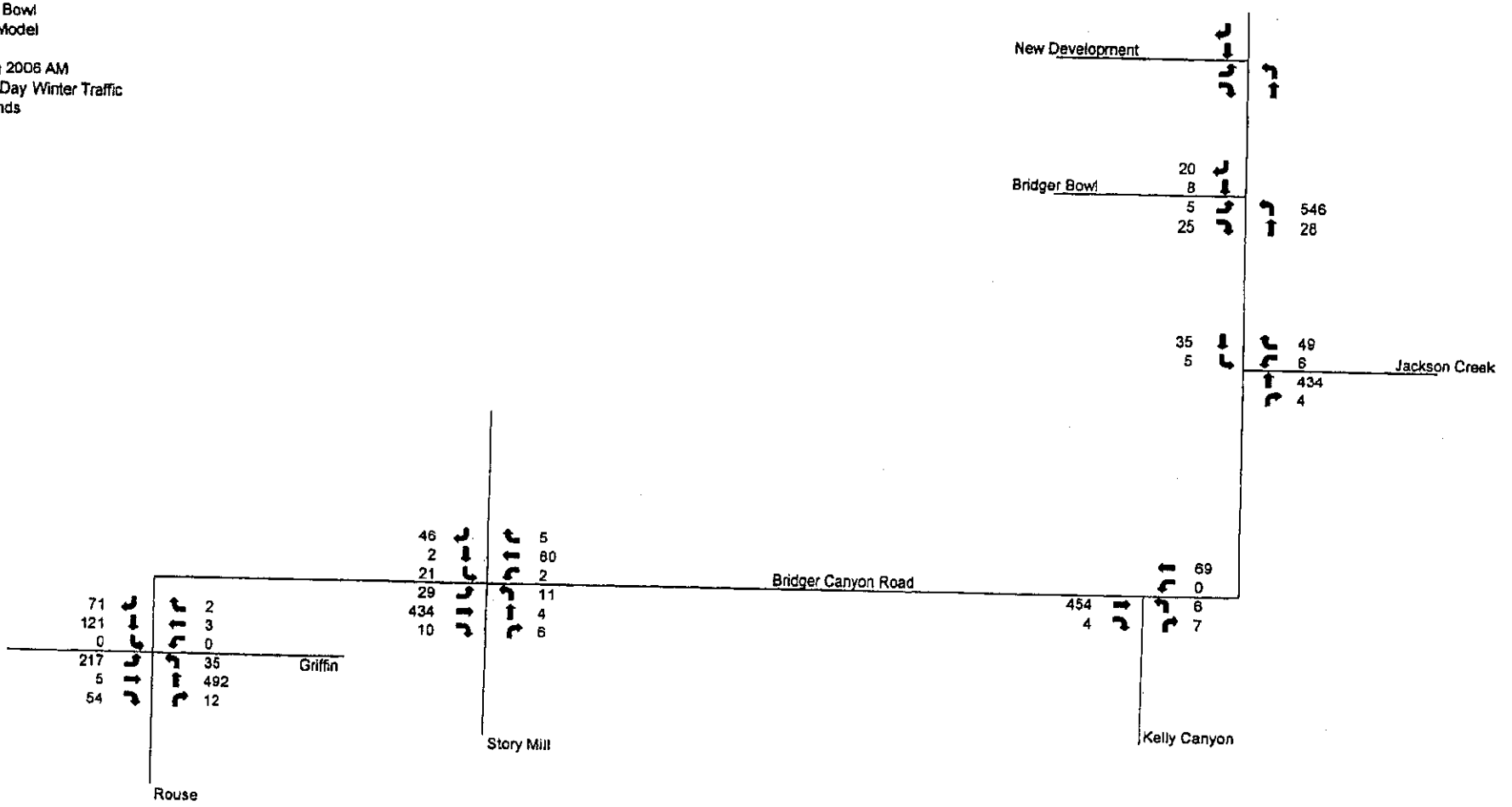


Bridger Bowl
Traffic Model
Phase 3
Projected Traffic Volumes
Weekday PM
2015
Background Growth
Factor= 1.42
4% Annual



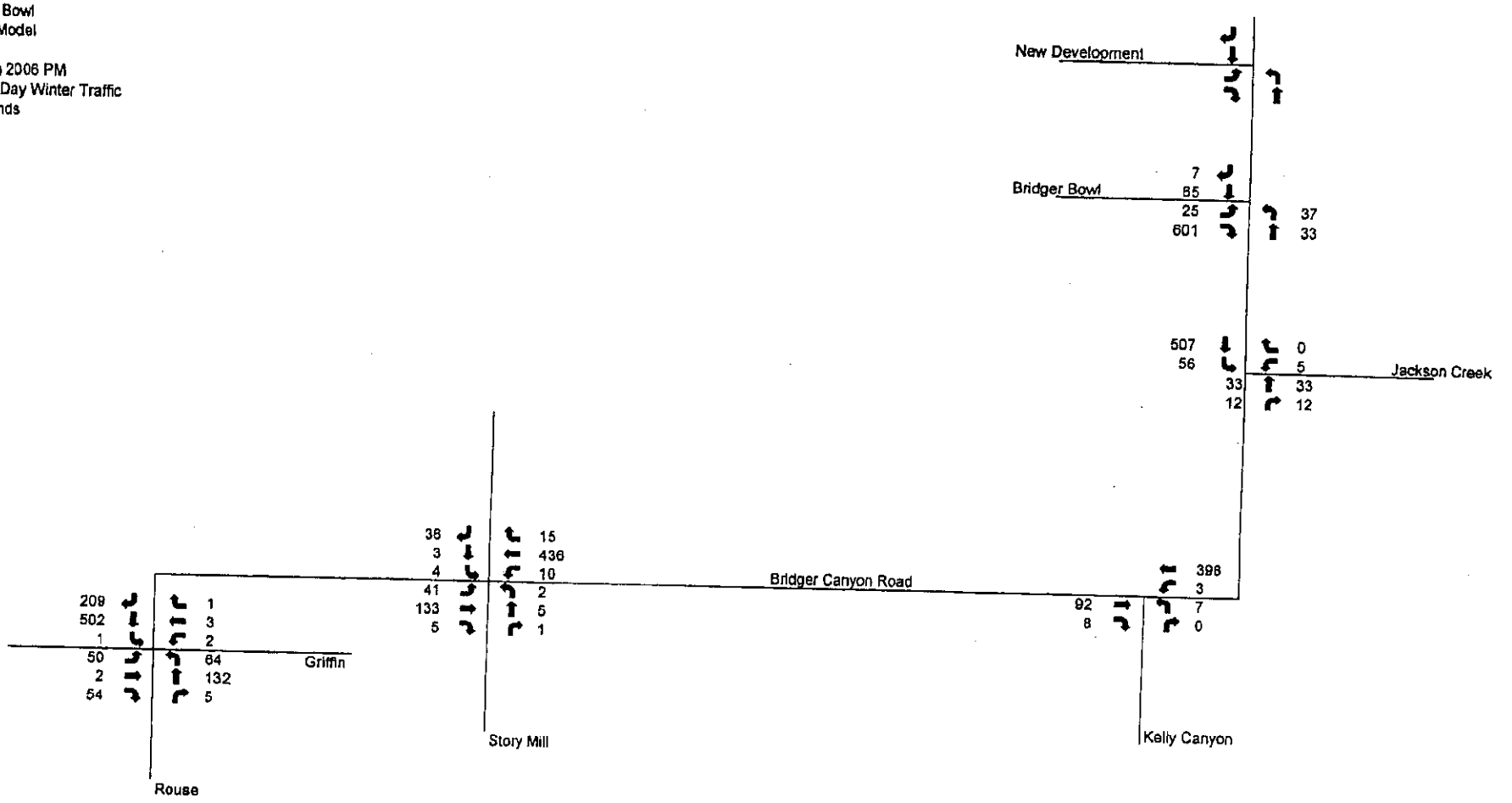
Bridger Bowl
Traffic Model

Existing 2006 AM
Design Day Winter Traffic
Weekends

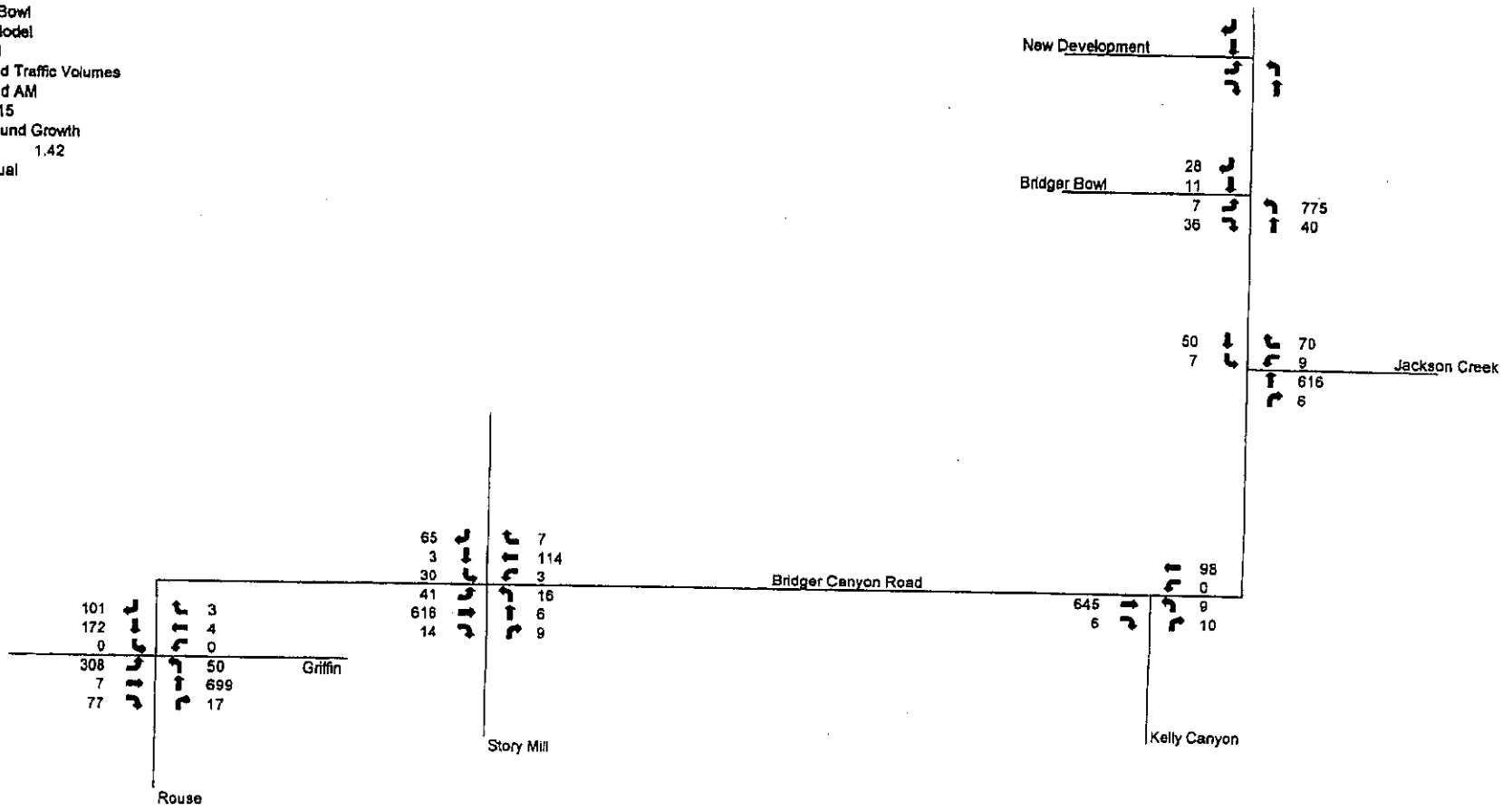


Bridger Bowl
Traffic Model

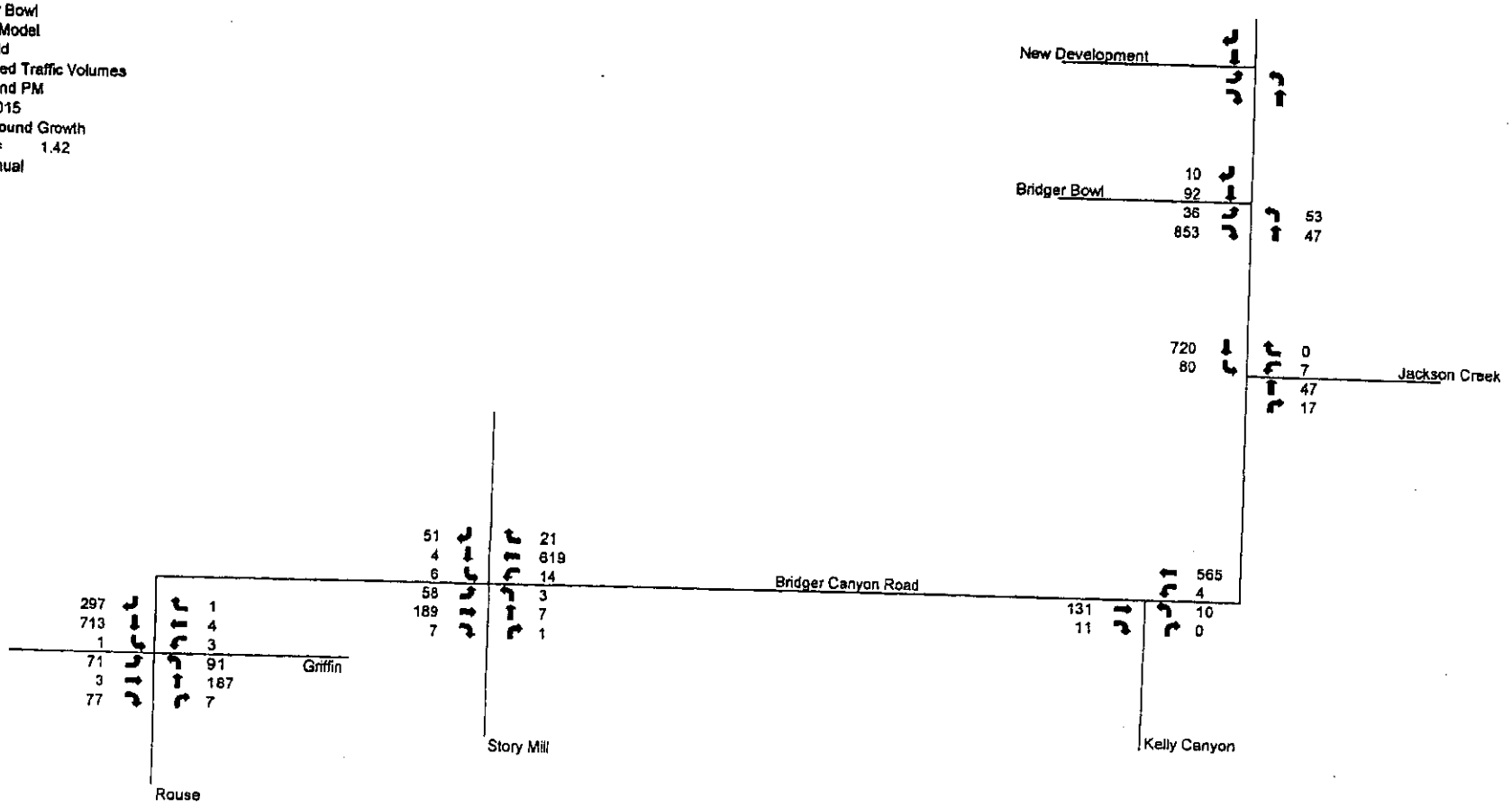
Existing 2006 PM
Design Day Winter Traffic
Weekends



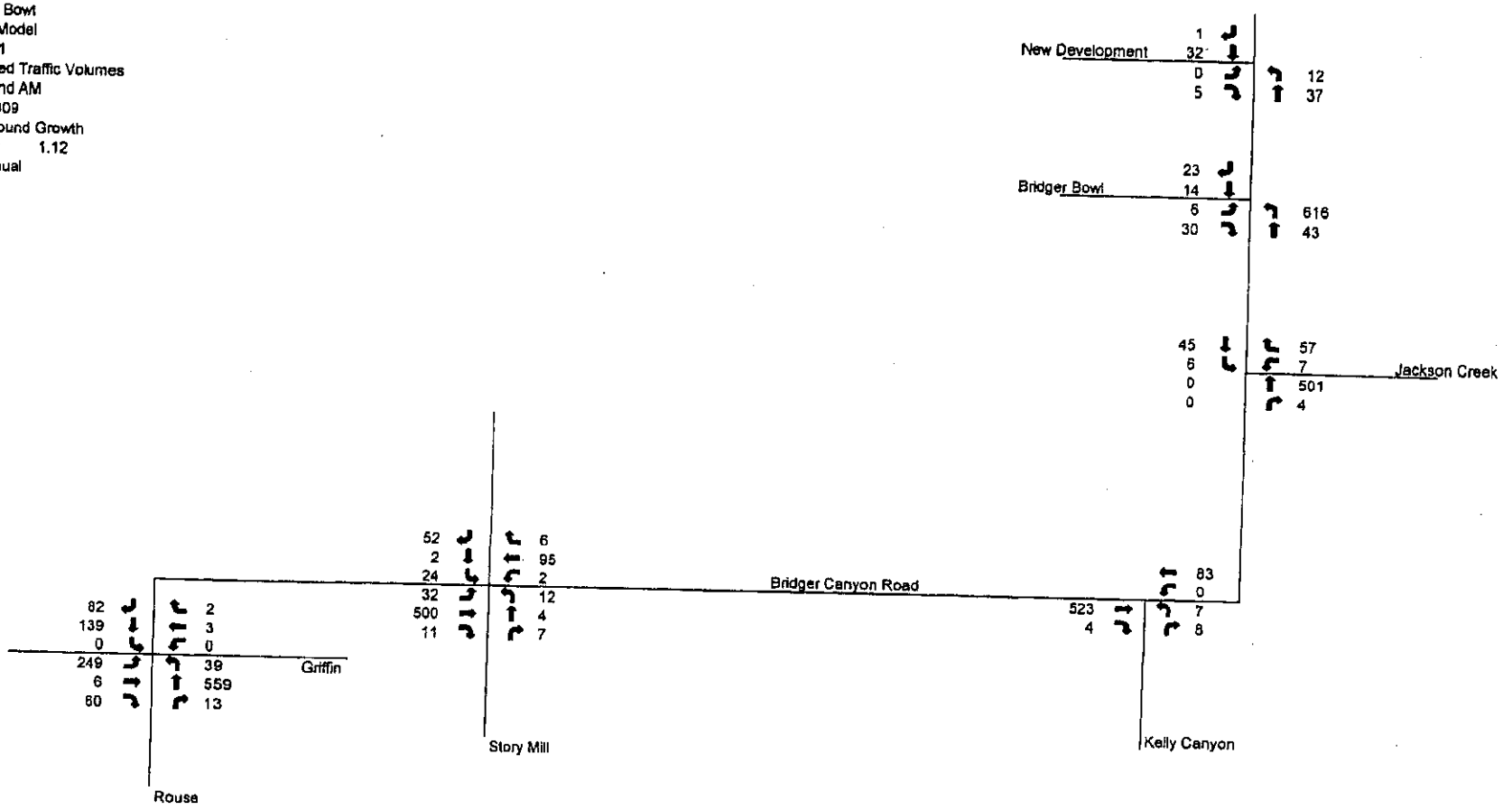
Bridger Bowl
Traffic Model
No Build
Projected Traffic Volumes
Weekend AM
2015
Background Growth
Factor= 1.42
4% Annual



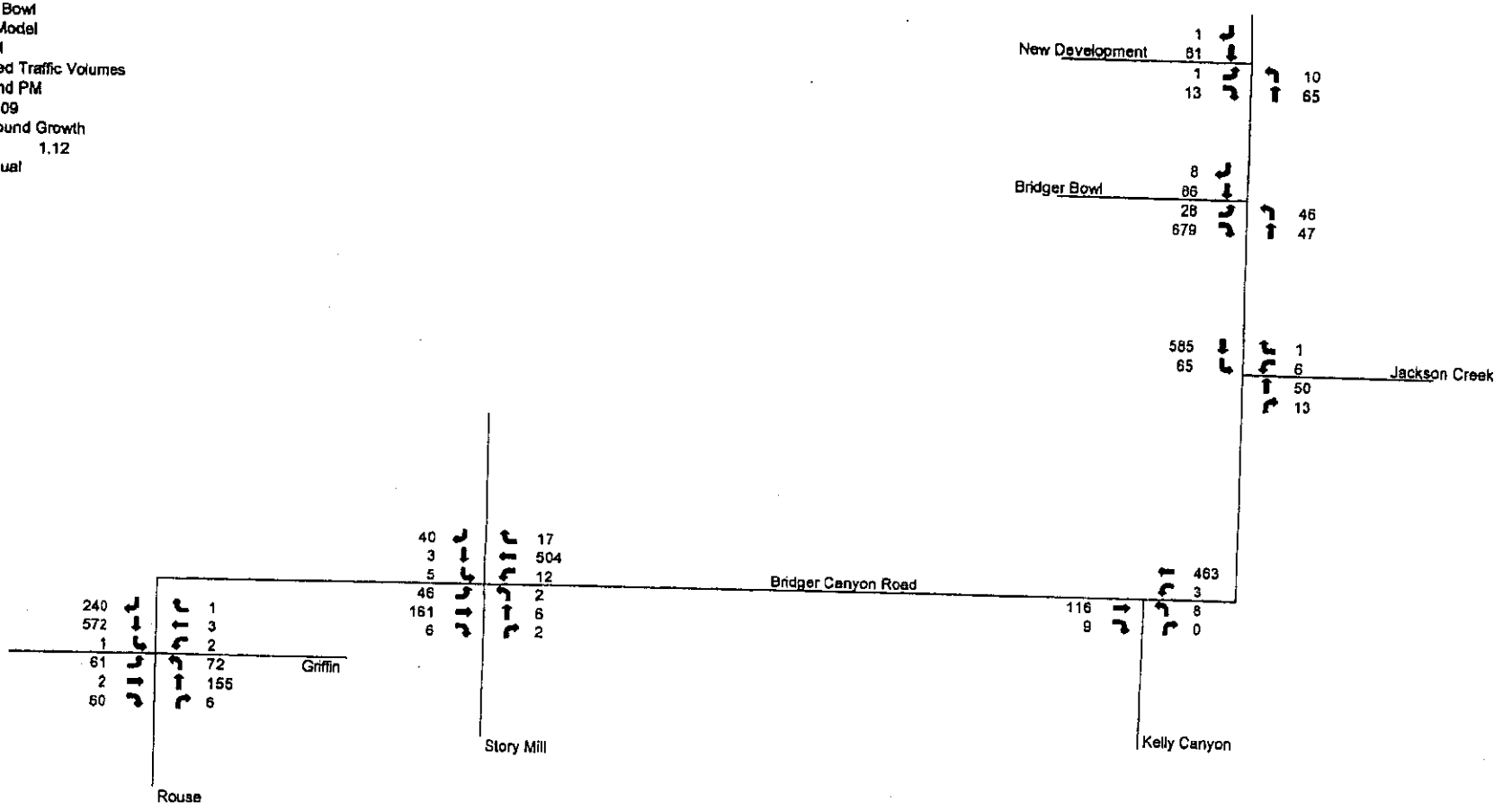
Bridger Bowl
Traffic Model
No Build
Projected Traffic Volumes
Weekend PM
2015
Background Growth
Factor= 1.42
4% Annual



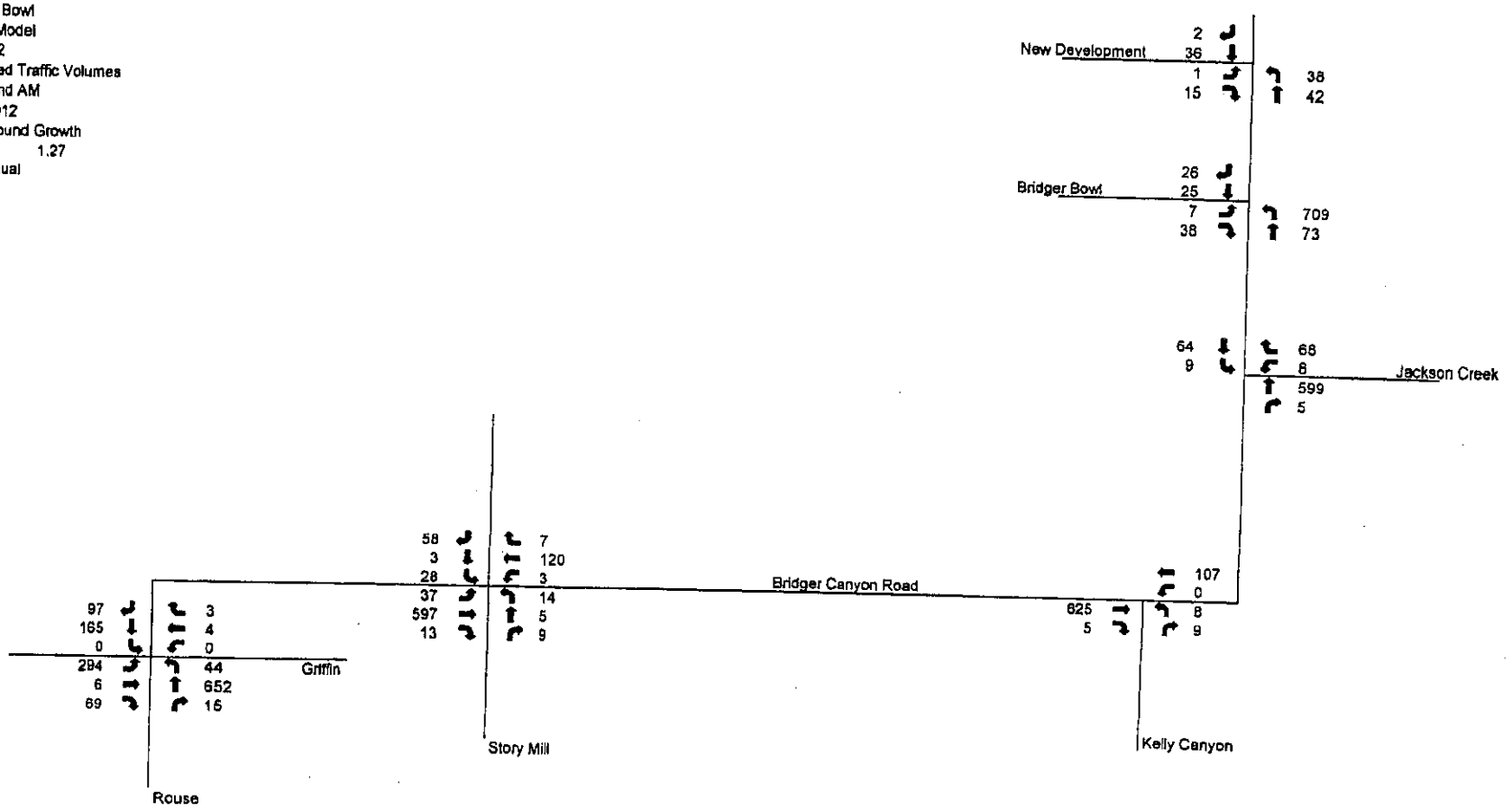
Bridger Bowl
Traffic Model
Phase 1
Projected Traffic Volumes
Weekend AM
2009
Background Growth
Factor= 1.12
4% Annual



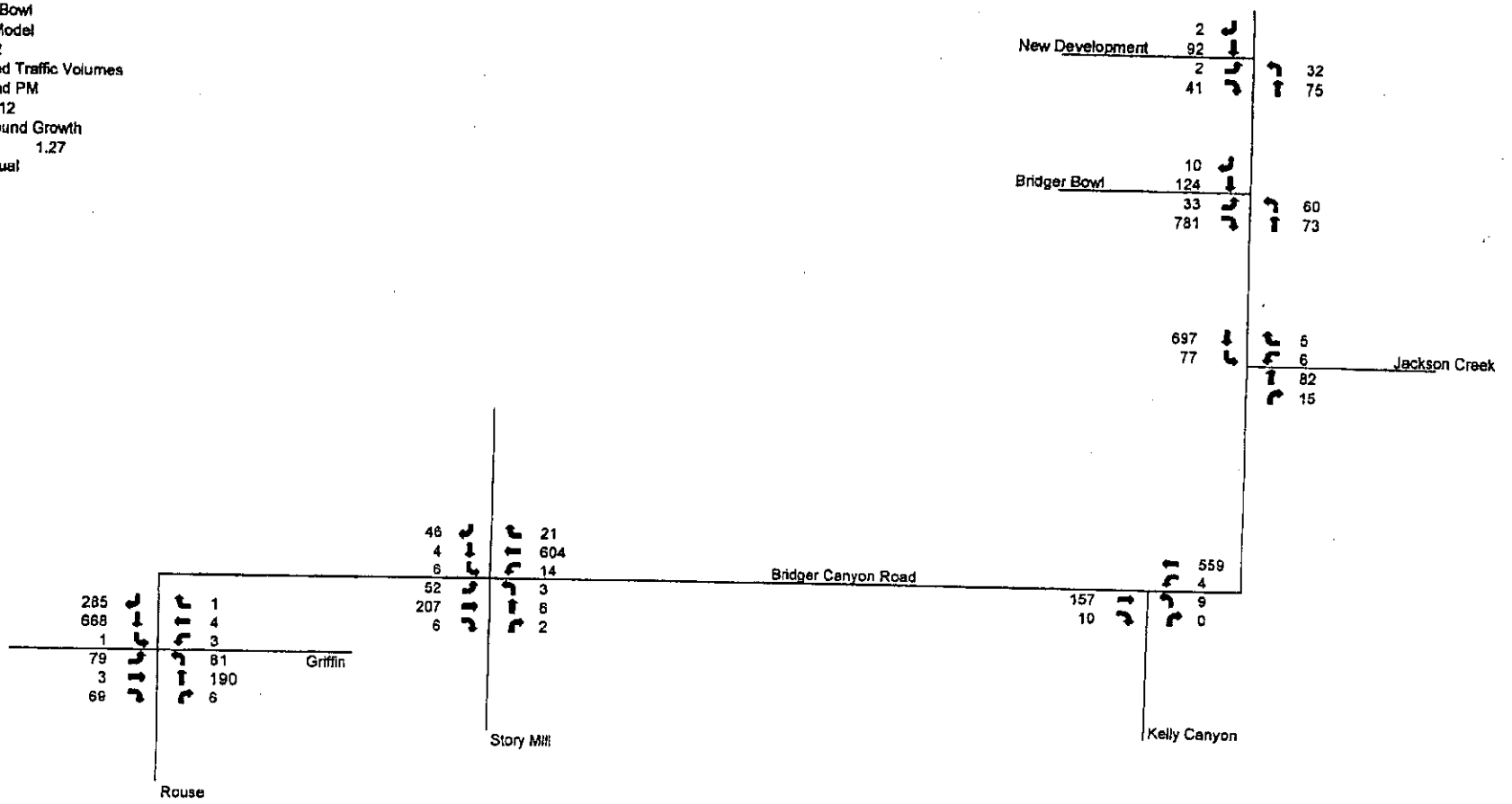
Bridger Bowl
Traffic Model
Phase 1
Projected Traffic Volumes
Weekend PM
2009
Background Growth
Factor= 1.12
4% Annual



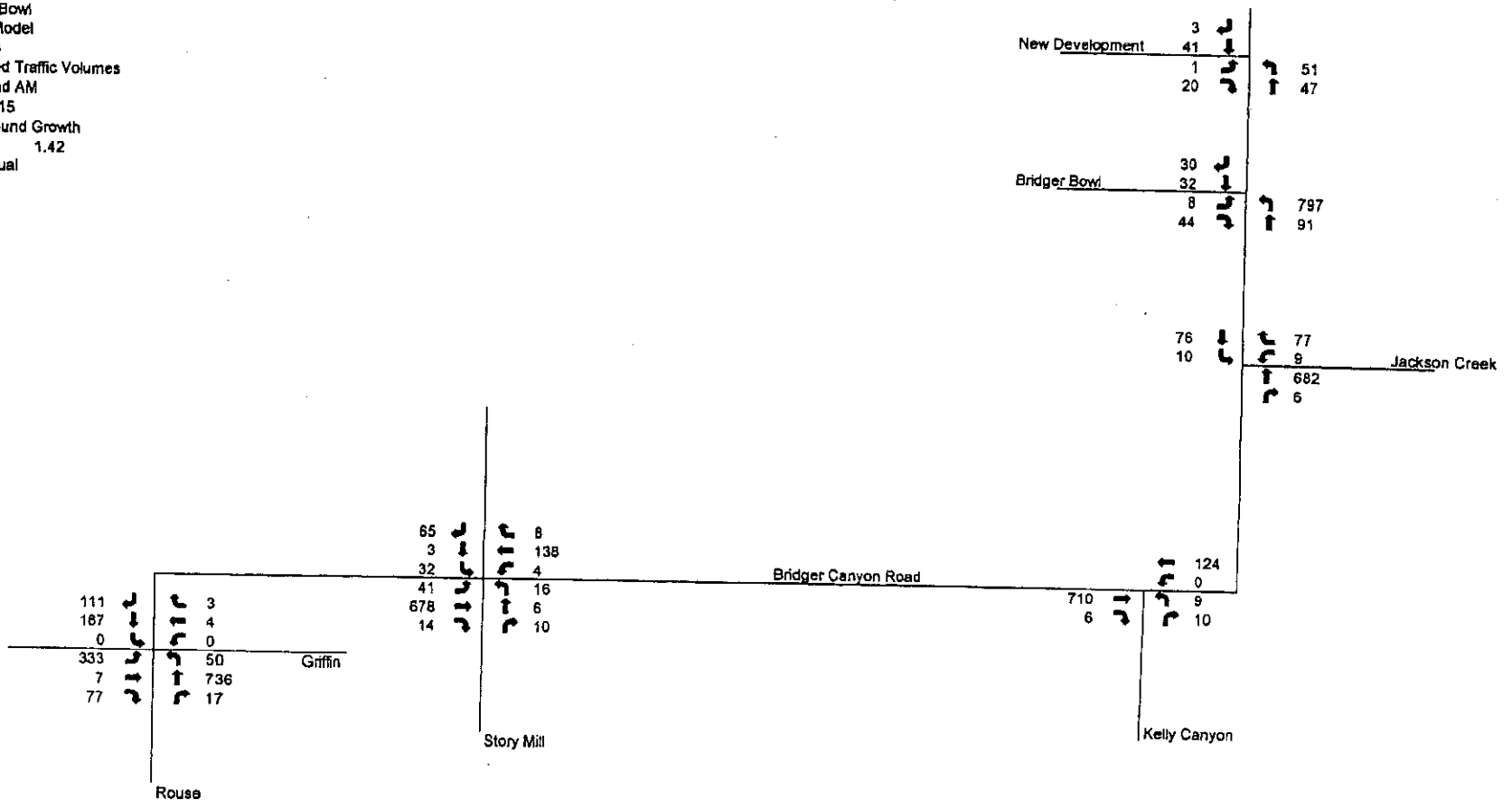
Bridger Bowl
Traffic Model
Phase 2
Projected Traffic Volumes
Weekend AM
2012
Background Growth
Factor= 1.27
4% Annual



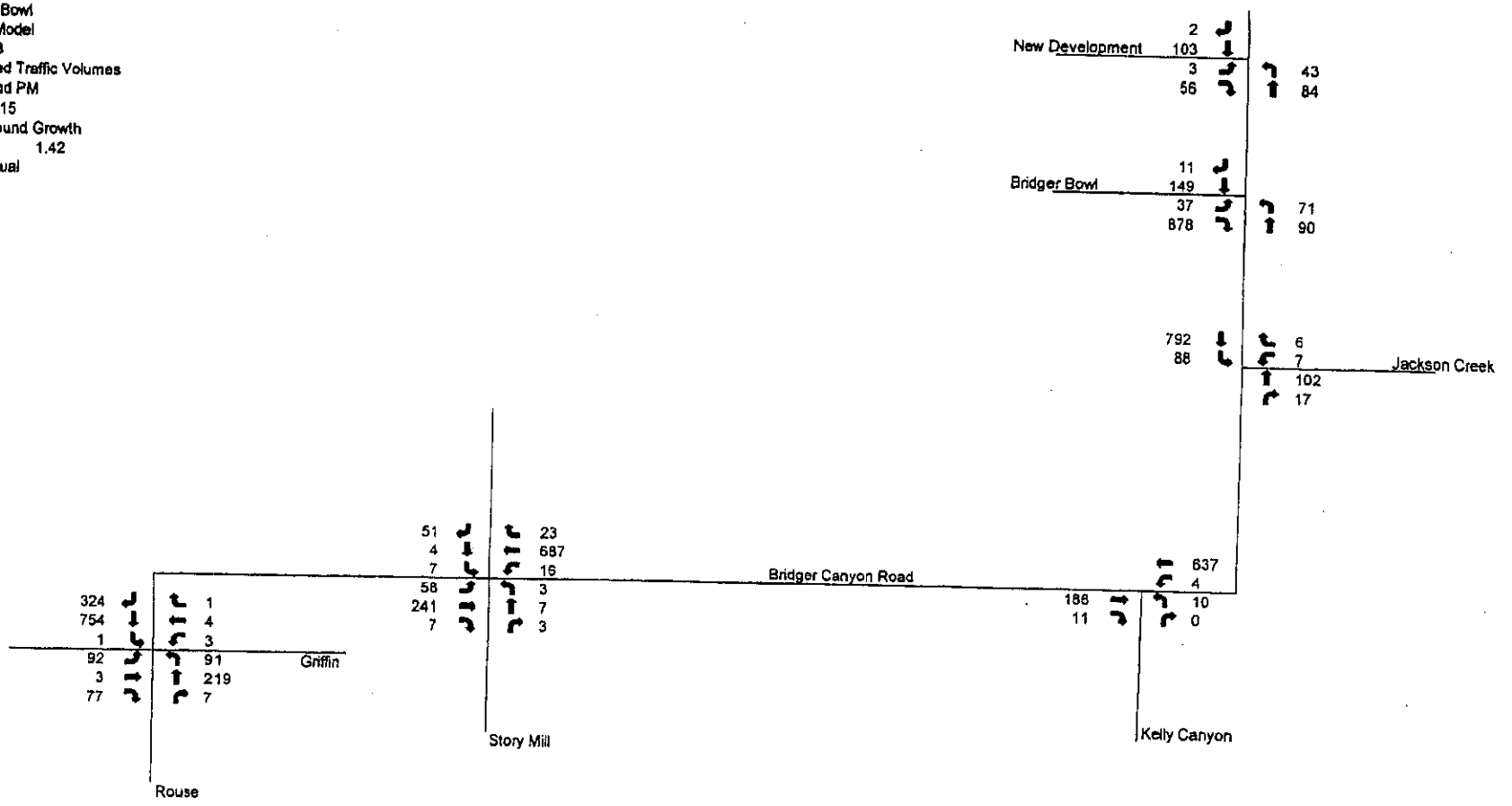
Bridger Bowl
Traffic Model
Phase 2
Projected Traffic Volumes
Weekend PM
2012
Background Growth
Factor= 1.27
4% Annual



Bridger Bowl
Traffic Model
Phase 3
Projected Traffic Volumes
Weekend AM
2015
Background Growth
Factor= 1.42
4% Annual

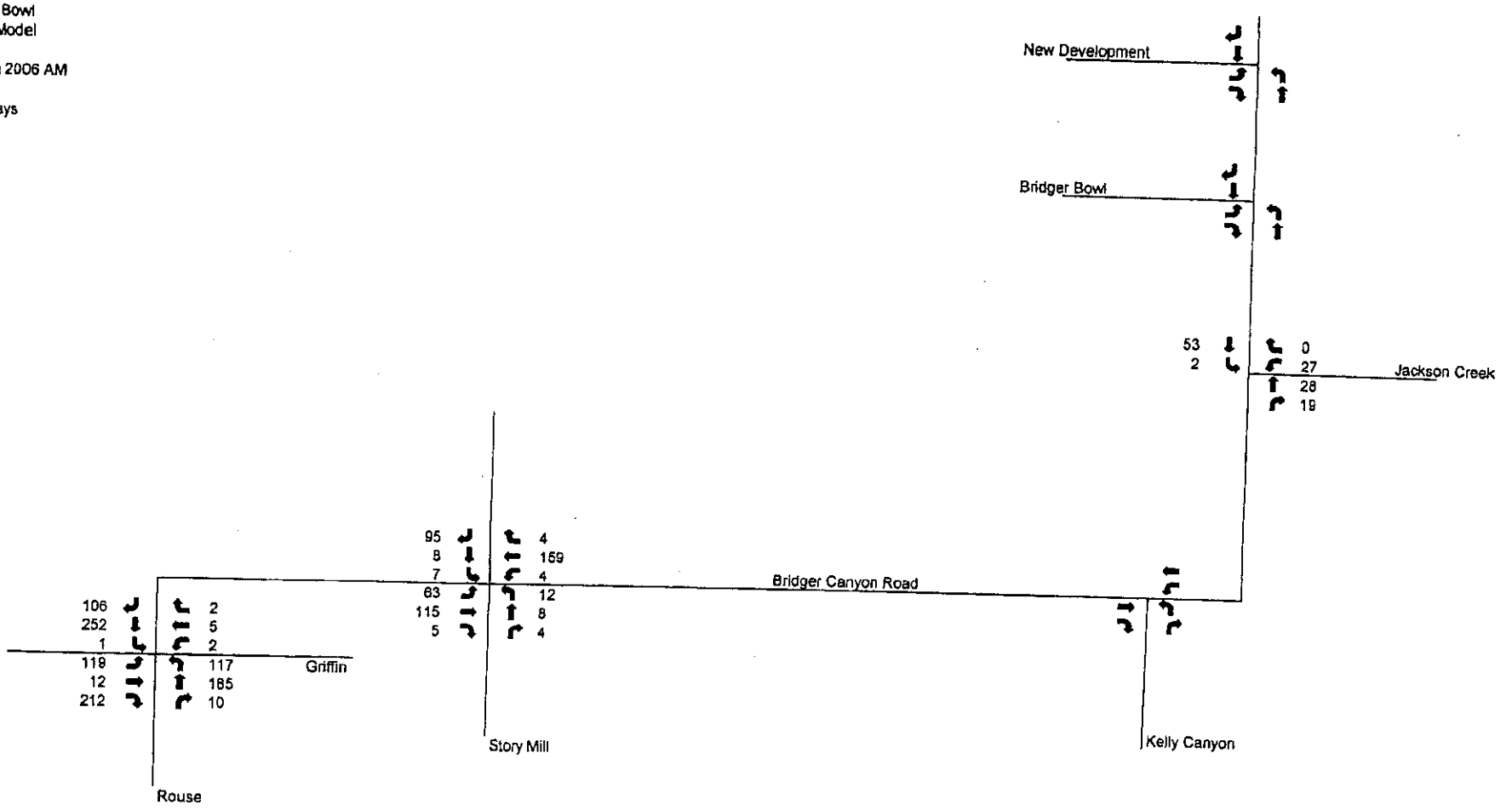


Bridger Bowl
Traffic Model
Phase 3
Projected Traffic Volumes
Weekend PM
2015
Background Growth
Factor= 1.42
4% Annual



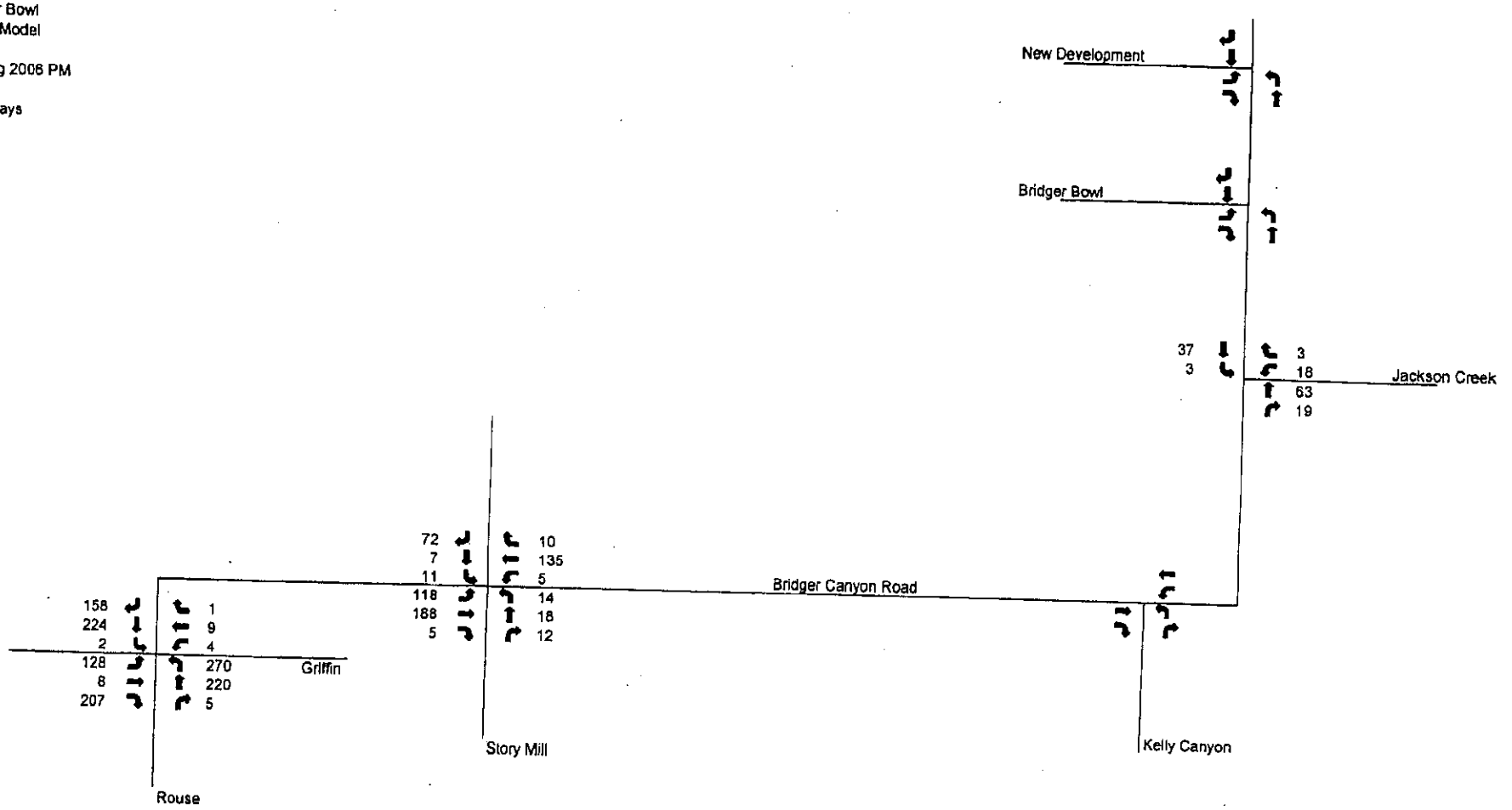
Bridger Bowl
Traffic Model

Existing 2006 AM
Spring
Weekdays



Bridger Bowl
Traffic Model

Existing 2006 PM
Spring
Weekdays



Bridger Bowl
Traffic Model

Existing 2006 Afternoon
Spring
Weekends