Technical Memorandum
Traffic Analysis for Bonanza Park Form Based Code
Prepared by PB and InterPlan for Gateway Planning Group
October 2012

Introduction

This memorandum is provided as a supplement to the form based code language and material developed for Park City Municipal Corporation (PCMC). It is intended to explain and summarize the traffic analysis work done in concert with the form based code research and development of Gateway Planning. This traffic analysis memo incorporates the work of both InterPlan and Parsons Brinkerhoff to provide a transportation framework for the successful implementation of the Bonanza Park Form-Based Code Initiative.

I. Trip Generation Analysis

One of the overall goals of this traffic memorandum is to provide information related to changes in travel behavior and trip generation based on the use of form based code in the Bonanza Park development. InterPlan performed trip generation analysis based on land uses supplied by PCMC staff for existing conditions, build-out under the existing zoning, and build-out under form based code. Various assumptions were made by Park City staff in defining the build-out land uses that are not documented in this analysis. It is important to note that the total number of square feet under build-out conditions (under existing zoning without form based code) is approximately 5.2 million SF and under form based code is approximately 6 million SF.

A. Trip Generation

Table 1 shows trip generation, combined for all land uses, for existing, build out of existing zoning, and form based code. The number of trips ("Raw Vehicle Trips") are calculated based on industry-standard ITE trip generation rates. It is important to remember that there are different numbers of total developed square feet as discussed above (5.2 million for build out, 6 million for form based code).

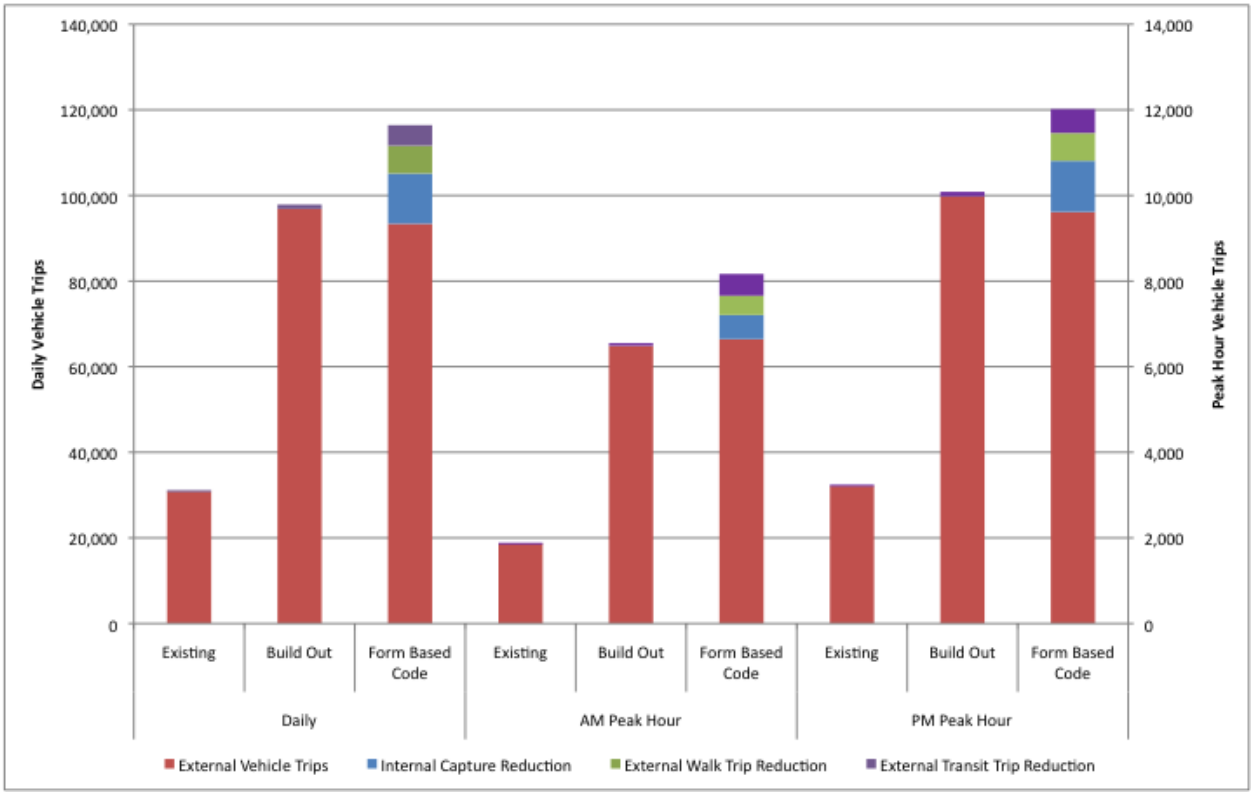
B. Vehicle Trip Reductions

These total vehicle trips are then reduced based on factors such as those that take transit to the area, those that bike or walk to the area, those that drive into the development but park once and do not make additional car trips within the development (internal capture). The reductions shown in Table 1 are all based on the Environmental Protection Agency's Mixed-use Trip Generation Model which accounts for different types of development based on density of land uses and the number of road intersections, among others. Form based code typically allows for more density and more intersections, which in turn results in more vehicle trip reductions for active transportation, transit, etc.

Table 1: Vehicle Trip Estimates

	Daily			AM Peak Hour			PM Peak Hour		
	Existing	Build Out	Form Based Code	Existing	Build Out	Form Based Code	Existing	Build Out	Form Based Code
Raw Vehicle Trips	30,857	96,875	116,433	1,872	6,490	8,167	3,213	9,980	12,016
External Vehicle Trips	30,559	95,880	93,391	1,857	6,429	6,643	3,182	9,875	9,614
Internal Capture	0	0	11,761	0	0	566	0	0	1,196
External Walk/Bike	0	0	6,481	0	0	450	0	0	649
External Transit	298	995	4,800	15	61	508	31	105	557

Source: ITE Trip Generation Manual, 8th Edition. EPA MIXED USE TRIP GENERATION MODEL v 4.0
Actual trips may vary based on the specific land use mix of the area.



C. Future Development Traffic Approval

To the extent possible, the methodology used in this trip generation analysis lays the foundation for future traffic analyses generated by individual developments as part of a future development approval process. However, without specific details of the final land uses, it is impossible to quantify the overall traffic circulation demand for the development. Park City should consider requiring that traffic studies be required as future development is proposed even with this traffic analysis.

A corridor agreement with UDOT on SR-248 (Kearns Boulevard) indicates that a future traffic signal will be located at Homestake Road. This will be the primary access to the Bonanza Park area for traffic on Kearns Boulevard.

An ongoing corridor study for SR-224 (Park Ave) suggests that there will be a future signal at the Homestake Road intersection and that Lame Dog will be realigned to make this a full, four-legged intersection (see graphic on page 7).

2. Phasing

The phasing of improvements, and more specifically, the order in which streets are built, will depend largely on individual properties and the timing of their development. City staff provided general information related to the possible sequencing of redevelopment over the next few years. It should be stressed that this information is speculation and relevant for only the next 10 years, approximately.

A. Possible Order of Development

The City believes that redevelopment along Kearns Boulevard (SR-248) is likely to occur first, possibly starting with properties between Homestake Road and Bonanza Drive then occurring further to the west between Homestake Road and the Park Avenue intersection.

B. Key Transportation Routes

The key part of the Bonanza Park's traffic network will be connections to the surrounding network which will provide primary access to the area. These include Kearns Boulevard, Park Avenue, and Bonanza Drive. To minimize traffic impacts on Park City's street system, connectivity through the development will be extremely important. Given speculation that redevelopment will likely occur first at locations along Kearns Boulevard, an east-west connection between Park Avenue and Bonanza Drive will be important in offering an alternative route within the development.

As redevelopment continues, providing additional connections that link perimeters both north/south and east/west will be important. The current configuration (illustrated below) is not conducive to moving traffic through the area under the current General Commercial build-out scenario. The existing lack of a street network concentrates ingress and egress at only a few locations generating traffic congestion and minimizing alternative travel routes.

It may be desirable for Park City to build the proposed street network (grid pattern) connections in advance of redevelopment, on a case by case basis, in order to achieve the transportation benefits of increased walk trips and reduced auto trips from the form based code as well as implement other policies (via the new code) such as shared use parking. A map of priority connections is shown here. This network is based on providing access to property likely to develop first (along Kearns Boulevard) and providing two (2) access points on each of the state routes and one to Deer Valley Drive to the south and Bonanza Drive to the east.

3. Transit Center

The concept for the Bonanza Park redevelopment is one of multiple uses connected by a network of walkable streets and trails and of high use of multi-modal transportation, including bicycles and public transit. PCMC sees the Bonanza Park area offering transit service similar to that of the existing service at Park City Mountain Resort and/or the Main Street Transit Center where several routes serve the destination and trip transfers are easily accommodated. As development begins to redefine the Bonanza Park area, the opportunity to locate a transit center within the district should be explored. Even at 50 percent of estimated build-out of millions of square feet with form based code, there will be 2 to 3 million square feet of development – creating demand for increased public transit to be located within the district. Accordingly, conceptualizing now a properly designed and expandable transit center should be undertaken. It should be noted that this strategy implicates potential future investment needs associated with such a facility.

A. Transit Market

The Bonanza Park redevelopment offers a rich market for transit ridership, offering shopping, restaurant, and residential land uses. Providing transit connections to employment and

recreational bases such as PCMR and Deer Valley furthers the desire to minimize the number of vehicle trips typically associated with this kind of development.

B. Aerial Transit (Gondola) Service

Discussion of a gondola or other aerial transit service connecting major trip generators in Park City such as PCMR, Deer Valley, and Downtown have been going on for several years. While the traffic analysis of this study did not specifically incorporate a gondola or similar types of aerial mass transit, there are several factors that should be considered in future PCMC deliberations on this issue.

There are many proponents of gondolas and other types of cable transit service and they are being used successfully as public transit facilities in other parts of the world, although examples in the United States are few. Breckenridge, Colorado built a gondola in 2007 called the BreckConnect that has been cited as reducing traffic volumes on specific roads in the town of Breckenridge. The base station for this facility is located adjacent to the town's main transit center as well as two large surface parking lots. The base facility, not including parking, encompasses just over 1 acre of land.

The Sandia Peak Tramway in Albuquerque, New Mexico was built in 1968 and provides access to both winter and summer recreation. The base area for this tram, including parking, is about 4.25 acres and also includes shared development with restaurants and shopping. As a comparison, the property owned by public works is approximately 5.25 acres, shown in yellow below.

With respect to a gondola connection to Bonanza Park, Park City's concern lies in becoming a parking lot for day skiers at PCMR and/or Deer Valley, depending on the configuration of the facility. Future analysis should examine whether this would be a cost-effective mode of transportation and an overall benefit to the city by easily transporting skiers and other visitors between major destinations such as PCMR and Bonanza Park without contributing to traffic congestion on Park City streets. Any analysis of an aerial transit facility in Bonanza Park should

consider strategies for capturing traffic before they reach the Bonanza Park area in addition to considering a distribution of vehicles to parking facilities at Deer Valley and PCMR or considering express bus service opportunities from Bonanza Park to the ski resorts

4. Driveway, Access, and Traffic Signal Spacing

As state highways, both SR-224 (Park Avenue) and SR-248 (Kearns Boulevard) are categorized by UDOT under a spectrum of access management categories. The details of each access management category vary depending on a variety of factors such as if the category of road is intended to provide higher speeds and greater mobility, or commercial access, residential access, etc. The segments of these highways that are adjacent to the Bonanza Park Development both fall under UDOT's access management category 7 (C-R) – Community-Rural Importance. UDOT describes this category as appropriate for highways that accommodate moderate to low speeds, moderate traffic volume, and a balance between through traffic and direct access. "These facilities move both regional and local rural traffic but with emphasis on local movements such as those common on small city Main streets."

A. UDOT Access Spacing Standards

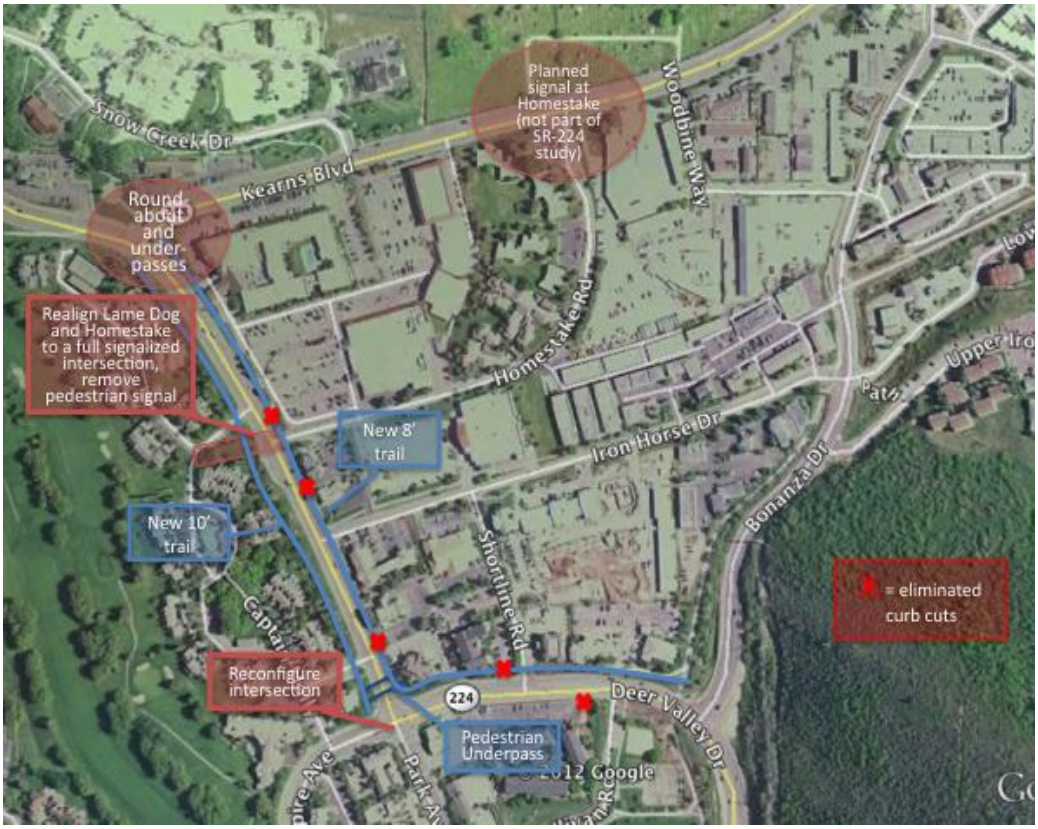
Access spacing standards for Category 7 roads is:

- Minimum signal spacing 1320 feet
- Minimum street spacing 300 feet
- Minimum access spacing 150 feet

Currently, the only signals that do not meet minimum signal spacing standards are the signals at Park Ave/Empire Ave/Deer Valley Drive and at Deer Valley Drive/Bonanza Drive. The distance between these signals is approximately 970 feet. Streets that do not meet the minimum spacing are Shortline Road and Sullivan Road on Deer Valley Drive which are about 280 feet apart and Sullivan Road and Bonanza Drive which are spaced approximately 240 feet apart. There are several accesses on both Park Ave and Kearns Boulevard that do not meet minimum spacing requirements. The SR-224 (Park Ave) corridor study that is currently in progress recommends closing some driveways that will make others in the corridor compliant with the spacing standard. But those proposed closures would not affect the proposed new BoPa street network.

B. SR-224 corridor study

Intersections on the Bonanza Park property with SR-224 will be coordinated with the SR-224 corridor study. The recommended improvements from the SR-224 Corridor Study are shown below. The Bonanza Park Area Plan should be updated to reflect elimination of curb cuts as shown in the SR-224 corridor study. Otherwise, the proposed connections mirror each plan. The 8' wide trail and the roundabout with under passes shown on the SR-224 corridor study should also be added to the Bonanza Park Area Plan.



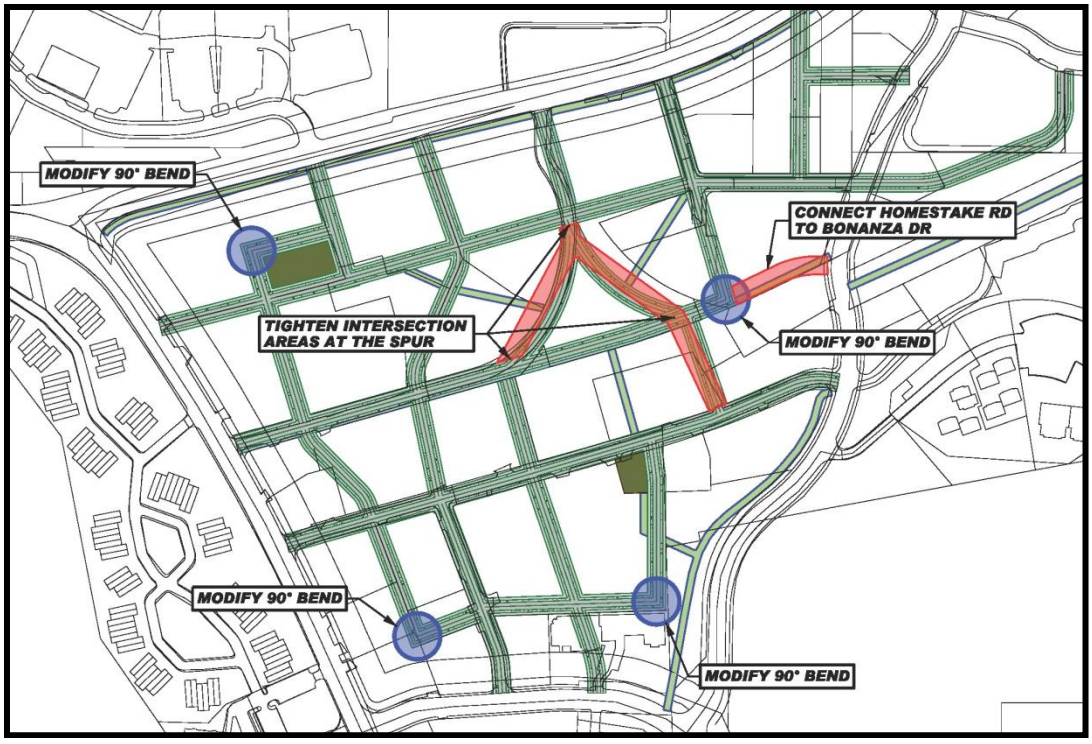
C. UDOT's Access Management Permitting Process

UDOT requires that new developments or modified land uses within existing developments acquire permits to access the state highway system. Both SR-224 and SR-248 are state highways. The Bonanza Park Plan recommending the form based code would require access to these routes via public streets, as noted in the land use and street plans. These public streets generally meet UDOT's access requirements. However, in the case of phased development, it is possible that the placement of public streets may not meet the access separation requirement from an adjacent driveway. Park City Municipal Corporation will work with UDOT to demonstrate that the plan will require phasing and that future phases will eliminate private driveways. Based on the preliminary street network identified by PCMC, there are three (3) locations on state highways that the minimum street spacing of 300 feet is not met. Those locations are shown on the map below. It is worth noting that one (1) of the three (3) locations currently exists as a right-of-way (Shortline Drive), and the other two (2) exist as driveways.

In the case where developments seek a private driveway on the state highway system, landowners must work directly with UDOT and follow Administrative Rule R930-6, *Accommodation of Utilities and the Control and Protection of State Highway Rights of Way.* Private driveways are generally inconsistent with the land use plan developed by Park City but may be granted through permission from UDOT provided the driveways can be shown to represent an improvement in traffic operations and/or safety. In the case of land development fronting Park Avenue (SR-224), access permits must follow UDOT's Access Management standards of Category 7, Community Rural. These standards require 1320 foot traffic signal spacing, 300 foot street spacing, and 150 minor access spacing as described above. On Kearns Boulevard (SR-248), UDOT's access categories are superseded by a corridor agreement between UDOT and Park City and Park City should be contacted directly. It is the goal of Park City to amend the Kearns Boulevard corridor agreement and to create a Park Avenue corridor agreement consistent with the Bonanza Park plan.

5. Street Layout Modifications

The consultant team worked with Park City Staff to refine the street network defined in the January 2012 Draft Bonanza Park Neighborhood Plan. The network was modified to enhance connectivity for vehicles, bicyclists, and pedestrians while considering the constraints of existing infrastructure and parcel boundaries that will influence the phasing for future development and therefore influence the viability of retrofitting the transportation network. The following figure was provided by Park City Staff on August 27, 2012 and represents the internal street network evaluated as part of the traffic analysis for this project. The figure also illustrates some additional modifications recommended to enhance the system effectiveness of this network for vehicles, bicyclists, and pedestrians. These recommended modifications are described below.

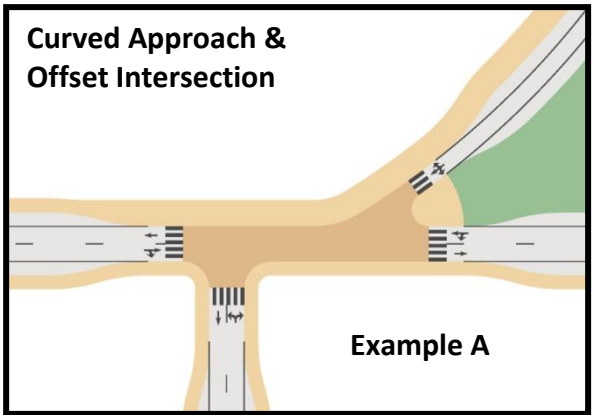


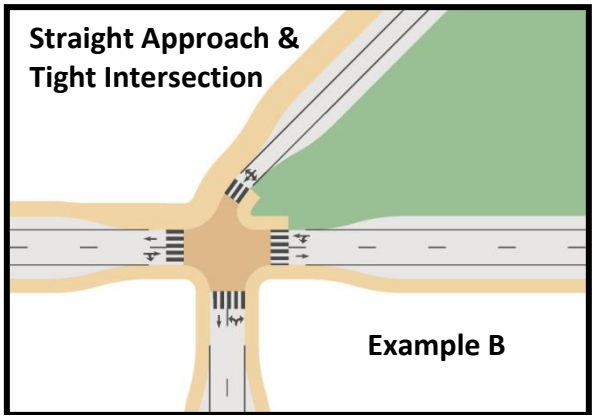
A. Tighten Intersection Areas at the Spur

The traffic operations recommended for the Spur would allow only one-way movements for the north-south (diagonal) streets of the Spur and two-way movements for the east-west street of the Spur (Homestake Road). The curved alignments for the diagonal streets were defined to follow the geometry of the previous railroad line and do not work well for urban intersections. This curved alignment is not good engineering practice because it creates skewed intersection angles that increase the intersection footprint and make it difficult for drivers to turn and see vehicles and pedestrians. The larger footprint may also increase the distances required for pedestrians to cross the intersection.

The Spur intersections and corresponding streets should be modified to tighten the intersection footprint. This can be achieved by straightening the diagonal streets and thereby reducing the skew at these intersections. The diagonal and opposing streets could also be modified (shifted) to minimize intersection offsets and thereby tighten corresponding intersection footprints. The street that connects Iron Horse Drive to the eastern diagonal street should be modified to intersect Homestake Road so that it aligns with the eastern diagonal street. The street that connects Iron Horse Drive to the west diagonal street is constrained by the existing storage units and expected phasing for the neighborhood. If shifting this western street is not viable, the western diagonal street should be shifted to align with its opposing street.

The figures below illustrate how one of the approaches could be modified to tighten the intersection footprint. Example A represents an intersection with the proposed curved and offset diagonal approach and Example B represents a modified and tighter intersection design.





B. Modify 90-Degree Bends

The modified street network shown above includes multiple 90-degree angles that are typical for intersections but do not work well for street segments. There are many options to rectify these tight 90-degree angles including a modification of the street network to avoid these tight angles. However, considering the various constraints that led to the proposed street network, the preferred treatment would be to add street "legs" to form three- or four-leg intersections. These additional "legs" could be private alleys or access streets. If adding "legs" is not feasible, the radius of curvature for these 90-degree bends should be increased to accommodate speeds of at least 15 to 20 miles per hour.

C. Connect Homestake Road to Bonanza Drive

Although connecting Homestake Road to Bonanza Drive would need to accommodate some grade differentials, existing contours indicate that such design would be feasible. This modification would enhance the connectivity of the system, however, if pursued, this connection must ensure that adequate intersection sight distance is provided at Bonanza Drive. Also, the proposed bicycle routes would need to be modified to eliminate the "double route" along Homestake Road to the east of the Spur (provide bike lane only along the south side of Homestake Road). For all locations, bike lanes should be kept away from gutter pans. To maximize street right-of-way, final design should consider using curbs without gutters to separate bike lanes from sidewalks.

6. Street Standard Cross-sections

With the Traffic & Transportation Master Plan adopted in 2009, Park City also revised the standard street cross-sections for city streets. Cross-sections that have been identified for the Bonanza Park area differ from the City's adopted standards. The table below provides a comparison between Master Plan cross-sections (in black) and BoPa cross-sections (in green). Facility types are shown in order of right-of-way width.

	Right-of-way Width	Amenities	Example
Local, non-Old Town	32 feet	Sidewalk Flex space (parking, bike lane)	Evening Star Drive, Doc Holliday
Local, Old Town	27-28 feet	Flex space (parking, bike lane) Sidewalk OR wider pavement	Woodside, Norfolk
Minor Residential Collector	43 feet	Flex space (parking, bike lane) Sidewalk	Meadows Drive, Three Kings Drive, Sidewinder Drive
BoPa Interior Block with Cycle Track – rounded edges of spur	52 feet	One lane of travel, one way Parking, both sides Sidewalk, one 15' Two-way bicycle track, with 3' buffer	
BoPa Interior Blocks	52 feet	One travel lane each direction Parking, both sides Sidewalks	
BoPa Interior Block with Cycle Track – one side parking	55 feet	One lane of travel each direction Parking, one side Sidewalk, two 8' Two-way bicycle track, with 3' buffer	
BoPa Interior Block with Cycle Track – straight edge of spur	55 feet	One lane of travel each direction Parking, both sides Sidewalk, one 8' Two-way bicycle track, with 3' buffer	
Major Residential Collector	62 feet	Flex space (parking, bike lane) Bus pull outs Sidewalks	Lucky John Drive, Little Kate Road, Lower Park Avenue
BoPa Interior Block with Cycle Track	63 feet	One lane of travel each direction Parking, both sides Sidewalk, two 8' Two-way bicycle track, with 3' buffer	
Commercial Collector	67 feet	Sidewalks Flex space (parking, bike lanes)	Bonanza Drive, Main Street, Snow Creek Drive

		Bus pull outs	
Non-UDOT Arterial	89 feet	Center turn lanes Multi-use paths both sides Two travel lanes Shoulders Park strips	Future Marsac
UDOT Arterial	117 feet	Center turn lanes Multi-use paths both sides Four travel lanes Shoulders Park strips	Kearns Boulevard (SR-248) Park Avenue/Deer Valley Drive/Marsac (SR-224)

While the BoPa cross-sections do differ slightly from those adopted as part of the Master Transportation Plan, they do share the intent of MTP cross-sections in that they provide narrow street widths with street amenities that accommodate all travelers, whether on foot, bicycle, or bus.

7. Rough Street System Cost Estimate

Using the typical sections and the GIS/CAD file for the proposed Bonanza Park Neighborhood network provided, the consultant team developed a spreadsheet to estimate the construction cost for the proposed street and trail networks and to estimate approximate cost per linear-feet estimates for each of the proposed typical sections. The resulting cost estimate is $8.5 million including $8.1 million for the street network and $0.4 million for the trails system (not including right-of-way acquisition costs). The following table summarizes the cost for each of the typical sections. Costs are reported separately for existing and new streets. Existing streets are those with existing infrastructure and reflect lower costs anticipated to retrofit existing infrastructure. Additional cost estimate calculation and assumption details are provided in the "BoPa Rough Street Cost Estimate" spreadsheet prepared as part of the cost analysis for the proposed Bonanza Park Neighborhood street system.

Typical Section DESCRIPTION	ROW Width (ft)	Cost (Exist) ($/LF)	Cost (New) ($/LF)	Travel Lane Width (ft)	Bike Lane Width (ft)	Parking Width (ft)	Walk Width (ft)
Interior Block No Cycle Track	52	$ 270	$ 460	10	-	8	8
Interior Block with Cycle Track - Along Rounded Edge of Spur	52	$ 270	$ 470	10	11	8	15
Interior Block with Cycle Track - Along Straight Edge of Spur	55	$ 280	$ 510	10	11	8	8

Interior Block with Cycle Track - Roads with Cycle Track and Two Sides of Floating Parking Lane	63	$ 310	$ 540	10	11	8	8

Summary of Results

A central question of the traffic analysis of the Form Based Code is whether the transportation system network "works." In a typical traffic analysis prepared for UDOT, new development traffic is analyzed and the roadway system is proposed to be sized so that traffic flow is not impeded by the new development. In Bonanza Park, the roadway system is being planned concurrent with planning for re-development and establishing the form based code, which will permit this re-development. The ultimate success of the roadway system is based on its ability to complement Park City's goals for the development of a balanced transportation system that fosters active transportation and transit use and views the private automobile as one of many modes, but not the dominant mode of travel.

The success of the Park City transportation system cannot be defined solely by a static "level of service" or a predefined level of infrastructure. An active balance must exist between single occupancy vehicle use, mass transit, walking and bicycling. As shown in the Trip Generation section of this analysis, the use of form based code as a land development regulating tool will foster the land uses and types of development that will result in greater internal walk trips, more transit trips, and lower automobile trips as compared to the entitled land uses under a conventional zoning code. However, given the potential magnitude of 4 to 5 million square feet of development in Bonanza Park, it is difficult and perhaps not desirable to define a transportation system that works in the long term without an understanding of how it might work under economically constrained phases.

In addition to the form based code, Park City should recognize four types of incentives or controls that the City can influence to ensure that the transportation system continually strikes the proper balance. These incentives and controls have been defined in other parts of this analysis but are summarized in this section to clearly define what the City can do to ensure that the transportation system works. The following briefly describes each policy control/incentive that Park City must actively initiate to ensure the success of the transportation system.

1. Access Management on Boundary Roads to Bonanza Park

In many ways, the goals of UDOT to promote unimpeded travel on Kearns Boulevard (SR-248) and Park Avenue (SR-224) differ from those of Park City to allow for some traffic congestion as a lever to promote transit and active transportation. However, limiting driveways for developments fronting these boundary roads will not only improve traffic flow, but it will foster the types of development that can be successful with walk and motor vehicle access from all sides as opposed to only motor vehicle access to and from the outside. This will require the countervailing joint efforts of property owners and the City to develop internal cross-access and

other means to complement external limitations of access. The access management section is described in section 4 of this analysis.

2. Internal Street Connectivity

The street layout plan, as discussed in section 5, provides an internal skeleton of walkable streets that have also been designed to allow for safe and efficient traffic flow. Numerous studies have shown that the propensity to walk as a travel mode increases as the density of internal streets and intersections increases. The development plan for Bonanza Park has added internal streets to ensure that back access is promoted. This secondary access is vital to allowing for shared use parking and reducing the access burden on the boundary roadways. It may be desirable for Park City Municipal Corporation to construct internal streets in advance of development to ensure that shared use parking is achieved and walk access is promoted.

3. Parking Management

Bonanza Park will never reach its development potential if parking for each land use is required on-site. The form based code begins to entitle land uses that can attract walk based travel by design. Walking from one use to the next will require that parking must be shared across multiple land uses so that residents and employees of the area park once and walk (or bike) to multiple trip destinations. Shared use parking must be promoted to initiate development that will result in a 24/7 pedestrian environment in Bonanza Park and in ensuring that Bonanza Park reaches its overall goal of becoming a mixed-use area where residents and employees share in a sense of community. There are multiple strategies that can be employed including shared parking, centralized parking and parking maximums rather than minimums.

4. Internal and External Transit Systems

Section 3 begins to define the concept and the end goal for a mass transit system in Bonanza Park. This analysis is not meant to define a direction or priority of transit expansion to and from (and within) Bonanza Park but is meant to offer transit as a potential policy incentive that Park City can offer to affect the balance of transportation.

Together, these four policy levers should be implemented by Park City to achieve a successful transportation system in concert with the overall form based code in order for the internal street/pedestrian/future transit network to accommodate the level of density proposed under the form-based code initiative