

# Appendix G



Kimley-Horn  
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## MEMORANDUM

Date: April 25, 2006

To: Lou Colombo, City of Albuquerque  
Matt Taecker, Taecker Urban Design and Planning

From: James M. Daisa, P.E.

**Subject: Volcano Heights Concept Plan – Traffic Operations Assessment and Boulevard Design Recommendations**

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This memorandum summarizes the methodology and conclusions of a traffic operations analysis and boulevard design study for the proposed Town Center area of the Volcano Heights Concept Plan. The objectives of this study are:

- Review the proposed boulevard design on Paseo del Norte and provide design assessment and recommendations, and
- Determine if the proposed signalized intersection spacing (1/4 mile) in the Town Center would degrade traffic operations below conditions with standard spacing (1/2 mile).

This memorandum is divided into two section 1) boulevard design recommendations, and 2) a summary of the traffic operations analysis.

### **Paseo del Norte Boulevard Design Assessment and Recommendations**

The Concept Plan proposes that Paseo del Norte within the Town Center be designed as a “boulevard” in the traditional sense. A traditional boulevard is a concept that combines a high-capacity thoroughfare with pedestrian-oriented frontages that encourage street activity. This is accomplished by providing one-way frontage roads parallel to the arterial street separated by a median with breaks that allow access to/from the arterial and frontage roads. The frontage roads serve fronting buildings, and provide on-street parking, ample landscaping, and a pedestrian environment buffered from the higher speed traffic by the frontage road itself. This concept has raised concerns about its affect on the traffic operations and safety of Paseo del Norte, specifically:

- Traffic turning into and out of the frontage road will create friction that interferes with the flow of through traffic on Paseo del Norte;
- Traffic turning out of the frontage road will attempt to weave across multiple lanes of Paseo del Norte to access the northbound left turn lanes creating a safety hazard; and
- Traffic slowing down to turn into the frontage road will create congestion and the potential for rear-end collisions.



There are several ways that the boulevard can be designed to mitigate these concerns, which are discussed below.

### Description of the Boulevard

The design of the Paseo del Norte Boulevard is illustrated in **Figure 1**, which provides a plan view of the Town Center. The boulevard section of Paseo del Norte is located between the intersections of Woodmont and Unser Boulevard, with one-way frontage roads in both directions parallel to Paseo del Norte. Each frontage road is accessed internally within the adjacent block by local streets, as well as through openings in the raised median separating the frontage road from Paseo del Norte.

The median openings offer access to passing traffic on Paseo del Norte. Although the frontage roads wrap around the Unser Boulevard side of the blocks, direct access to the frontage roads is not provided from Unser, except for a right-turn slip ramp south of the Paseo del Norte/Unser intersection (see Figure 1). The northbound frontage road can be accessed via internal streets, from Woodmont Road via an intersection set back a minimum of 150 feet from Paseo del Norte, and from two median openings on Paseo del Norte. The southbound frontage road can be accessed from the right-turn slip ramp on Unser Boulevard, internal streets, two median breaks on Paseo del Norte and has egress to Woodmont Road.

**Figure 2** illustrates the detail of the frontage road design between Woodmont and Unser Boulevard, focusing on the design of the median openings. The proposed design utilizes a continuous right turn lane in which traffic can use to decelerate when entering the frontage road and to accelerate when exiting the frontage road. Traffic exiting the frontage road can then weave into the through lanes on Paseo del Norte, or remain in the right turn lane and turn at Unser Boulevard.

### Design Recommendations for Paseo del Norte Boulevard Segment

- The frontage road intersections with Woodmont Road (in each direction) should be located a minimum of 150 feet from the intersection of Woodmont with Paseo del Norte.
- The beginning of the continuous right turn lane should accommodate a 340 foot long deceleration length (for 45 mph) which can include a 100 foot long taper length.
- The northern median opening in the northbound direction (the opening closest to Unser Boulevard) should only allow right turns into the frontage road. This eliminates traffic turning out into the operational area of the Paseo del Norte/Unser intersection and avoids driver attempts at weaving across multiple lanes of travel to access the northbound left turn lanes.
- The second median opening in each direction should be located a minimum of 250 feet upstream from Unser Boulevard and Woodmont Road (500 feet is proposed) to provide storage length in the continuous right turn lane to accommodate right turn queues at these intersections.



- Recommended posted speed limit on Paseo del Norte and Unser Boulevard through the Town Center area is 35 mph.

#### Design Recommendations for Concept Plan Area Network

**Figure 3** illustrates the recommended intersection lane configurations, control, and number of through lanes for the Concept Plan area. **Figures 4 through 8** illustrate roadway cross-sections for Paseo del Norte and Unser Boulevards at various locations. **Figure 4** illustrates the boulevard segment of Paseo del Norte. **Figure 5** illustrates Paseo del Norte with exclusive bus lanes. The section in **Figure 6** illustrates several sections of Paseo del Norte and Unser Boulevards as either 6 lanes (without exclusive bus lanes) or 4 lanes (with exclusive bus lanes). The section in **Figure 7** illustrates the section of Unser Boulevard with a northbound access lane (located between Woodmont and Paseo del Norte). The section in **Figure 8** illustrates the typical section of Unser Boulevard through the escarpment as it enters the plan area. This section has been revised to accommodate the proposed exclusive BRT lanes.

#### Options for Pedestrian Access Across Paseo del Norte/Unser Boulevard Intersection

The design recommendations presented above and operations analysis described below assume an at-grade intersection at Paseo del Norte and Unser Boulevards. Because of high traffic volumes this intersection requires multiple through and turning lanes resulting in a large intersection with very long pedestrian crossings. In addition, two “free-right” turn lanes shown in **Figure 3** (lanes that allow a free flow of right turning traffic without signal control) result in a pedestrian barrier when there are high volumes of right turns as in the peak period.

Pedestrian are required to cross 112 feet of travel lanes on Paseo del Norte excluding the center median (which should be a minimum of 8 feet to serve as a refuge island for slower pedestrians). Unser Boulevard requires a 78 foot crossing excluding a pedestrian refuge. On the approaches which require free right turn lanes pedestrian are required to cross an uncontrolled lane of traffic. Intersections of this size are not uncommon, but are a barrier to pedestrian travel due to real and perceived exposure to moving traffic. Additionally, the required signal timing to accommodate pedestrians can significantly reduce traffic capacity. Options to accommodate pedestrians include:

- 1) Provide conventional at-grade pedestrian crossings on all four approaches as described above. Provide pedestrian signal head (with countdown timers) and pedestrian pushbuttons. Provide a minimum 6 foot wide (preferable 8 foot wide) raised center median on all four legs as a pedestrian refuge with a pedestrian pushbutton. Use appropriate minimum pedestrian crossing times.
- 2) Reduce exposure to free right turn traffic by eliminating pedestrian crosswalks on the northbound Unser Boulevard approach. Provide crosswalks on remaining three approaches. This option reduces pedestrian exposure and may improve



traffic operations but is inconvenient for pedestrians and may be viewed as a further barrier to walking.

- 3) Provide grade-separated pedestrian crossings. This can be either a tunnel or a bridge. The required clearance for a bridge, and ADA grade requirements, results in a long span at significant cost. Similar constraints pertain to a tunnel, but in addition, tunnels are less desirable from a pedestrian security perspective and are less used than bridges. The bridge option may best be accommodated at mid-block locations connecting private developments with high levels of pedestrian demand between them (e.g., connecting an office park with a mixed-use retail area).

### Traffic Operations Analysis

The purpose of the traffic operations analysis is to determine if the circulation network proposed in the Volcano Heights Concept Plan would degrade traffic operations below conditions if the circulation network was implemented as previously planned.

In 1989 the Albuquerque City Council adopted a bill (Enactment No. 169-1989) that establishes the alignment and design standards for Unser Boulevard, specifically Unser Boulevard shall be developed as a divided four lane parkway. It shall have a maximum design speed of 45 mph. Additionally, current City, County and State design guidelines for principal arterial roads recommend signalized spacing at ½-mile intervals with right-in/right-out only intersections at ¼-mile intervals. Paseo del Norte is planned as a six lane divided principal arterial with similar spacing requirements as Unser Boulevard. This adopted set of design standards represents the “base plan” as analyzed below.

The proposed Volcano Heights Concept Plan includes the development of a Town Center located at the intersection of Paseo del Norte and Unser. This town center contains a compact mix of higher-density residential, retail, and office uses. The Town Center also contains a pedestrian-scaled grid of internal streets. Additionally, the Town Center would be served by a proposed Bus Rapid Transit (BRT) system connecting Volcano Heights to job centers including downtown Albuquerque. The street and transit network, combined with the mix of land uses within the Town Center is intended to create a pedestrian and transit-oriented district that encourages trip-linking, and a choice of transportation options that reduces automobile travel. In order to create a walkable street network, and provide multi-modal access to the Town Center from the surrounding neighborhoods, the proposed street network includes full access signalized intersections spaced at approximately ¼-mile.

The Concept Plan proposes that Paseo del Norte within the Town Center be designed as a “boulevard” in the traditional sense. A traditional boulevard is a concept that combines a high-capacity thoroughfare with pedestrian-oriented frontages that encourage street activity. This is accomplished by providing frontage roads parallel to the arterial street separated by a median with breaks that allow access to/from the arterial and frontage



roads. The recommended design of the frontage roads is discussed in the previous section.

The Concept Plan also proposes to include exclusive busway/HOV lanes (high occupancy vehicle) on Unser Boulevard and Paseo del Norte, in addition to the mixed flow lanes (four on Unser and six on Pase del Norte). The busway/HOV lanes would be for the exclusive use of transit vehicles and/or could be utilized by high occupancy vehicles (e.g., vehicles with 3 or more persons). These lanes are critical to ensure the Bus Rapid Transit system is competitive with the automobile. The traffic operations analysis does not model these exclusive lanes resulting in a conservative evaluation. The analysis does reflect transit use in the form of a reduction in traffic volumes (see Forecasting Methodology below).

#### Summary of Forecasting Methodology

Initial year 2025 PM peak hour traffic projections have been developed by MRCOG. The MRCOG travel demand forecasting model is a regional model and estimates traffic volumes at a coarser level than needed to conduct an operations analysis of the Paseo del Norte and Unser corridors. Therefore the MRCOG model link volumes were manipulated to produce intersection turning movements. Two key assumptions were used in the development of traffic projections:

- 1) The MRCOG model link volumes at the “gateways” surrounding the Volcano Heights Concept Plan area remain constant in the initial projections and the derivation of “through” traffic (traffic that passes entirely through the plan area without stopping).
- 2) Traffic projections for land uses within the Concept Plan area are reduced by 25% to reflect the compact, mixed-use nature of the plan as well as the extensive BRT system. The reduction is applied only to trips that have at least one end within the plan area. This adjustment reduces the initial “gateway” volumes described above.

Through traffic in the plan area (traffic passing entirely through the Concept Plan area without stopping) equals about 38% of the total traffic using streets within the plan area. **Figure 9** shows the projected 2025 PM peak hour intersection turning movements for the Concept Plan and **Figure 10** shows the volumes for the Base Plan. Exhibit A provides a detailed description of the traffic projection methodology.

#### Network Assumptions

As discussed above, two scenarios are evaluated in the traffic operations analysis, 1) a base scenario which assigns the projected 2025 PM peak hour traffic to a network with signalized intersections spaced at ½ mile intervals or greater<sup>1</sup>, and 2) a concept plan

<sup>1</sup> There is one exception to this spacing assumption in the base scenario: the intersection of Unser/F Street (Monroe) is located approximately ¼ mile north of the intersection of Paseo del Norte and Unser to permit access to the proposed town center.



scenario which assigns the projected 2025 PM peak hour traffic to a network with signalized intersections spaced at ¼ mile intervals or greater. For comparative purposes both scenarios are based on the same traffic projections—those reflecting the Concept Plan with a 25% internal reduction from MRCOG forecasts. The primary difference between the two scenarios is that the traffic in the base plan is concentrated at fewer intersections and the base plan does not include exclusive BRT/HOV lanes on Unser Boulevard and Paseo del Norte to and from the Town Center<sup>2</sup>. Below is a summary of additional network assumptions common to both scenarios:

- Free flow speed = 45 mph
- Signalized intersection master cycle length = 100 seconds
- Interconnection: Paseo del Norte and Unser corridors are synchronized
- Number of through lanes on Paseo del Norte = 6
- Number of through lanes on Unser = 4
- Intersection turn lanes added as necessary to accommodate demand

Both Paseo del Norte and Unser Boulevards propose exclusive bus lanes leading into the Town Center. Although turning vehicles would be allowed to use these lanes, they are not modeled in the traffic operations analysis because they would overstate the street's capacity. Therefore the analysis is conservative.

#### Comparison of Traffic Operations

As described above the purpose of the traffic operations analysis is to determine whether the proposed Town Center street network would degrade traffic operations beyond conditions with ½ mile intersection spacing. This determination is based on both an intersection delay and level of service evaluation and an arterial travel time and level of service evaluation. **Table 1** compares intersection delay and level of service between the Base and Concept plans. A comparison of the common signalized intersections shows little difference in delay and level of service between the two plans.

**Table 2** compares common performance measures for both Paseo del Norte and Unser Boulevards. Paseo del Norte operates at a similar average speed in both plans, with the exception of a slightly lower westbound speed in the Concept Plan. The base plan network operates at a LOS B eastbound and LOS C westbound, while the concept plan operates at LOS C in both directions. The difference in total corridor travel time between the two scenarios is less than 60 seconds. This can be considered a negligible difference concluding that the Concept Plan does not significantly degrade level of service.

Similar conclusions can be made regarding the comparison for Unser Boulevard in which both plans result in a similar average speed and level of service.

#### Feasibility of Grade Separating Paseo del Norte and Unser Boulevard

<sup>2</sup> While exclusive BRT/HOV lanes are being proposed in the Concept Plan, they are not modeled in the traffic operations analysis.





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*Volcano Heights Concept Plan  
Traffic Analysis  
April 11, 2006*

The objective of the Volcano Heights Town Center is to provide a pedestrian and transit-oriented mixed-use activity center, accessible by multiple modes of transportation. This objective needs to be balanced with a transportation system that must accommodate very high traffic demands. Grade-separating the intersection of Paseo del Norte and Unser Boulevard was identified as a way to accommodate traffic while improving pedestrian access to the Town Center. However, a feasibility assessment of a grade-separated interchange concluded that it would not provide the desired balance.

**Table 1  
Comparison of Signalized Intersection Levels of Service  
Base Plan versus Concept Plan**

Intersection	2025 PM Peak Hour			
	Base Plan		Concept Plan	
	Delay	LOS	Delay	LOS
Paseo del Norte and Woodmont North	3	A	4	A
Paseo del Norte and Woodmont South	n/a	n/a	18	B
Paseo del Norte and Azul	55	D	42	D
Paseo del Norte and Plata	32	C	32	C
Paseo del Norte and Rainbow	215	F	229	F
Paseo del Norte and Universe	218	F	268	F
Paseo del Norte/Office Campus Access	n/a	n/a	59	E
Unser Boulevard and Chasima	n/a	n/a	37	D
Unser Boulevard and Monroe (F St)	33	C	25	C
Unser Boulevard and Paseo del Norte	89	F	90	F
Unser Boulevard and Rainbow	193	F	126	F
Unser Boulevard and Squaw Road	108	F	87	F
Unser Boulevard and SW Parkway	39	D	17	B
Unser Boulevard and Woodmont	n/a	n/a	38	D

n/a = not applicable - Intersection does exist in this scenario.  
Intersection delay = average controlled delay based on the operations method of the 2000 Highway Capacity Manual (TRB Special Report 209).

While a grade-separated interchange of Paseo del Norte and Unser Boulevard would improve traffic operations it would have the following impacts on the town center:

- Grade-separation is inconsistent with the pedestrian-orientation of the town center; while it reduces the volume of traffic pedestrian are exposed to, it increases the size of the intersection reinforcing it as a barrier to walking.
- While the grade-separation concept would cross Pase del Norte under Unser Boulevard, Unser Boulevard would need to be raised as it spans the undercrossing. The spanning of would reduce the visibility of the town center.
- The configuration of the interchange and required right-of-way would affect the shape of the adjacent parcels and orientation and placement of buildings to the street edge.



- Grade-separation precludes implementation of the boulevard concept on Paseo del Norte and Unser Boulevards.

**Table 2**  
**Comparison of Arterial Levels of Service**  
**Base Plan versus Concept Plan**

	2025 PM Peak Hour			
	Base Plan		Concept Plan	
<b>Paseo del Norte Boulevard</b>				
	<b>Eastbound</b>	<b>Westbound</b>	<b>Eastbound</b>	<b>Westbound</b>
Travel Time (minutes)	7.8	7.4	8.1	8.4
Distance Traveled (miles)	3.7	3.7	3.7	3.7
Average Speed (mph)	28	28	28	24
Arterial Level of Service	B	C	C	C
Total Vehicle Miles of Travel (Both Directions)	16,200		15,484	
Total Stops	23,900		27,000	
<b>Unser Boulevard</b>				
	<b>Northbound</b>	<b>Southbound</b>	<b>Northbound</b>	<b>Southbound</b>
Travel Time (minutes)	8.3	7.4	8.3	7.7
Distance Traveled (miles)	2.8	2.8	2.8	2.8
Average Speed (mph)	20	22	20	21
Arterial Level of Service	D	C	D	D
Total Vehicle Miles of Travel (Both Directions)	11,500		11,023	
Total Stops	21,300		23,000	
Arterial level of service based on the 2000 Highway Capacity Manual (TRB Special Report 209) urban streets methodology.				

The section below describes the right-of-way needs for a grade-separated interchange.

Right-of-Way Requirements for Grade-Separation

Based on a single-point urban interchange design, Paseo del Norte would undercross Unser Boulevard, connecting to Unser with on and off-ramps (similar to a diamond interchange configuration). Unser would be required to slope slightly above grade. The undercrossing of Paseo del Norte would require stabilized slopes (2:1) and some retaining walls as well as a bridge structure to accommodate Unser Boulevard and the at-grade single-point intersection. This configuration would require more right-of-way than a conventional at-grade intersection, as shown below.

- 1) Both approaches of Paseo del Norte would require a triangle of right-of-way 1,200 feet in length and 300 feet at its widest point (approximately 150 feet on either side of the street's centerline at Unser).





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2) Both approaches of Unser Boulevard would require a triangle of right-of-way 1,200 feet in length and 150 feet at its widest point (approximately 75 feet on either side of the street's centerline at Pasco del Norte).



## **Exhibit A**

### **Travel Demand Forecasting Methodology**

The steps described below document how the MRCOG year 2025 traffic projections on roadway segments were used to develop more detailed intersection turning volumes for the operations analysis. The methodology derived three types of trips affecting the Volcano Heights project area, and assigned these trips to the proposed network. The three types of trips include through traffic, external project traffic, and internal project traffic. These trip types, and how they were derived, are explained below. The methodology resulted in the estimation of PM peak hour intersection turning movements at key signalized intersections on Paseo del Norte and Unser Boulevards.

#### Derivation of Project Traffic Projections

The “project” is defined as the Volcano Heights area plan as proposed by the City and Taecker. This plan proposes ¼-mile signalized intersection spacing within the Town Center area of the plan, as well as a “boulevard” design on Paseo del Norte within the Town Center.

1. Obtained 2025 Concept Plan PM peak hour, volume shapefiles, TAZ shapefiles, and trip table from MRCOG.
2. Developed TRAFFIX network containing the proposed signalized intersection locations. The network contains Traffic Analysis Zones (TAZs) for each of the seven project zones, consistent with the TAZ system used by MRCOG in its regional travel demand forecasting model. Project area TAZs include: 63110, 63120, 63130, 63340, 63350, 63960, and 63970. The network also contains six project “gates” which create a “screenline” or perimeter around the project area. The gates include: Paseo del Norte (west), Paseo del Norte (east), Unser (north), Unser (south), Rainbow (north), and Universe (north). The TRAFFIX network has a detailed roadway network to reflect the study intersections on Paseo del Norte and Unser.
3. Reduced the trip table data to show trips internal to the project area zones.
4. Determined external “project” trips by TAZ. External trips are trips that begin or end within the Volcano Heights Concept Plan area and travel to/from one of the gates, representing trips that travel “external” to the project area. The external trips were calculated by the total TAZ volumes (measured at the centroid connection) minus internal trips from each TAZ. Internal trips are trips that have both origins and destinations within the Volcano Heights project area.
5. Determined “through traffic” (traffic that passes entirely through the project area from one external gate to another without stopping) on model network. Through traffic volumes were calculated by proportionally reducing the external in/out gates



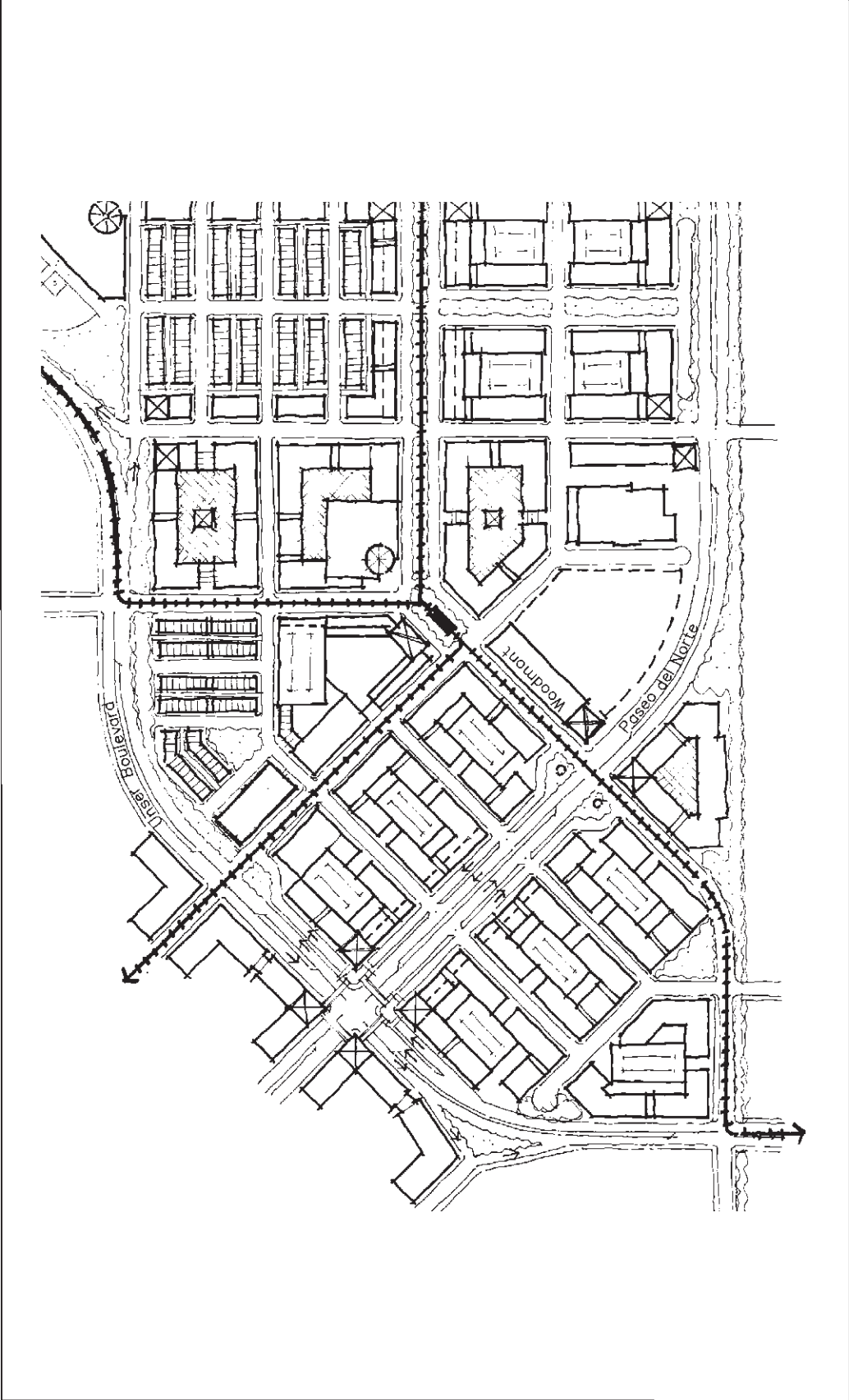
volumes by the external “project” trips. The external gates (Rainbow and Universe) located directly north of the project site were assumed to contain only 5% project volumes.

6. Created a six by six matrix with the “through traffic” in and out volumes for each of the six external gates. Proportionally distributed volumes in the matrix by row then column until balanced. Input the “through traffic” volumes along Paseo del Norte and Unser into the TRAFFIX network.
7. Input the external “project” trips into the TRAFFIX TAZs. Paths were input based on multiple travel patterns that could be expected. Trip distribution was computed for the in and out external trips based on the total gate volumes minus the through traffic volumes. A 25% reduction was taken: 15% of the reduction was applied to the external “project” trip generation to account for non-auto trips<sup>3</sup>, while 10% of the reduction is internal trips made by automobile but that do not use the major arterial streets.
8. Manually distributed internal trips from one TAZ to another based on the MRCOG model’s trip table. Internal trips volumes were input into TRAFFIX.
9. 2025 Concept Plan intersection turning movement volumes were exported from TRAFFIX (final volumes reflected through trip volumes plus internal trips plus external trips).
10. The resulting modeled intersection turning movements were reviewed resulting in some minor adjustments to turning movements at individual intersections. Adjustments were made to either balance volumes between adjacent intersection, or to add traffic to intersection legs to better reflect the proposed land uses accessed by that intersection.
11. Transfer resulting intersection turning movements to SYNCHRO model for detailed traffic operations analysis.

#### Derivation of Without Project Traffic Projections

The Without Project scenario is defined as the Volcano Heights area plan as proposed by the Planning team including Taecker Urban Design and Planning using current roadway design standards that require ½ -mile signalized intersection spacing within the plan area. In this scenario, the volumes derived in the steps above were re-assigned to a lower number of signalized intersections representing current spacing standards.

<sup>3</sup> A 25% reduction reflects a general agreement amongst City planning and transportation staff, and MRCOG staff that the compact mixed-use, and higher density development (as well as proposed transit system) of Volcano Heights results in lower trip generation than if the area was planned on conventional suburban patterns.



**Figure 1**  
**Illustrative Plan of Volcano Heights**  
**Town Center**

**Albuquerque, New Mexico**  
**Volcano Heights**



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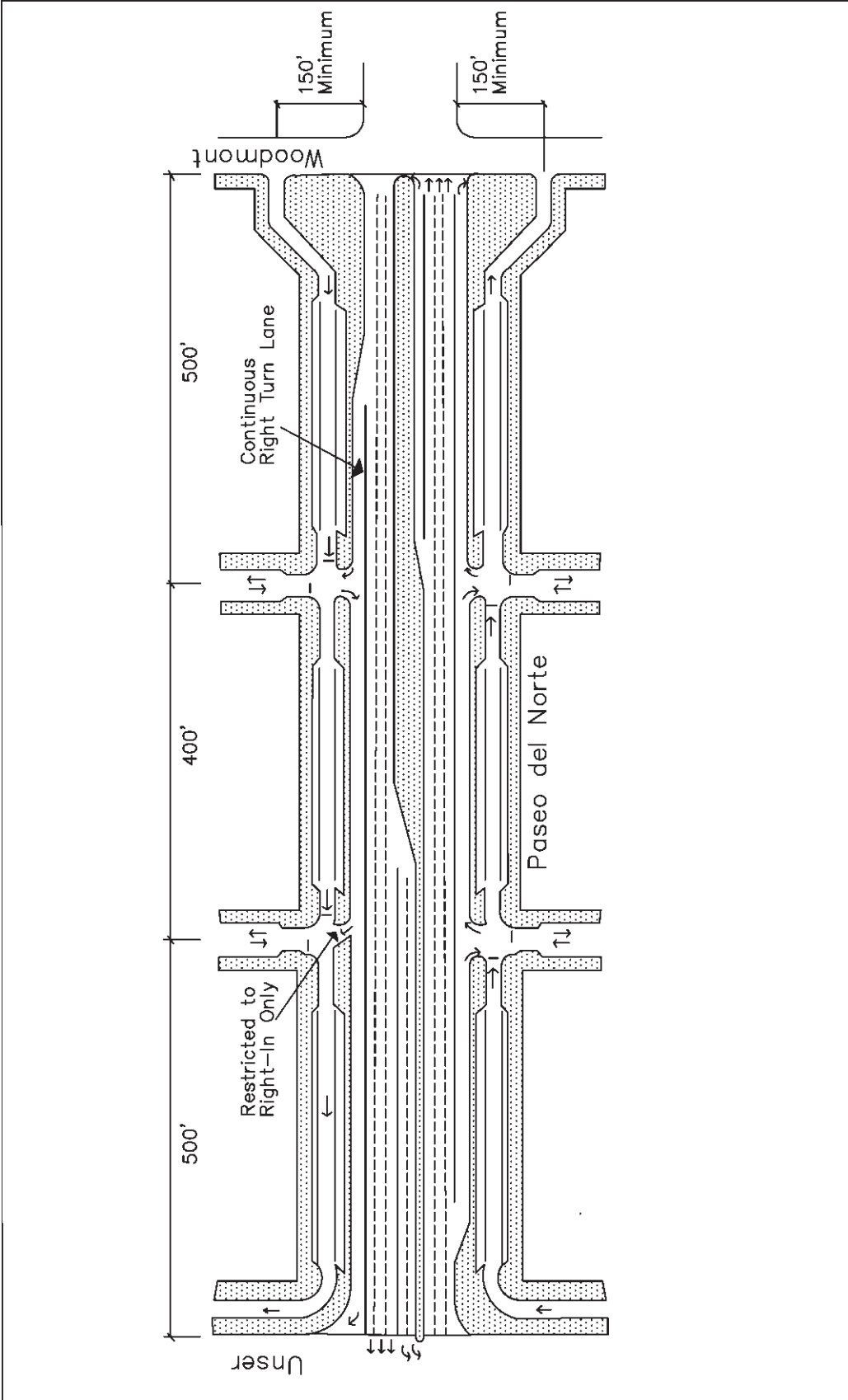
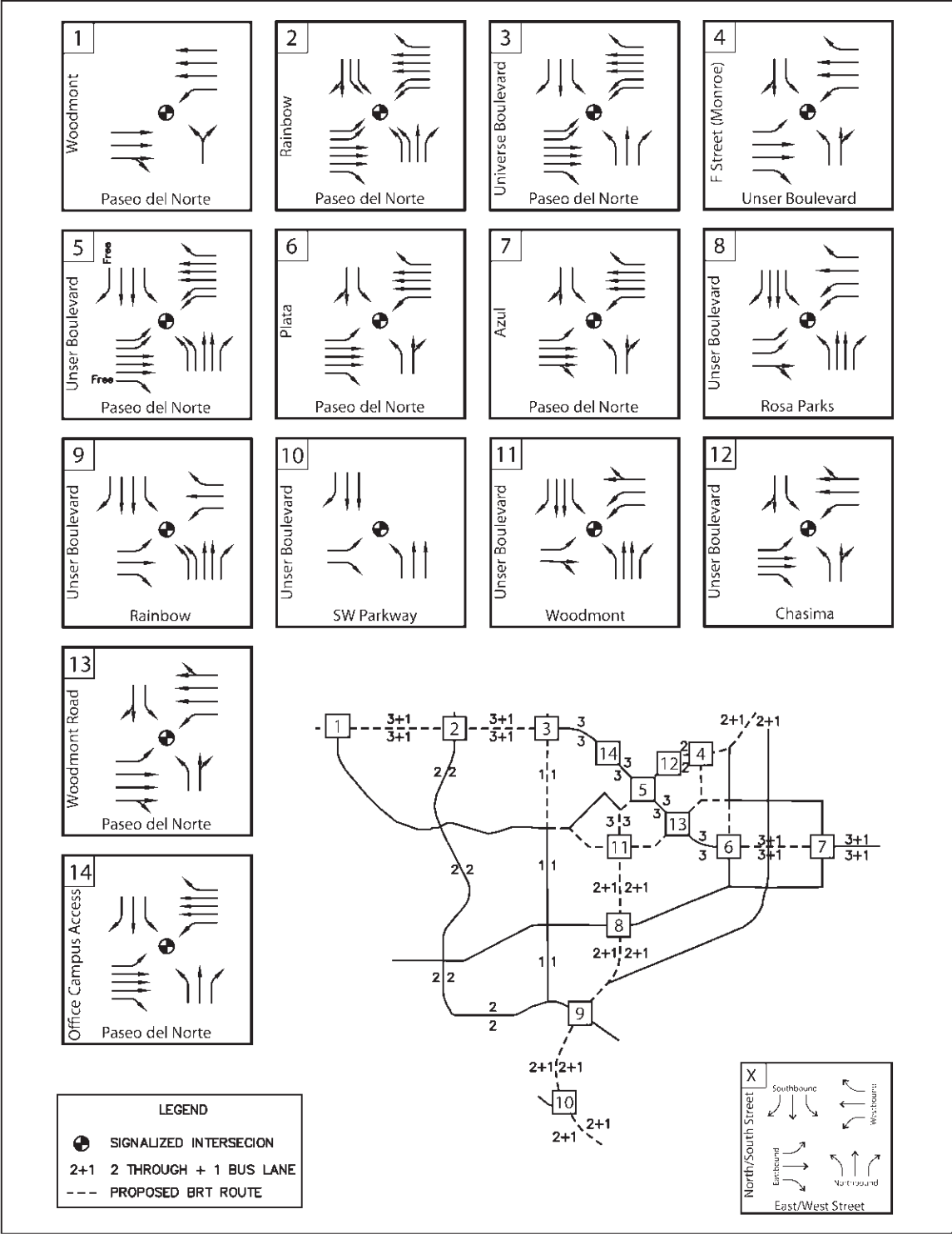


Figure 2  
Conceptual Design of  
Paseo del Norte Boulevard

Albuquerque, New Mexico  
Volcano Heights

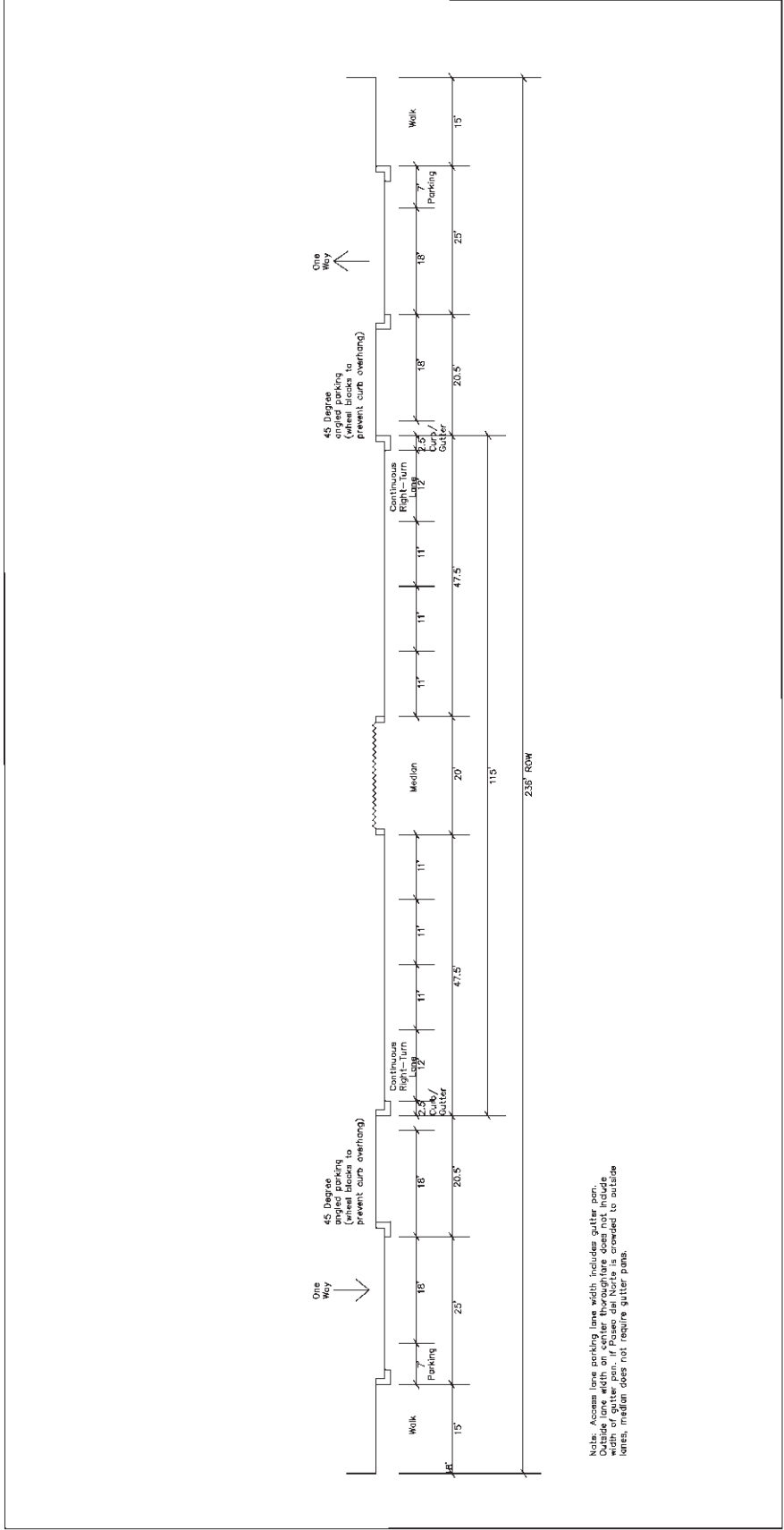




**Albuquerque, New Mexico  
Volcano Heights**

**Figure 3  
2025 Concept Plan  
Lane Geometry**





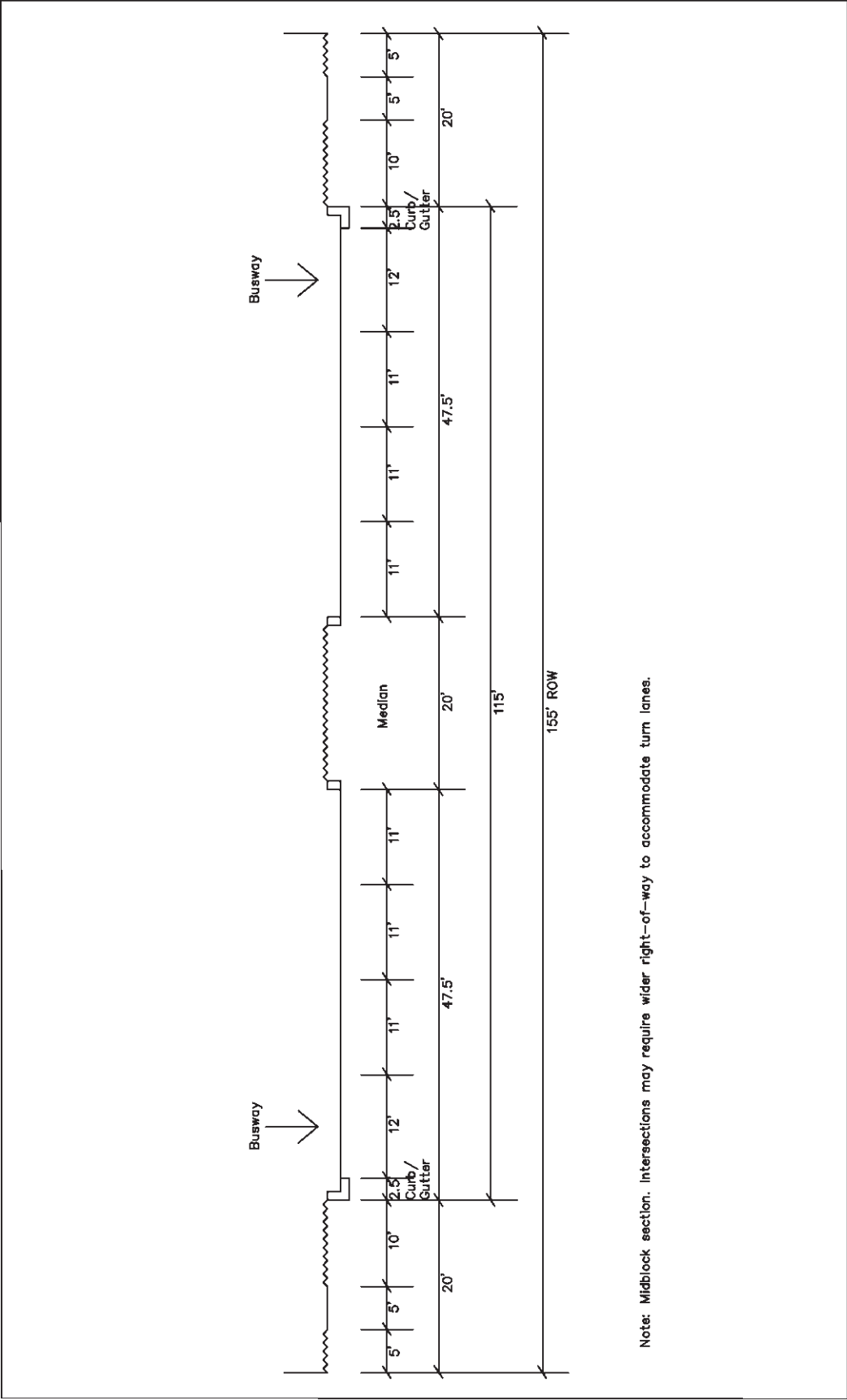
Note: Access lane parking lane width includes gutter pan. width of gutter pan. if Paseo del Norte is crowded to outside lanes, median does not require gutter pans.

**Figure 4**  
**Paseo del Norte (Access Lane Both Sides)**

**Albuquerque, New Mexico**  
**Volcano Heights**





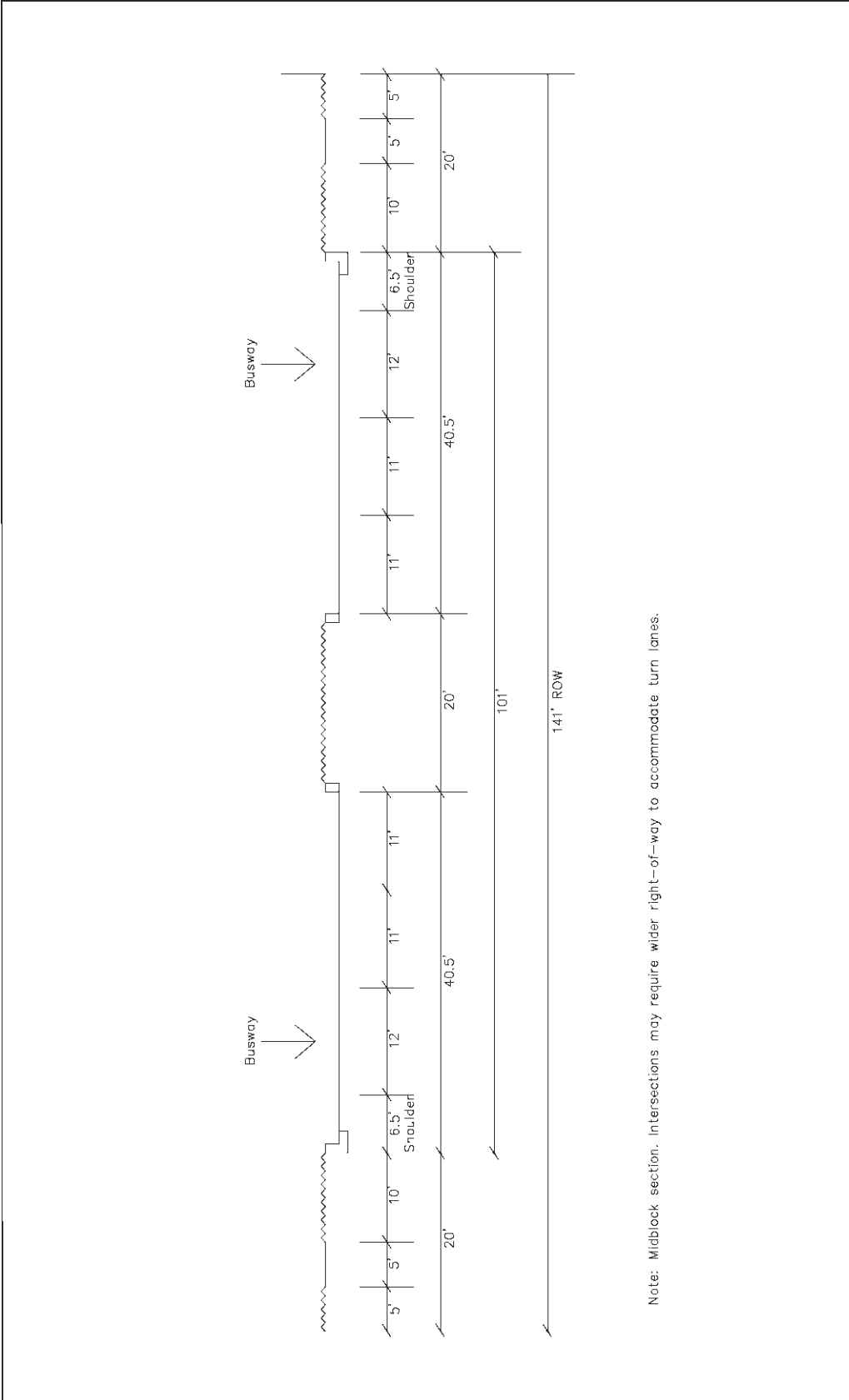


Note: Midblock section. Intersections may require wider right-of-way to accommodate turn lanes.

Figure 5  
Paseo del Norte (6 Lane plus BRT Busway)

Albuquerque, New Mexico  
Volcano Heights



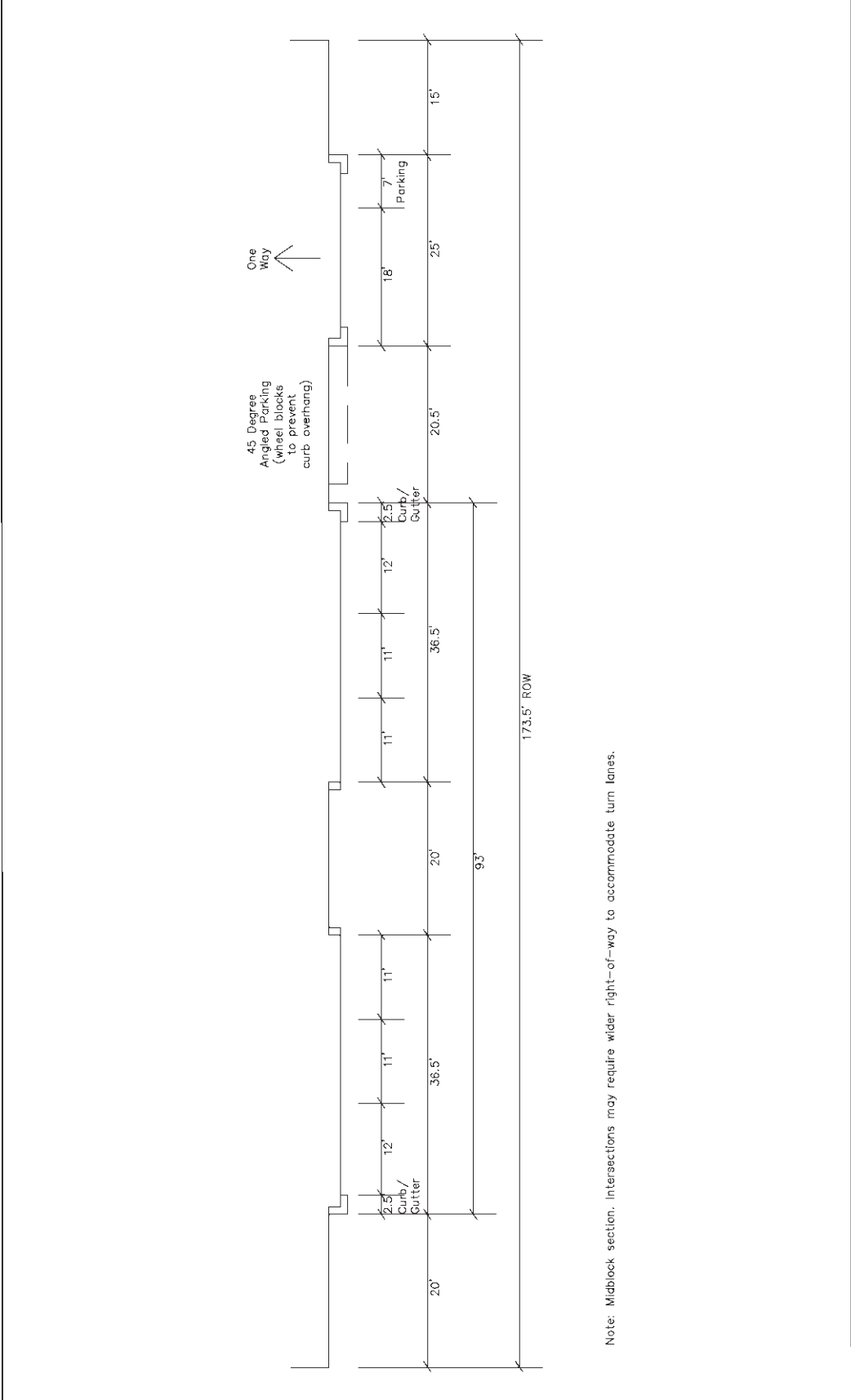


Note: Midblock section. Intersections may require wider right-of-way to accommodate turn lanes.

Albuquerque, New Mexico  
Volcano Heights



**Figure 6**  
**Paseo del Norte 6 Lane without BRT**  
**Unser 6 Lane without BRT (Paseo del Norte to Woodmont)**  
**Unser 4 Lane with BRT (South of Woodmont, North of F St)**



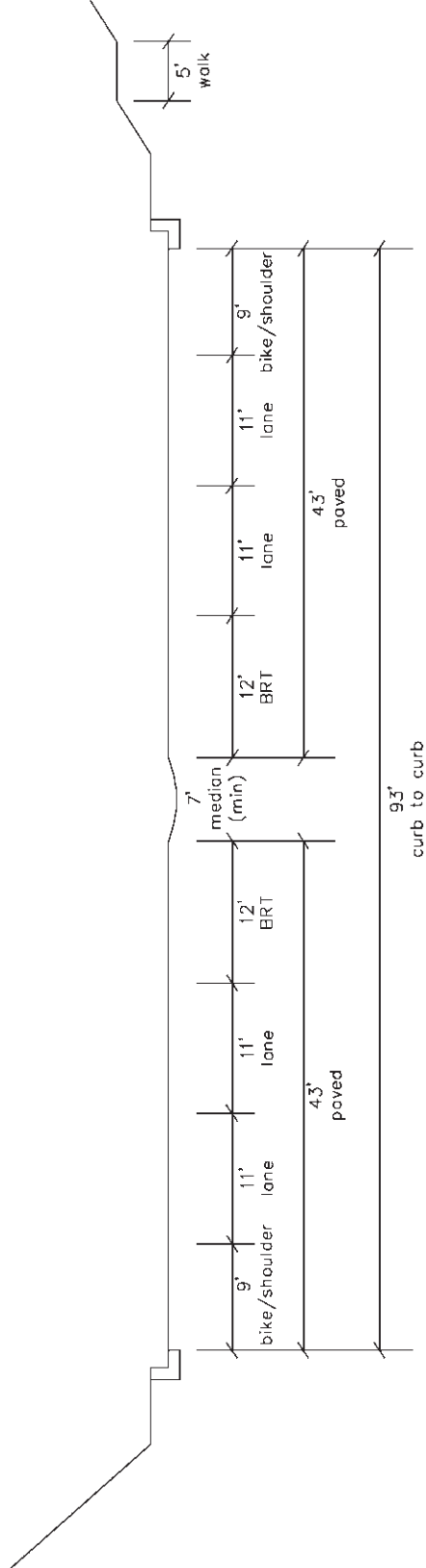
Note: Midblock section. Intersections may require wider right-of-way to accommodate turn lanes.

Figure 7  
Unser Boulevard  
(Access Lane One Side)

Albuquerque, New Mexico  
Volcano Heights



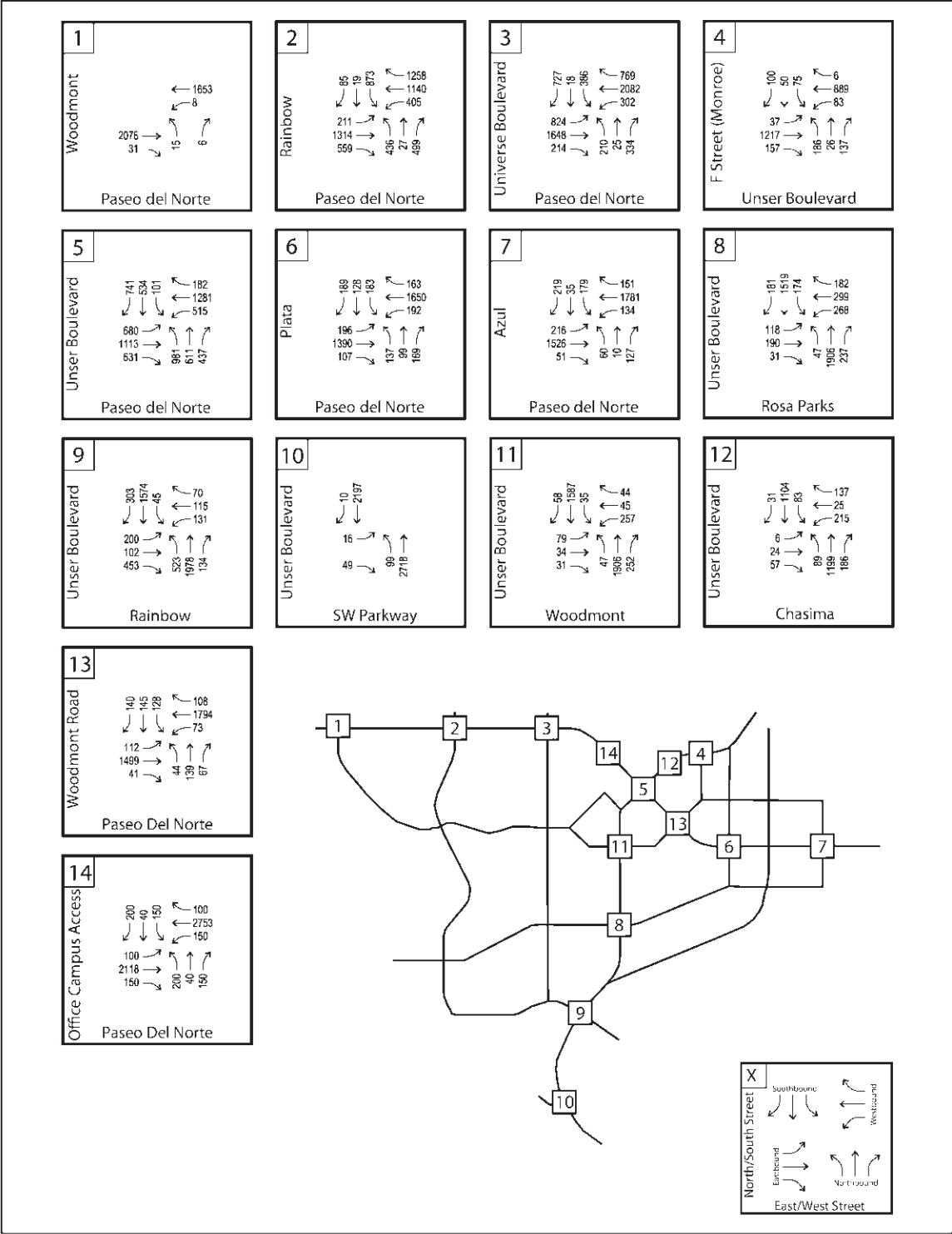
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**Figure 8**  
**Unser Boulevard (with BRT)**  
**Through Escarpment**

**Albuquerque, New Mexico**  
**Volcano Heights**

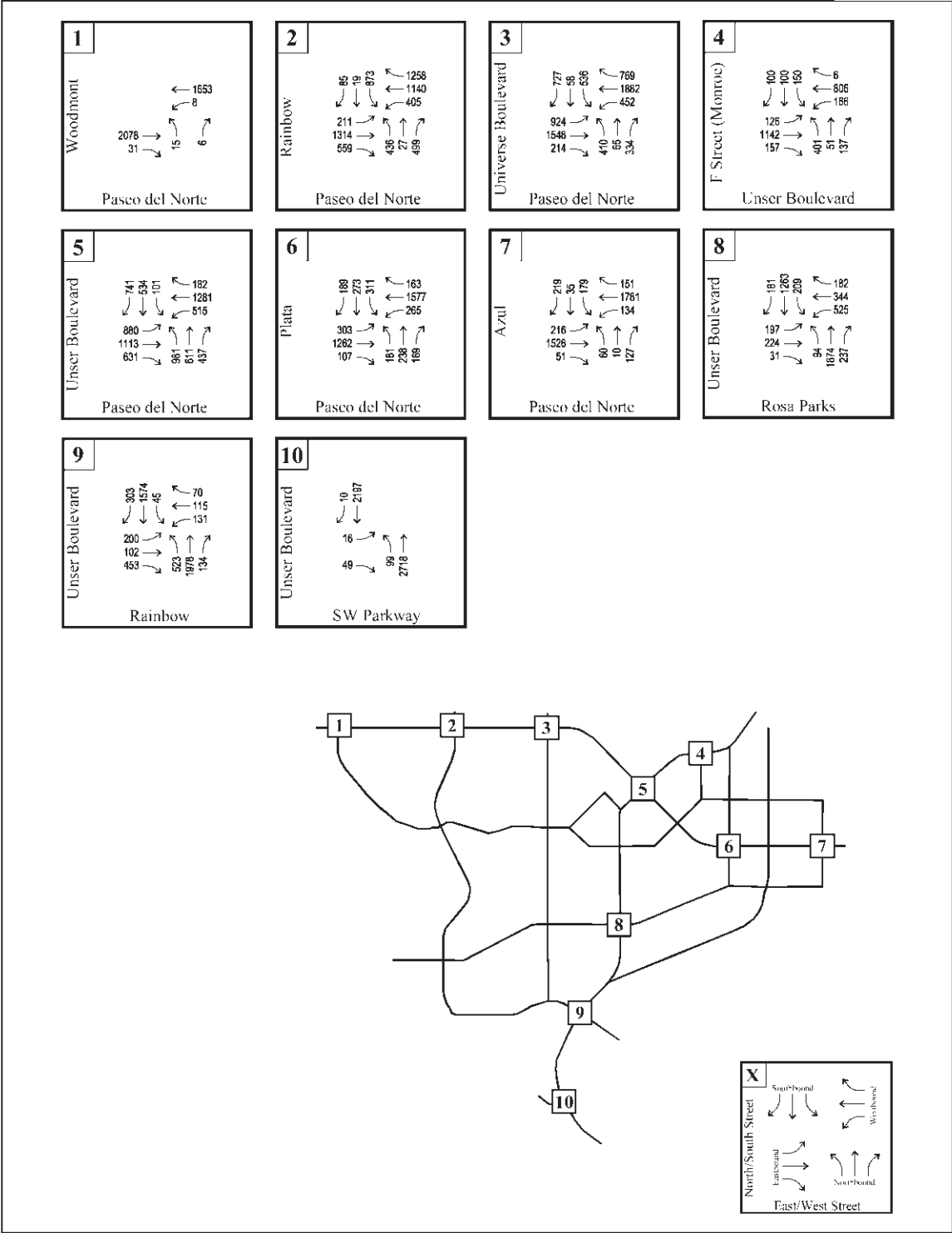




Albuquerque, New Mexico  
Volcano Heights



**Figure 9**  
**2025 Concept Plan**  
**PM Peak Hour Volumes**



Albuquerque, New Mexico  
Volcano Heights

Figure 10  
2025 Base Plan  
PM Peak Hour Volumes

