TECHNICAL APPENDICES

COMMUNITY MASTER PLAN
LEVEL A PLAN : JUNE 2005

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MESA DEL SOL
ALBUQUERQUE SOUTH MESA

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MESA DEL SOL

WATER SUPPLY

A. General

Mesa del Sol will promote and encourage sustainable water system practices, including such innovative approaches as aggressive water conservation, high desert landscaping design, wastewater reuse plans and aquifer recharge programs to ideally use less water per capita than average for the rest of the City.

The latest adopted water master plan, Master Plan of Water Supply for the City of Albuquerque, New Mexico and Environs (1963), included the area that encompasses Mesa del Sol for facilities planning. The site lies physically within what is called the Hubbell Springs Trunk. Subsequent to the adopted 1963 Master Plan, the portion of Mesa del Sol above the escarpment was eliminated from the active water master planning area but is now being reconsidered with the recent advent of master planning for the Mesa del Sol area.

Mesa del Sol lies to the south and east of the existing City of Albuquerque water system. The closest major plant facilities to the area are the Miles Pump Station, situated on University Boulevard approximately one mile east of Yale Boulevard, and Burton Reservoir situated on Carlisle Boulevard at San Rafael Road. Figure A-1 portrays the existing primary infrastructure that is available to initially serve Mesa del Sol within Water Zone 3 facilities. Service is now provided from Burton Reservoir to the Ethicon Plant, located immediately east of 1-25 and north of Rio Bravo Boulevard. The Mountain View addition, located west of Second Street and south of Rio Bravo Boulevard, is now serviced by means of a transmission line in University Boulevard and two pressure reducing stations which then continue west on Rio Bravo Boulevard, west of 1-25. There is one well and a reservoir that presently serve Montessa Park and an on-site well and reservoir on the Journal Pavilion site for service to that facility.

The Mesa del Sol water supply will be designed to conform to the City of Albuquerque Water Resources Management Strategy. Since the water system will be operated and maintained by the Albuquerque Bernalillo County Water Utility Authority (WUA), system component design must conform to specific design requirements. Those general guidelines for the design of the water system as presented here are based on past experience from records for the Albuquerque Metropolitan Area, and current City of Albuquerque master plan criteria. Actual water use at Mesa del Sol may be less per capita because of a combination of water saving devises, water reuse and an aggressive water conservation program, but the basic system design must conform to WUA standards.

B. Water Demand Characteristics

One of the essential elements of water system design and configuration is that of water demands. The development at full build-out will contain a mix of residential, industrial, commercial, and recreational facilities in addition to several urban centers. The major development in terms of land use will comprise more than 6,000 acres of residential development, which will constitute the majority of water system demand with the exception of irrigated parks and playing fields both targeted to use reuse water. The City of Albuquerque has instituted an aggressive water conservation program which consists of education in water use plus water irrigation time restrictions, mandated use of low water use fixtures in new housing, and incentive programs to change out high use fixtures to low use fixtures in existing homes. The result of that program is that per capita use has dropped from nearly 250 gallons per day average to under 180 gallons per day with an achievable target of 150 gallons per capita day (gpcd). The City has not developed water system consumption values on a per unit basis (such as per developed acre or per square foot of constructed development) for other uses such as commercial and industrial development although peaking factors for those usage types are being evaluated. As a consequence the current per capita value includes all uses. The City is continuing its efforts to conserve water, with its new goal to reduce overall use by an additional ten percent.

Unique opportunities, not available to many developed communities, exist at Mesa del Sol to offer reduced water consumption and therefore lower the number of required water rights, including wastewater reuse opportunities. If implemented, per capita consumption could be dramatically reduced. As the Mesa del Sol conceptual master plan is refined as part of the Level B Community Master Plan, these opportunities will be fully explored, and per capita consumption modified accordingly.

1. Peak Day Demand

Water system design criteria are based on two specific related peak system demands rather than average day demand conditions. The first of these is called the Peak Day Demand, which describes the maximum amount of water consumed over a 24-hour period, described as a constant rate over that 24-hour period. The WUA water system is designed so that in any 24-hour period, the amount of water consumed must be replenished by supply, using either well production, surface water supply, or a combination of the two. Peak-Day Consumption under current WUA criteria, is 264 GPCD, based on the goal Average Day Demand of 150 GPCD times the historic PD/AD factor of 1.76 for the last three years The Peak Day production needs for Mesa del Sol under full development, assuming an average of 12 persons per acre, will be 27.88 million gallons per day (MGD).

2. Peak Hour Demand

The second system demand related value, Peak-Hour demand, is the maximum amount of water consumed for any one-hour period of the day. This guideline is particularly important when sizing storage facilities that must provide supply in excess of the Peak Day Production. Based on the last three years of data the residential Peak Hour to Average Day (PH/AD) ratio is 2.98. Using this factor and the goal of 150 GPCD, leads to a PH rate of 447 GPCD.

C. Supply

The Mesa del Sol water supply will be designed to conform to the City of Albuquerque Water Resources Management Strategy. Under this strategy, average day supply on a city-wide basis will come from one treated surface water source. Any consumption in excess of average-day will be supplied from groundwater sources. The implementation of this strategy was completed under the San Juan-Chama Drinking Water Project, designed first to determine then implement the most cost effective means of utilizing the San Juan-Chama surface water supply throughout the city. As a result of the program, San Juan-Chama water in varying quantities will be distributed throughout the City as defined by a combination of economics plus federally mandated water quality standards beginning in 2007.

Because the Southwest experiences cyclic periods of rainfall, the surface water supply cannot be relied on as the sole supply for average-day consumption requirements. Albuquerque's Water Resources Management Strategy recognizes that periods of drought will occur and has established a groundwater reserve as part of the overall water strategy for use during those periods. Consistent with that plan, the Mesa del Sol supply will be designed to be able to provide Average Day supply plus standby capacity from a groundwater well field. The proposed well field would most likely be located within the northern areas of Mesa del Sol.

Arsenic Regulations

New EPA requirements concerning maximum concentration levels (MCL's) and disinfection go into effect in 2006. Among the most important MCL's in terms of impact on groundwater in the metro area is the new arsenic regulation. With promulgation of the new arsenic MCL, some of the water within the Albuquerque area will require treatment above the current disinfection and fluoride treatment currently provided for well fields to meet this new standard. Preliminary water quality samples from the SEO well test field indicate the groundwater below Mesa del Sol will require arsenic treatment to meet the new standards, unless arsenic levels are mitigated sufficiently by the blending of the well water with anticipated San Juan Chama (SJC) Diversion waters. In addition, it is likely that a minimum chlorine contact time requirement will be created for groundwater supplies. Some levels of MCL's contemplated, including the new arsenic regulation, plus chlorine contact time would dictate centralized facilities. With this in mind, plus the fact that the Mesa del Sol groundwater well field must be sized for Average-Day production, it may become prudent to collect all Mesa del Sol groundwater at a single location.

It is assumed for Mesa del Sol that the injection point of the WUA's SJC-treated surface water will be delivered to the Burton Reservioir as part of the east side pipeline project, as shown in Figure A-2. Treated surface water will be integrated into the Mesa del Sol water distribution system, either at the location of Mesa del Sol's groundwater supply storage or into the distribution system service storage reservoirs. Water from the Water Treatment Plant will be distributed by way of two main pipelines, one going east, the other crossing the Rio Grande at Campbell Road. There are four reservoirs on the east side that are in the DWP project – Coronado, Leyendecker, Charles Wells, and Burton. On the west side there are three reservoirs, Volcano Cliffs, College, and Don. The surface water does not reach the Volcano Cliffs reservoir. The DWP reservoir on the east side designated to receive surface water closest to Mesa del Sol is the Burton Reservoir. From Burton Reservoir, water can be dropped to lower zones or pumped by Burton Pump Station to Ridgecrest Reservoir. Because of the elevation of Mesa del Sol and the resulting hydraulic grade, the appropriate location for supply to Mesa del Sol from the city is from Ridgecrest Reservoir or some point between that reservoir and Burton Pump Station.

D. System Configuration Criteria

The WUA has various general system component requirements that must be considered for any water system. The following criteria were used in the conceptual water system configuration. They include the following:

1. System Pressure

System pressure is used to set pressure zone boundaries and configuration, and size transmission and distribution system piping. System pressure requirements are divided into two distinct categories: 1) static pressure or the pressure within the system under system demand conditions; and 2) residual pressure or the pressure that will occur within the system under the full range of system demands that is predicted. The general criteria used for the Mesa del Sol system configuration include the following:

- Static: 100 pounds per square inch (PSI) maximum to 50 PSI minimum pressure.
- Residual: 110 PSI maximum to 40 PSI under any system condition other than fire demand. Minimum pressure of 20 PSI during a fire demand situation.

2. Storage Requirements

Two distinct types of storage are required for the Mesa del Sol ultimate development; service storage and primary storage.

- Service Storage is that storage that provides gravity service to the water system. There are several components that dictate actual storage requirements.
  - Equalizing Storage - Water production from all sources is equal to peak day (PD) demand, requiring sufficient storage within the service reservoir to supply the difference between peak day usage and peak hour (PH) usage, called equalizing storage. Equalizing storage of City facilities currently comprises 36 percent of Peak Day Demand.
  - Fire storage - In the event of a fire during a Peak Day event the fire demand must be supplied by storage. At present the fire storage required by the City for Mesa del Sol is a 6,000 gallons per minute (gpm) fire for a six-hour period.
  - Control Storage - Control storage is that storage required to avoid cycling of production facilities. Required control storage at Mesa del Sol has been determined to be 10 percent of the total of equalizing plus fire storage.
- Primary Storage – In cases where well production is placed within the service area, it must first be collected and treated prior to delivery for meeting system demands. This Storage is called Primary storage since there is no gravity service directly from this reservoir. Primary Storage could also be utilized for Storage of surface water from the City system. The City has stated Primary Storage requirement equal to 10 percent of production capacity. Since surface water could also be utilized the Primary Storage may be larger than that amount, equal to an amount to be determined in further system analyses.

3. System Demand Criteria

A water system must be designed to provide adequate volumes of water at adequate pressures under varying system demands. A water system analysis is conducted with conditions that encompass these various system demand scenarios. The following system demand criteria were considered for this system evaluation:

Peak Day: 150 gallons per capita (Average Day) * 1.64 PD/AD factor
Peak Hour: 150 gallons per capita (Average Day) * 2.98 PH/AD factor
Transfer: Pump Station Peak Day Capacity to Service Reservoir
Peak Day plus Fire: fire at 6,000 gpm/6 hour

E. Proposed Mesa del Sol System Sizing and Configuration

1. Site and System Elevations

The WUA water system configuration is based on providing gravity service from service storage. The highest elevation in the Mesa del Sol boundary is 5,337 feet, and the lowest elevation is 4,910 feet. A minimum static pressure of 50 pounds psi is required by the City. One psi of water pressure in a gravity system is derived from an elevation differential of 2.31 feet. Using this guideline, the minimum high water elevation of a storage facility to serve this area is 5,452 feet. The City has stated that the overflow elevation of Mesa del Sol storage facilities need not correspond exactly to the overflow elevation of existing WUA reservoirs because the Hubbell Springs Trunk, of which Mesa del Sol will become a part, will terminate at the eastern boundary of that development. The overflow elevation of the City's Ridgecrest reservoir of 5,473 feet is more than that minimum 5,452 feet elevation required at Mesa del Sol. Since the maximum static pressure of 50 psi is required, there is an opportunity by constructing the Mesa del Sol facilities at an overflow elevation of 5,452 feet to use the additional hydraulic grade available from the WUA's system to provide water from that source to Mesa del Sol.

2. Phasing

It is proposed that the first phase of development be limited to that amount of development that can be served from a water line extension of the WUA's existing system in terms both of system demand and fire protection requirements. That line extension along the proposed extension of University Boulevard would be a Zone 3E line whose water source is the Burton Pump Station. As proposed development exceeds the capacity of the water line extension in terms of Mesa del Sol itself or those customers currently served by the line north of the Tijeras Arroyo, storage on site with a booster station could be utilized to store instantaneous system peaks and fire protection needs. Once development approaches the capacity of transmission line transport to Mesa del Sol, it becomes imperative that on-site production begin. Groundwater supply can augment surface water supply, but the permitting process for well applications requires public notification and can take considerable time. For that reason, it is strongly recommended that the well application process be pursued aggressively at the inception of Mesa del Sol by the WUA in order for the wells to be approved and permitted by the time they are needed within Mesa del Sol.

3. System Storage Alternatives

Three options exist for the location of system service storage. Each option provides opportunities and has requirements vastly different than the other options so each will be described in some detail in the subsequent paragraphs.

- **On-site Elevated Storage** (Preferred Approach) – Elevated storage has been not been utilized within the existing WUA contiguous water distribution system to date because the topography of the existing service area within Albuquerque has provided the elevation changes required to utilize ground storage in a cost effective manner. Please refer to Figure A-3 for the overall water system master plan and the elevated storage alternative. In the case of Mesa del Sol, the length of transmission line required to construct either at grade ground storage or substantially buried storage is such that on-site elevated storage is more cost effective when the cost of the required transmission line and the off-site storage is considered. A review of possible sites for ground storage or buried storage reveals that possible sites would lie generally north and just east to Sandia National Laboratories Area III and access to the water storage site for maintenance would be problematic for system planners to resolve adequately. Furthermore, the optimum location of on-site elevated storage would be in the designated Employment Center area in the northeast quadrant of Mesa del Sol where the higher elevations would minimize the height of the elevated storage reservoir and provide maximum system pressures.

  Using WUA standard sizing criteria, the ultimate build-out production requirement of 21.16 MGD (Peak Day Demand) and an equalizing storage capacity requirement of approximately 36 percent of Peak Day demand, equates to 7.62 million gallons (MG) storage. Current fire protection provisions of 6,000 gallons per minute for a six-hour duration, would add 2.16 MG storage. Control storage requirements of almost one (1) MG (10 percent of the sum of equalizing plus fire storage) would further increase the total service storage capacity to 10.76 MG. However, elevated storage sizing does not use the same criteria as that stated for ground storage due to the higher construction costs involved with the elevated storage. The equalizing storage must be evaluated considering both energy costs and capital construction costs to determine the optimum equalizing storage requirement. This value will be certainly less than the traditional 36 percent of Peak Day demand equalizing storage. Similarly, fire storage for a system utilizing elevated storage as its service storage is stored in the ground storage reservoir, or primary storage in the case of Mesa del Sol, utilizing a fire pump to provide fire protection service when needed. In essence, some of the storage volume usually found in the ground based service reservoir will be based in the primary storage instead. Both the primary storage and pump station capacity must be upsized accordingly.

- <u>Hubbell Springs Off Site Ground Storage</u> - This alternative conforms to the existing WUA water trunk system approach and existing storage configuration, as shown on Figure A-4. The potential location of a Hubbell Springs ground storage facility to serve Mesa del Sol by gravity, based on an overflow elevation of 5452 feet, is approximately 10,400 feet east of the property, within KAFB. The ultimate build-out production requirement of 21.16 MGD (Peak Day Demand) and an equalizing storage capacity requirement of approximately 36 percent of Peak Day demand, equates to 7.62 million gallons (MG) storage. Current fire protection provisions of 6,000 gallons per minute for a six-hour duration, would add 2.16 MG storage. Control storage requirements of almost one (1) MG (10 percent of the sum of equalizing plus fire storage) would further increase the total service storage capacity to 10.76 MG. Primary storage requirement for the well field or combination well field/treated surface is 2.12 MG, representing 10 percent of Peak Day production requirements. The 10,400 foot transmission main connecting gravity storage facilities to the distribution system would be a minimum 48" or equivalent.

The success of this preferred alternative in being accepted by adjacent agencies and landowners is based on timely discussions with these entities, and subsequent processing of the required permits and agreements. The WUA must take the lead in this effort as quickly as possible, if this alternative approach is adopted at a future time.

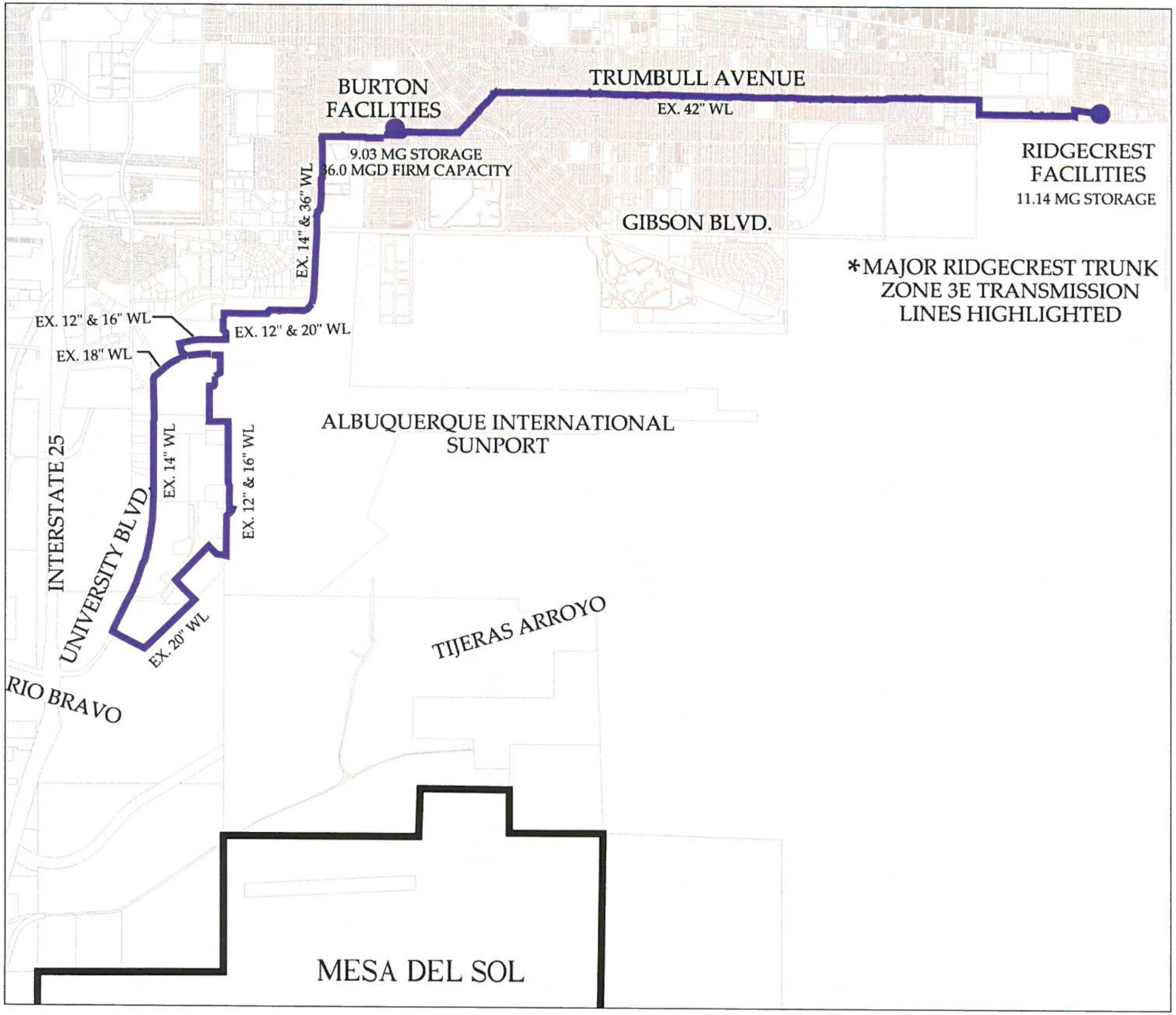
- Ridgecrest Reservoir Alternative – In the event it is deemed not feasible by KAFB to locate storage within the base boundaries and elevated storage is not deemed feasible, it would be possible to utilize the existing hydraulic grade line of Ridgecrest Reservoirs as supply for Mesa del Sol. Please refer to Figure A-5. As stated previously, there is an elevation difference of 21 feet (5,473 versus 5,452 feet) between the Ridgecrest facilities and those required by Mesa del Sol. That difference could be used to transfer water from the WUA's Ridgecrest Trunk, either from Ridgecrest Reservoir itself or Burton Pump Station discharge line. Since initial development, water service could be provided by an extension of the existing water system infrastructure in University Boulevard (whose source HGL would come from Ridgecrest Reservoir and would feed ground on-site storage) and if Ridgecrest Reservoir serves as an ultimate system storage, then another long-term option is to allow the system on Mesa del Sol to essentially float off of Ridgecrest Reservoir. When water from Ridgecrest Reservoir is required, the system pressure on Mesa del Sol would be allowed to drop to a minimum of 40 psi, and, when well supply from Mesa del Sol system is required, any well capacity in excess of that required on-site would be pumped to Ridgecrest Reservoir.

As a result, a new transmission line between Ridgecrest Reservoir and Mesa del Sol must be sized so that the HGL on Mesa del Sol does not drop below that required to sustain a minimum pressure of 40 psi during anything other than a fire event, or no less that 20 psi during a fire event. Similarly the transmission line must be sized appropriately to allow system pressures not to exceed 110 psi under a transfer condition when pumping well water to Ridgecrest Reservoir. The likely alignment across the Tijeras Arroyo for the transmission line may be the southerly projection of Louisiana Boulevard, east of the airport. An existing City sewer line currently uses this alignment today. A portion of this alignment would cross KAFB.

The preferred water system approach of elevated storage and future onsite wells for Mesa del Sol, as shown in Figure A-3. The initial phasing of this system consists of a 24-inch transmission line extension along University Boulevard. As development exceeds system capacity, on-site primary ground storage and a pump station would be provided. Beyond that, a phased well field system and offsite storage reservoirs would be required. Wells and a booster station designed to provide the required ultimate capacity must be constructed. The wells are anticipated to have an average production capacity of 1,000 gallons per minute (gpm), and all wells would produce water to be treated at the primary storage prior to being pumped by the booster station.

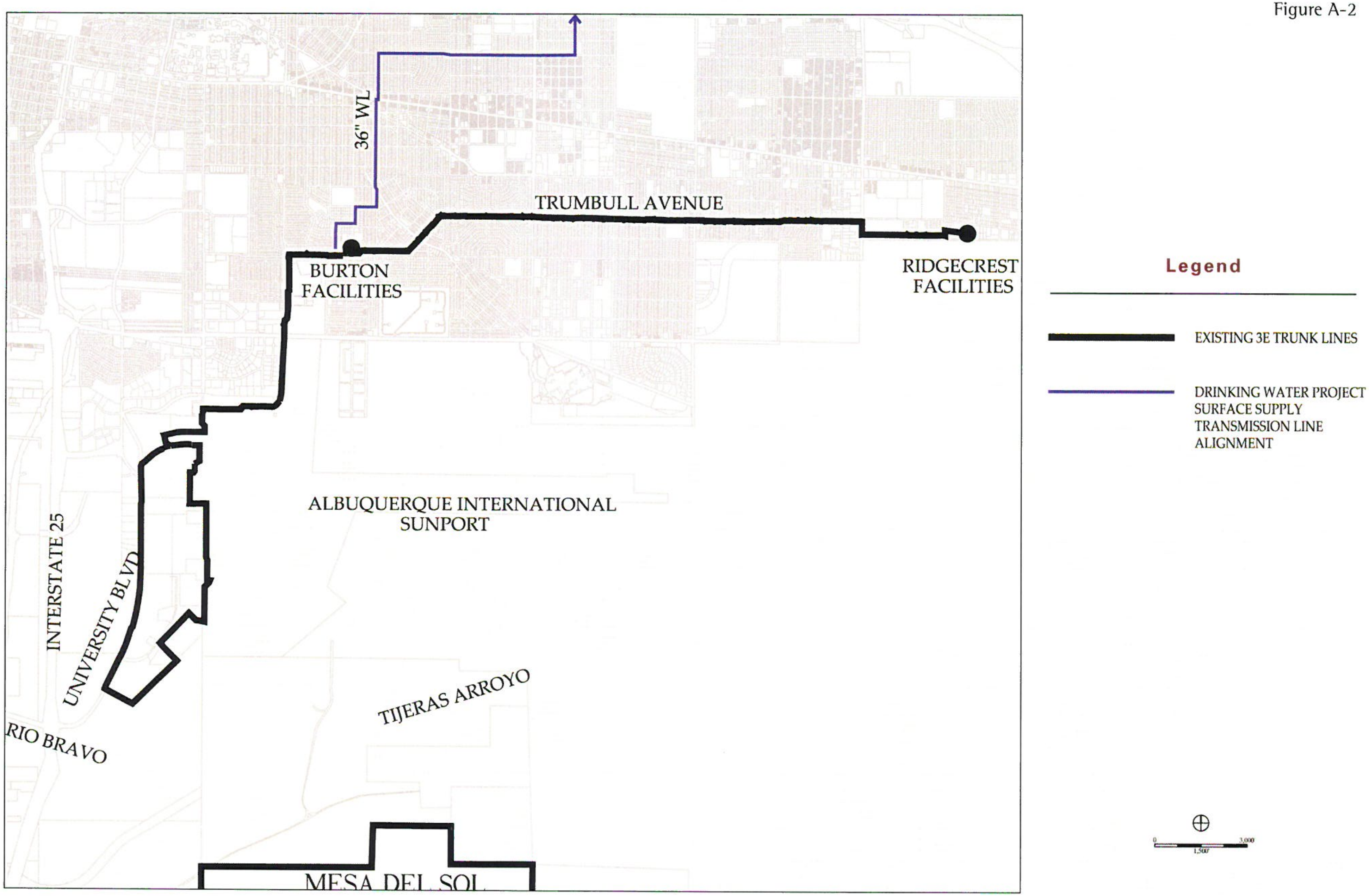
EXISTING WATER SYSTEMS
TRUNK LINES

Figure A-1



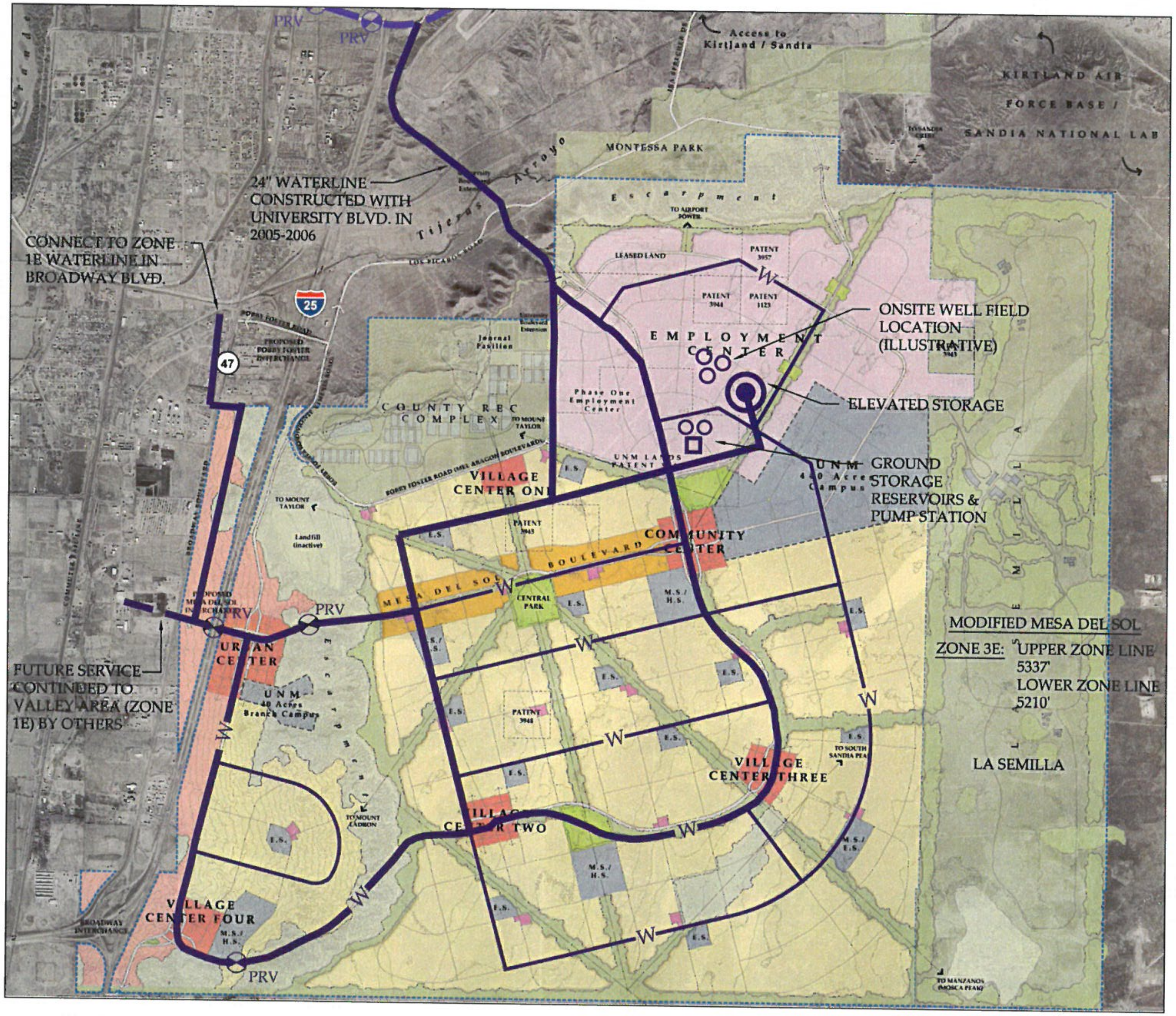
PROPOSED DRINKING WATER PROJECT
SURFACE WATER TRANSMISSION LINE

Figure A-2



PROPOSED ONSITE ELEVATED STORAGE WATER SYSTEM

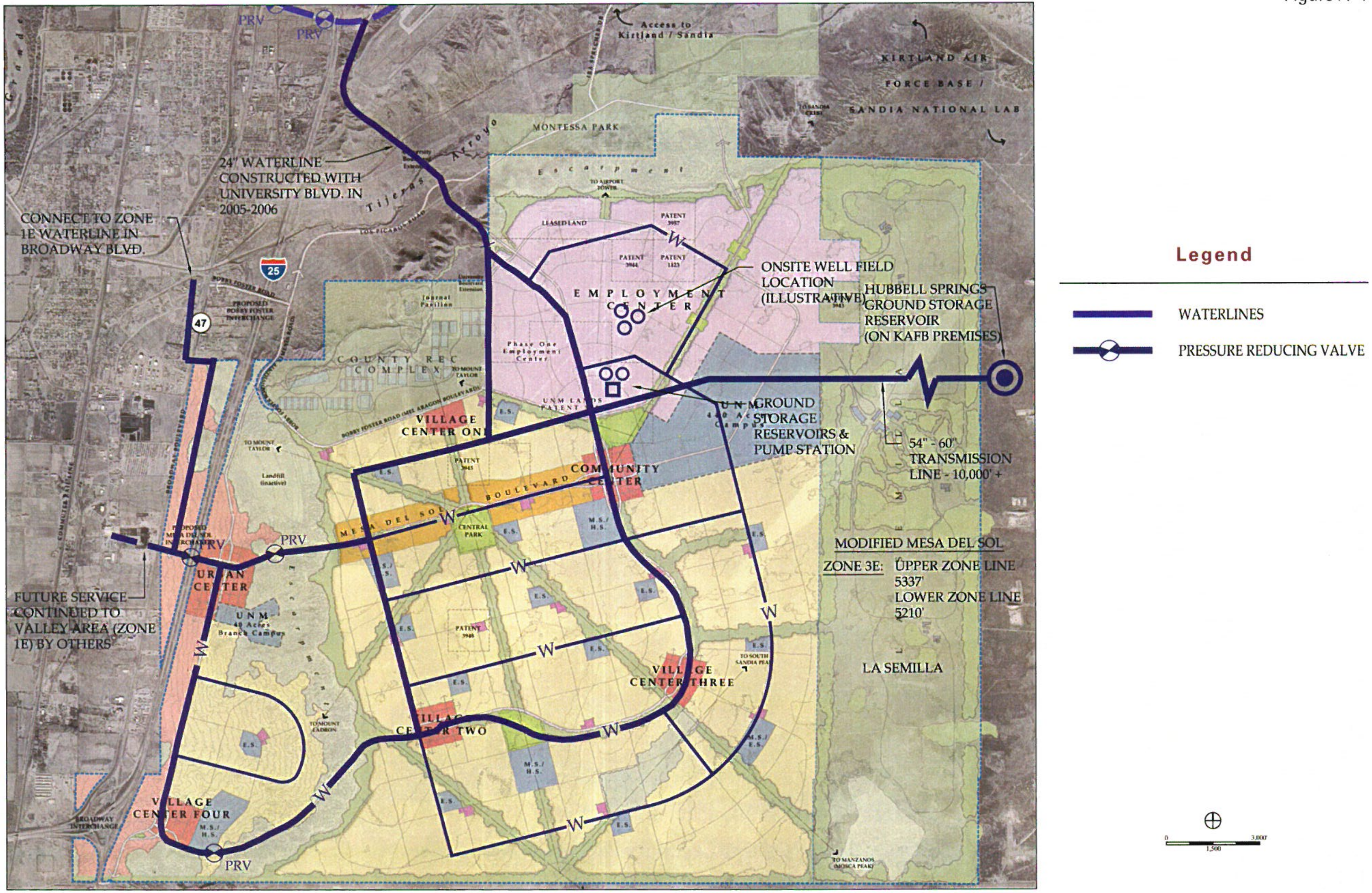
Figure A-3

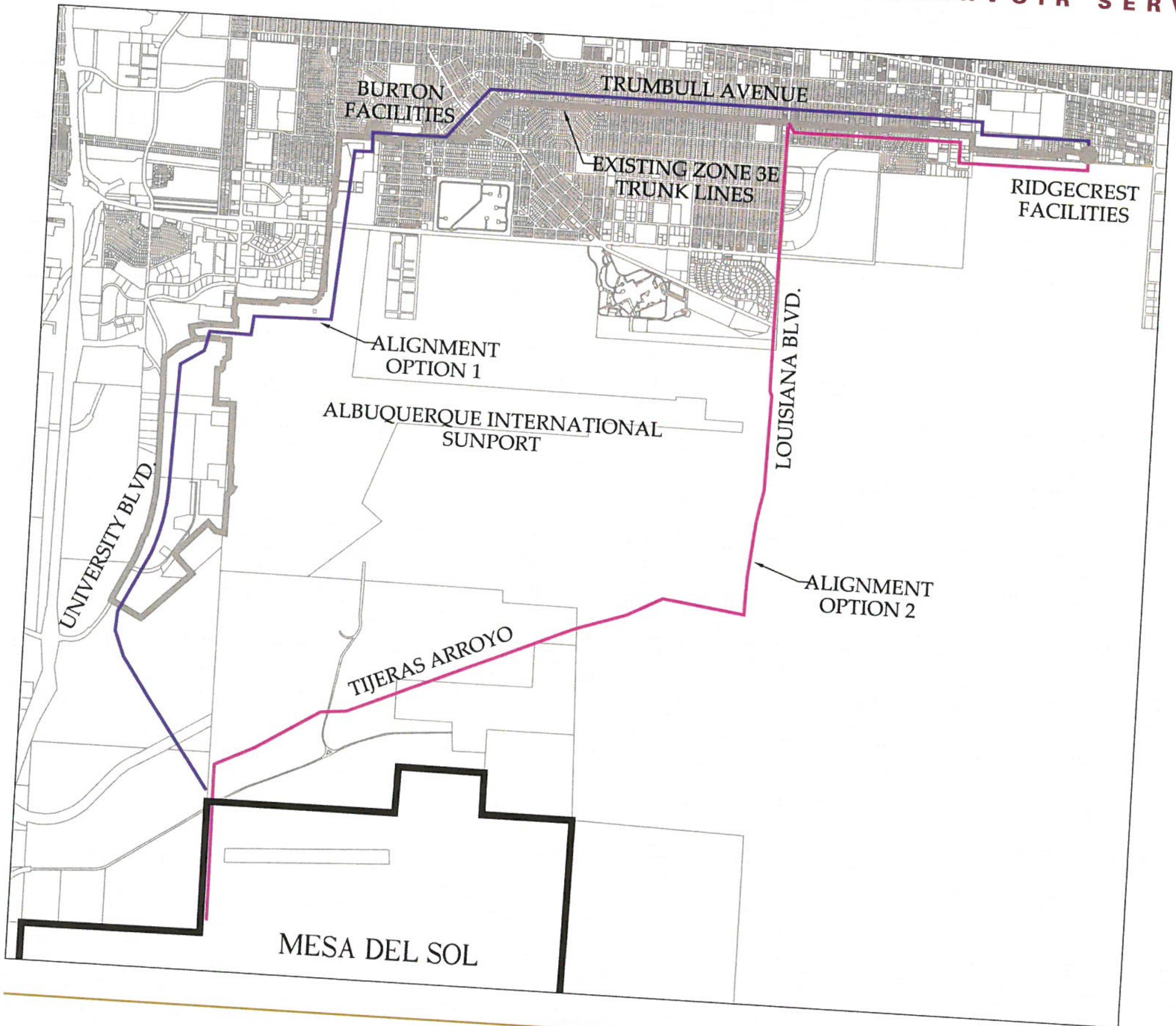


Legend

HUBBELL SPRINGS OFFSITE GROUND STORAGE ALTERNATIVE

Figure A-4





POSSIBLE OFFSITE IMPROVEMENTS WITHOUT AN ELEVATED OR GROUND HUBBELL SPRINGS ZONE 3E RESERVOIR

Figure A-5

Legend

OPTION 1 ALIGNMENT

OPTION 2 ALIGNMENT

STORMWATER MANAGEMENT

LEVEL A PLAN : JUNE 2005

B

MESA DEL SOL

STORMWATER MANAGEMENT

A. Introduction

The Mesa del Sol project is located adjacent to and south of the Tijeras Arroyo, one of the most prominent drainage features in the Albuquerque area. The majority of the planned development area is located within a large natural depression forming a playa basin. In a playa basin, no surface water escapes to the Tijeras Arroyo or any other arroyo or watercourse, and the playa basin therefore is defined as a "closed basin." Areas within the playa basin typically consist of very shallow slopes. These features and related geographical characteristics of the site are portrayed on Figures B-1, B-2 and B-3.

Areas outside of the playa basin, such as the west escarpment area are more typical to Albuquerque in that most of the contributing drainage basins slope toward the Rio Grande or the Tijeras Arroyo. The western escarpment slopes are very unique, consisting of very steep slopes and mostly undevelopable areas. Special attention will be given to development improvements considered in the vicinity of the escarpment. The drainage management planning must respect the intrinsic natural value of the extreme and unique landscape.

B. Existing Hydrologic Conditions

Currently, there are no improved drainage facilities serving the planned Mesa del Sol development. As mentioned, a substantial portion of Mesa del Sol is a closed basin (hereafter referred to as the mesa top). These areas consist of existing natural ground slopes ranging from mild to extremely flat. In the existing undeveloped site condition, the 100-year storm event does not generate a stormwater runoff volume greater than the playa volumetric capacity, including off-site flows. An analysis of the existing capacity for the playas was prepared and included in the revised Mesa Del Sol Level A Master plan prepared by the State Land Office, dated January 1999.

Other portions of Mesa del Sol drain from the site to the south, north, and west. Some small areas along the south boundary historically drain to the south onto the Isleta Pueblo lands. These areas consist mostly of mild to extremely flat slopes.

The northern escarpment located along the north boundary of the project historically drains to the north through private property ultimately discharging to the Tijeras Arroyo. Slopes in this area range from extremely flat to extremely steep.

Significant portions of the project slope to the west and discharge storm runoff to the west (Western Escarpment Area). Stormwater runoff from these areas pass through the existing drainage culverts under I-25 that are intended and designed to serve historic runoff conditions only. Once runoff passes I-25, there are no improved downstream drainage structures to convey developed or undeveloped runoff to the Rio Grande. Slopes in this area range from mild to extremely steep.

Portions of Mesa del Sol are located west of I-25 between I-25 and Broadway Boulevard. These areas consist predominately of steep to relative flat terrain. As stated earlier for the western escarpment slopes, no significant downstream storm drainage facilities currently exist to serve this area.

Off-site drainage basins to the east of Mesa el Sol, including large areas of KAFB, generate stormwater runoff that drains across La Semilla and reaches Mesa del Sol.

C. Proposed Developed Hydrologic Conditions

Each of the described areas of Mesa del Sol will require different management concepts depending largely on the outfall available or lack thereof. Within the mesa-top area, containment onsite will be the principal stormwater management strategy. Areas that have positive drainage outfalls available will use more conventional storm drain management systems. Please refer to Figure B-4 for the overall graphic representation of stormwater management planning for Mesa del Sol.

1. Mesa Top Area

The majority of Mesa del Sol is part of a unique hydrologic area for Albuquerque consisting today mostly of many small playas and several large playas. Preserving this historic theme, Mesa del Sol's undeveloped and developed runoff is proposed to be retained on the mesa top. Based on the historic conditions of Mesa del Sol drainage, this solution is reasonable and viable. It is recommended within the master plan that on-site retention ponds be used as the primary stormwater management method for the mesa-top area. The proposed system would consist of an engineered retention pond system of many retention ponds strategically located throughout the development.

The mesa top clearly has unique characteristics, affecting the procedural aspects of drainage planning as well, since the City's Design Process Manual (DPM) does not specifically address these characteristics. The DPM considers terrain that has slope and a conveyance to the Rio Grande, either natural or manmade. The DPM requires all water to drain within 24 hours, and therefore requires a release of stormwater to downstream areas. As the mesa-top playas do not have an outlet, the detention ponding and the flow rate design criteria of the DPM are inadequate for these areas. Furthermore, retaining the natural ability for recharge in this area is critical to preserving the existing historic nature of the mesa top's playa basins, as well as beneficial. The retention ponding approach for Mesa del Sol will provide a non-typical but sustainable drainage management solution.

Similar to what has been done for valley areas in Albuquerque, it is clear that an exception to the DPM will have to be granted in order to address the playa condition.

The existing playa has been determined by recent studies to provide sufficient capacity to accommodate the 500-year storm event. The 100-year design storm, a more common threshold of study, for the mesa top generates approximately 1,000 acre feet of water, well below the 2,400 acre-feet capacity of the existing playa system. Therefore, a proposal to contain all undeveloped and developed runoff onsite within the playa area is reasonable and viable, and is proposed as a part of the drainage master plan.

The State Engineer has jurisdiction over stormwater runoff and also requires evacuation of stormwater within 96 hours. Both the City and the State Engineer normally require release of flows to the Rio Grande; however, both agencies typically are assuming man-made structures exist in an environment that naturally outfalls to the river. The State Engineer's Office has stated playas are recognized and as such in cases involving playas, the State will not require the stormwater to be drained to the River.

In review, the unique characteristics of the mesa top, the City DPM's inadequate coverage of this condition, the State Engineer's recognition of the role of playas, and the playas themselves demand a non-typical drainage management solution. Such solutions include on-site containment of all stormwater runoff by means of a engineered retention pond system that consists of many retention ponds strategically located throughout the development. The Distributed Retention and Infiltration Pond (DRIP) system is proposed for the mesa-top areas.

The existing FEMA floodplains, located over the playas, will not be impacted by Mesa del Sol development until possibly the middle stages of development. However, when proposed development threatens to disturb the floodplains, appropriate design and administrative procedures to remove the floodplains from FEMA maps will be required.

2. Retention Pond Design (DRIP) Concepts

Large-scale and aesthetically pleasing retention ponds are proposed to be the primary stormwater management concept, as conceptually portrayed in Figures B-5 through B-8. The retention ponds generally will be large, regional drainage facilities planned to be strategically located within large public open spaces or parks. Multi-use facilities are often planned for these areas to serve as public open space, parks, ball fields, playing fields, and other recreational use areas. The non-drainage uses will be designed to consider the drainage function. The design storm should be appropriately designed for a storm event that considers the lack of an over-flow outfall and the potential for property damage should the storm event exceed the capacity of the facility. The design standard is proposed to be the 100-year 10-day storm event (as defined by the City DPM). For this region, this design storm is approximately 3.6 inches of rainfall applied over a time frame of 10 days.

The ponded areas are to utilize appropriate Best Management Practices (BMP's) and to comply with all local, state, and federal laws and requirements, especially the City DPM and Drainage Ordinance. Because of the retention ponding approach, other stormwater management practices may also be employed. Such practices may include water harvesting, water re-use for irrigation, and other water conservation uses.

Each retention pond or a system of retention ponds, will be self contained and not necessarily connected to any other ponding areas. This approach is somewhat modular and scalable and therefore ponds can easily be located anywhere design needs dictate and can be sized to meet the design flow necessary for the contributing area. This ease of location and design makes the DRIP system applicable to all parts of the mesa-top area.

The DRIP system is conceptually proposed to consist of a multi-stage system made up of several smaller storm drain components contained within a large pond. In summary, the system will consist of a collection system, an inlet structure, an energy dissipater structure, a diversion structure to divert water to a water quality facility, a water quality facility (forebay pond), the main ponding area, and an infiltration basin, all of which are contained within the larger retention pond.

In addition to the ponding capacity, the ponds will use a collection and infiltration feature to infiltrate stormwater. The infiltration measures are an extra step that will:

- address minimal nuisance ponding,
- assist in the ultimate evacuation of the ponded water,
- speed up the process of evacuating ponded water,
- lessen the potential for creating a mosquito habitat, and
- reduce the impact of ponding water on the proposed recreation and open space uses.

Inlet Structure

At the point the collection system discharges into the DRIP pond, an energy dissipater/inlet structure is proposed to collect incoming flow and transition the flow into the ponding/open space without system damage and in a safe manner appropriate for a potential multi-purpose use area. The inlet structure may also divert flow to the water quality ponds.

Water Quality Pond

Within or near the inlet structure/energy dissipater, low flows are diverted to the water quality pond, also called the forebay. The purpose of the forebay is to collect the "first flush" runoff carrying the majority of the sediment, floatable contaminants, and contaminants such as oil, metal, antifreeze, etc. The water quality pond attempts to intercept and remove much of these pollutants. The pond design, material, and plantings are essentially a filter that is planned to be disposable, replaceable, and maintainable. Once the pond reaches a point over time where it can no longer filter out the target contaminants, the filter soil and plant materials are to be excavated and placed in a solid waste facility. The soil and plant materials are replaced and the cycle is started again, to be perpetuated indefinitely. The design storm event is typically small, and may be approximately the first one-quarter inch of runoff of any storm event.

Main Storage Pond

The primary purpose of the main pond is storage of the design storm and contains all of the operational components listed. The main pond is also intended for other uses such as improved parks, playing fields, and open space areas. Areas within the pond intended to receive high use landscape treatments, such as parks or playing fields with turf, will be raised from the pond bottom such that the surface is equal to or above the two-year storm event. The lower areas of the main pond that receive the higher frequency storm runoff events are to be improved and planted with species of plants appropriate for such an open space environment, able to absorb water so as to make evapo-transpiration possible and to further filter the water moving through the main pond. It is here that water harvesting methods may most easily be used to support plant species that otherwise could not survive, resulting in a desirable habitat and open space.

Infiltration

Throughout the pond system, stormwater will be consumed by minor local infiltration, evaporation, and evapo-transpiration. This rate of recovery and discharge is highly variable; therefore, a system of infiltration wells will be used as the final discharge point of the system. This will ensure proper infiltration when there is not enough capacity at minor local areas to infiltrate all of a major storm event. The design event for the infiltration wells is intended to maintain the health of the plant materials within the pond system subject to inundation and to eliminate a potential for creating a habitat for mosquitoes or unacceptable standing water. The infiltration/injection wells will be constructed facilities that act under passive hydrostatic pressure "to inject" stormwater into the subsurface soils. It is estimated that existing technologies and methods will be used that consist of vertical or horizontal perforated pipes that leach stormwater into the subsurface soils. The sizing and details for the system will be highly dependant on the infiltration capacity of the sub soils, yet to be determined. A maintenance program for the wells will be established to ensure proper operation.

Maintenance

Maintenance of the major storm drains, DRIPs, and related storm drain systems are anticipated to be City of Albuquerque or Mesa del Sol or both entities' responsibility via a maintenance sharing agreement. However, a private development association or private Public Improvement District (PID) or similar entity may also be considered for such ownership and maintenance.

Further planning and design is required to refine the master plan and the drainage management concepts. As a part of the development process, subsequent master plans will be developed in greater detail. Associated and corresponding drainage management plans will also be developed to support these master plans. More detailed designs will address the final design and operation of the DRIPs.

3. Western Escarpment Area

The escarpment and the areas to the west are proposed to be served by conventional storm drain systems. This area currently lacks significant downstream storm drain infrastructure. This area is a part of the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) Southeast Valley Drainage Management Plan area. In this study, AMAFCA identified a system of channels and storm drains that would collect developed runoff from the region including all of the west escarpment area of Mesa del Sol, then convey and discharge the stormwater runoff to the Rio Grande. Mesa del Sol proposes working with AMAFCA to develop a regional drainage plan that further details and refines the Southeast Valley Drainage Management Plan (SEVDMP) to include Mesa del Sol's planned improvements (not currently in the SEVDMP).

Mesa del Sol plans to use conventional storm drain improvements consisting of retention ponds, detention ponds, surge ponds, and storm drain sewers to collect, hold, detain, and release developed stormwater runoff to the AMAFCA- sponsored SEVDMP. Mesa del Sol will also participate with AMAFCA in the planning, design, funding, and construction of the outfall storm drain facilities necessary to convey stormwater to the Rio Grande. Preliminary review of the SEVDMP suggests that a modified version of option I-B is most appropriate for the area.

In this option, the SEVDMP collects 2,815 cubic feet per second (cfs) and detains the runoff in a detention facility planned to be approximately 187 acre feet in size. The detention pond discharges at a flow rate of 78 cfs to the Rio Grande via a 48-inch diameter storm drain. This current AMAFCA DMP design does not account for developed flows from Mesa del Sol. An amendment to the plan to accommodate the developed condition is required. In concept, Mesa del Sol proposes using on-site detention and retention ponding to reduce discharge rates from Mesa del Sol to levels equal to or less than the capacity of SEVDMP.

This option, in concept, calls for the Barr Channel to be improved for stormwater conveyance purposes and extended south to a proposed detention pond to be located at the intersection of I-25 and the railroad tracks. Collected stormwater will be released from the detention pond in a 48 inch diameter pressure storm drain pipe that is planned to outfall to the Rio Grande, crossing over the Middle Rio Grande Conservancy District (MRGCD) Riverside Drain.

Because conventional drainage management methods are proposed for this area, standard design criteria will be used, as defined by the City of Albuquerque Development Process Manual for the 100-year six-hour storm event. Temporary interim retention ponding is planned to be used to allow development in a phased manner. The interim retention ponds would be ultimately removed or replaced by detention ponds and public storm drains once the downstream storm drains are in place and operational.

Maintenance of the major storm drains and related facilities in this Western Escarpment area are anticipated to be a public entity (the City of Albuquerque or AMAFCA) responsibility.

4. Northern Escarpment Area

Areas located along the north boundary of the project historically drain to the north through private property, ultimately discharging to the Tijeras Arroyo. These areas are relatively small and represent a negligible portion of Mesa del Sol. Because of sensitive steep slopes, this area will not be developed, and accordingly, drainage patterns will continue as they always have occurred.

5. La Semilla

The easternmost section of Mesa del Sol is the one-mile wide La Semilla. La Semilla is a reserve where little or no development is planned. This property and the remainder of Mesa del Sol share playas that cross into both areas. Off-site basins originating on KAFB to the east drain across La Semilla onto Mesa del Sol. Approximately 3,210 cfs reaches Mesa del Sol via La Semilla. The possibility of using La Semilla to intercept and pond stormwater before it reaches Mesa del Sol will be studied. It is assumed that all off-site stormwater generated by KAFB and La Semilla will be accepted by Mesa del Sol and the affected DRIPs will be designed accordingly.

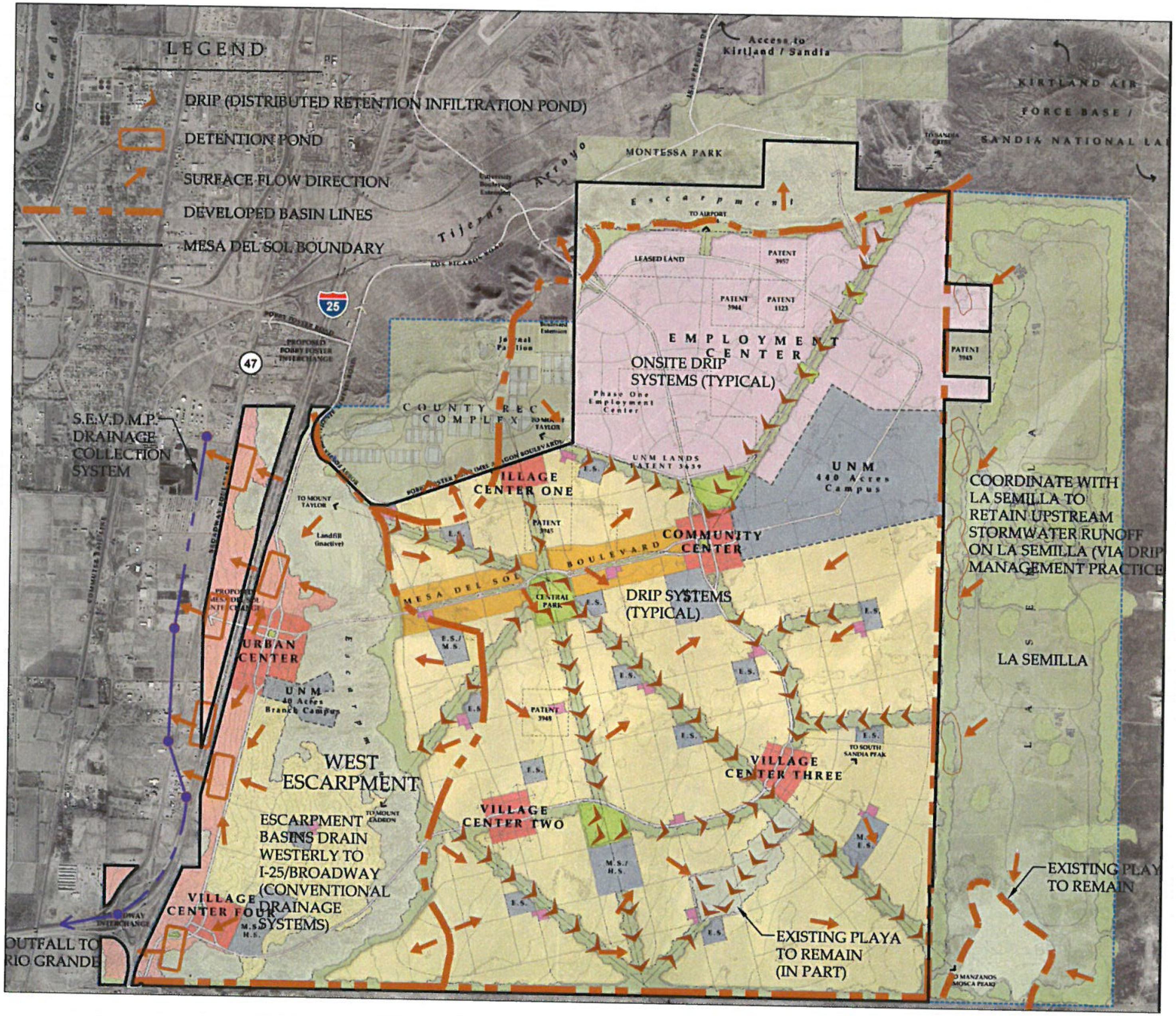
6. Bernalillo County Recreational Complex

Located adjacent to and north of Mesa del Sol and adjacent to and west of University Boulevard is the Bernalillo County Recreational Complex. The complex is approximately 600 acres and is planned to contain many public entertainment and recreation activities, such as playfields, in addition to the existing amphitheater (Journal Pavilion) and a soccer field complex. Generally speaking, no stormwater will be received from or discharged to the County complex. The current concept plan does not see a need to accommodate cross drainage. However, subsequent planning and design of both Mesa del Sol and the County complex may indicate a need for cross drainage. Such accommodations are possible and will be considered. At this time, this master plan does not consider cross drainage and the two projects are assumed to be hydraulically separate and independent.

D. Further Planning

As planning proceeds with the development of the Level B Master Plans, site specific drainage plans will be developed that further define the drainage management methods needed to accomplish the concepts presented in this plan. Subsequent submittals will include a detailed and comprehensive drainage management plan study for the entire development. The study will include the benefit of additional meetings, discussions, design thought, planning, and advancement of the concepts presented. Mesa del Sol will work closely with the Office of the State Engineer, City, County, and AMAFCA in order to incorporate each agency's concerns and requirements and to develop a detailed plan that is acceptable to all parties.

Figure B-1



NOTES:

- THE SITE CONSISTS OF 2 MAJOR AREAS: THOSE AREAS THAT DRAIN TO NATURAL PLAYA BASINS (MESA TOP) AND THOSE AREAS THAT NATURALLY DRAIN TO THE WEST (ESCARPMENT AREA).
- SHOWN FACILITIES ARE ILLUSTRATIVE ONLY.

MESA TOP AREA

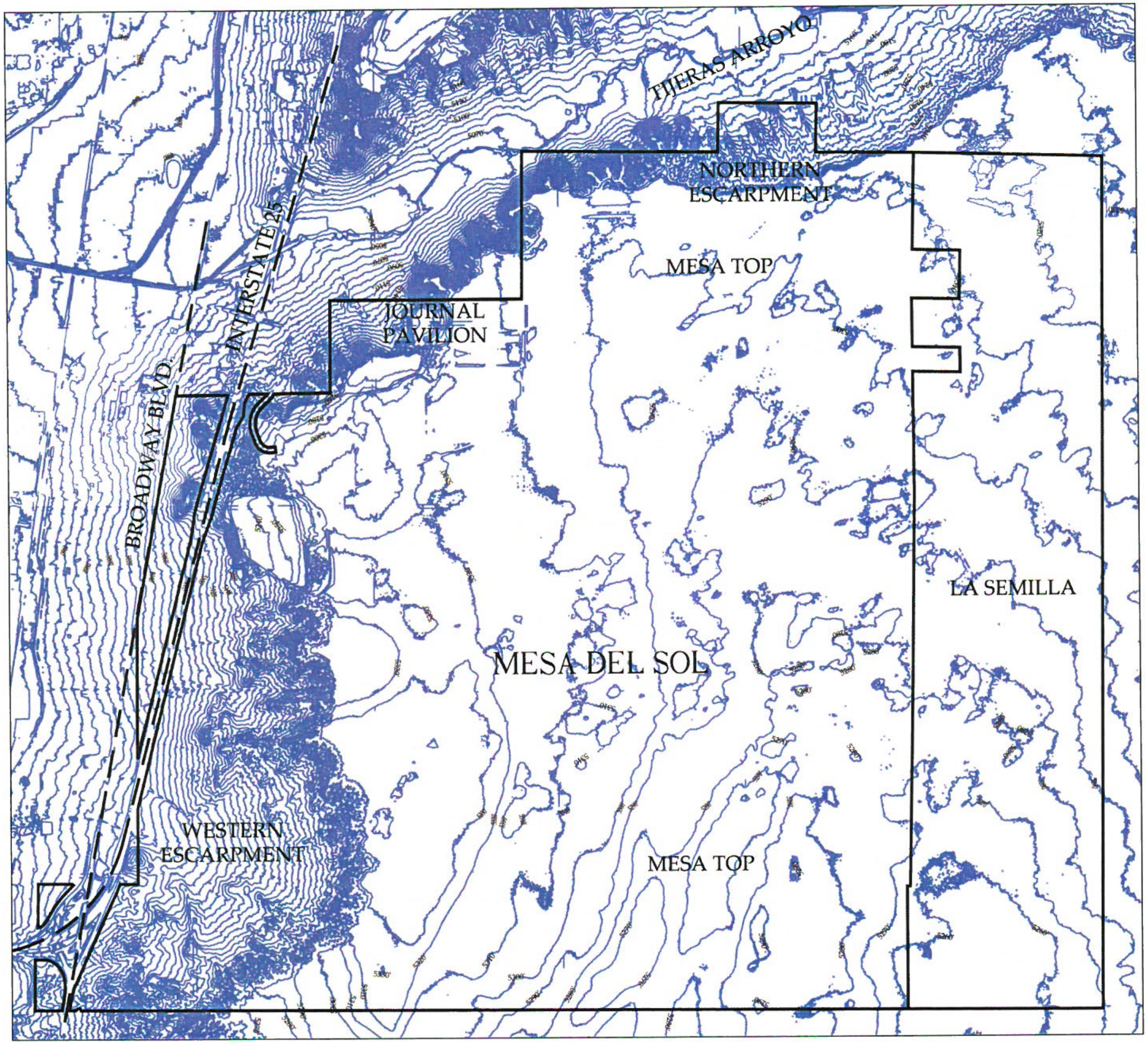
- DRAINAGE MANAGEMENT CONCEPT PLAN USES DISTRIBUTED RETENTION/INFILTRATION PONDS (DRIPS) TO COLLECT ALL FLOWS GENERATED ON THE MESA TOP IN THE RESIDENTIAL LANDS.
- NON-RESIDENTIAL LANDS (I.E. EMPLOYMENT CENTER, UNM, PUBLIC SITES) MAY UTILIZE SHARED ONSITE DRIP SYSTEMS.

WEST ESCARPMENT

- THE DRAINAGE MANAGEMENT CONCEPTS CONSIST OF COLLECTING RUNOFF IN DETENTION PONDS AND DISCHARGING STORM WATER TO A LARGE STORM WATER DETENTION BASIN AS PROPOSED BY THE AMAFCA STUDY ENTITLED "SOUTHWEST VALLEY DRAINAGE MANAGEMENT PLAN", DATED JAN. 1988. THE DETENTION POND DISCHARGES TO THE RIO GRANDE.

TOPOGRAPHICAL MAP

Figure B-2

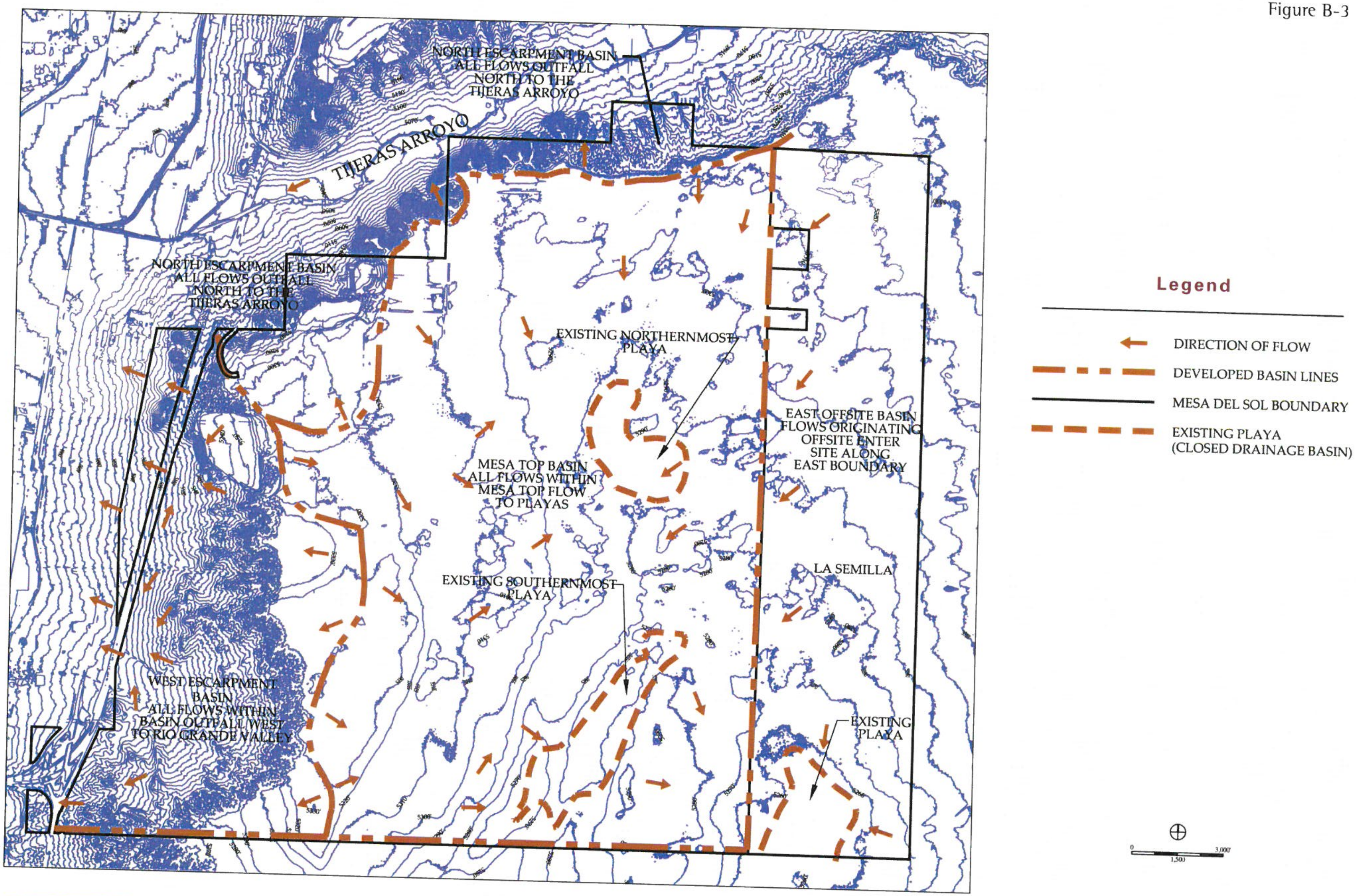


NOTES:

- 10' CONTOUR INTERVAL IS SHOWN.

EXISTING DRAINAGE BASIN PLAN

Figure B-3



FEMA FLOOD PLAIN MAP

Figure B-4

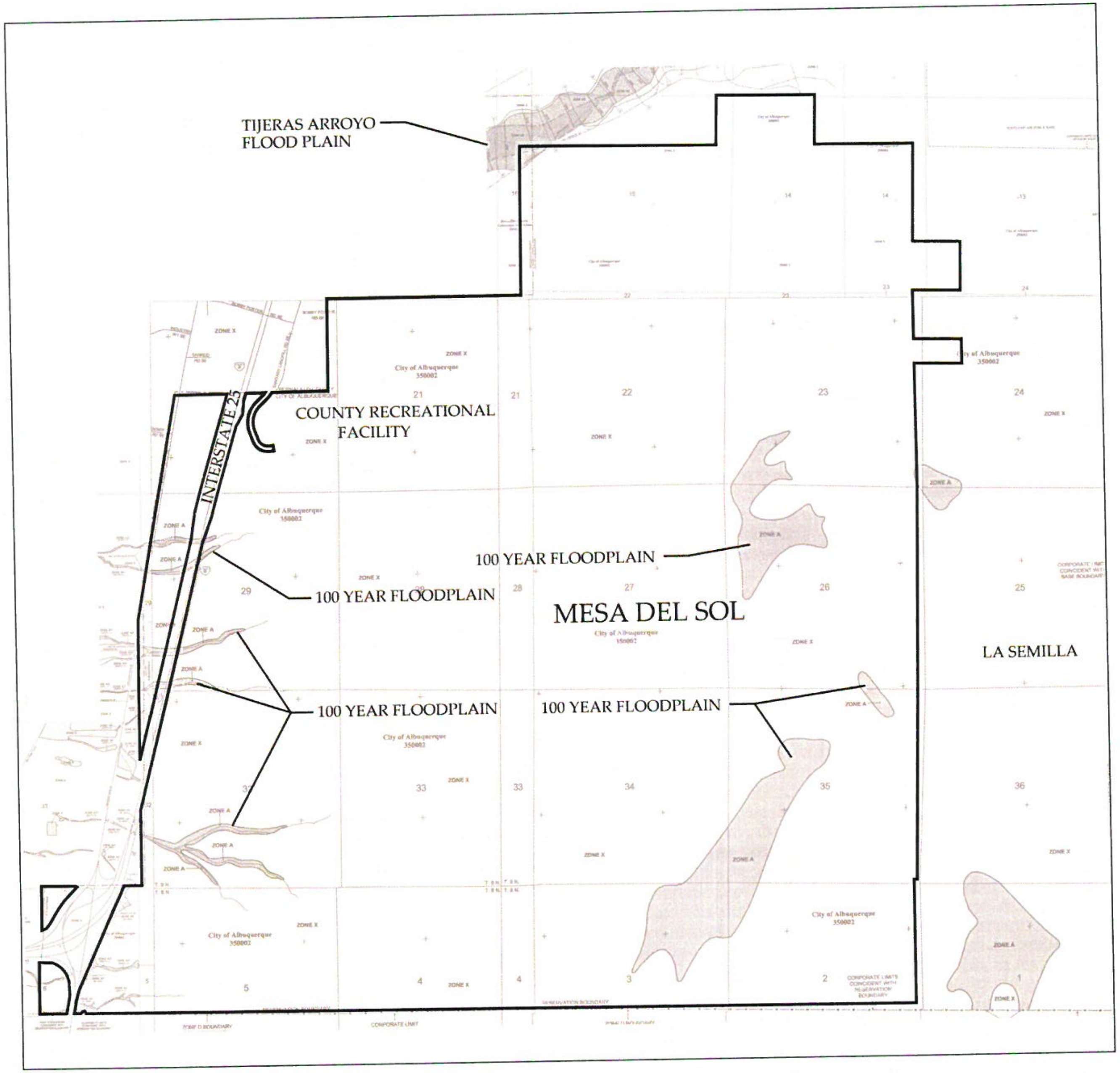
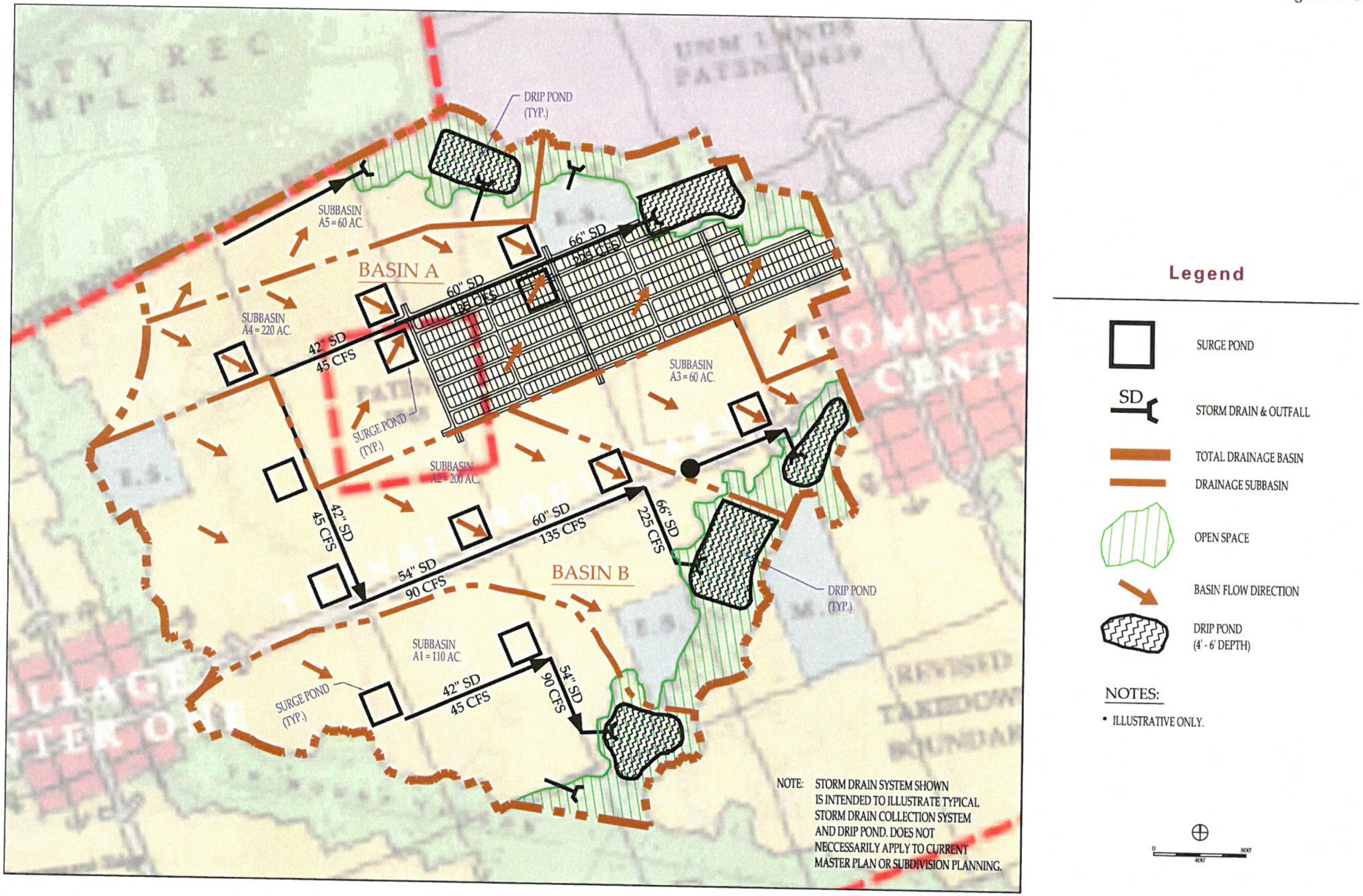
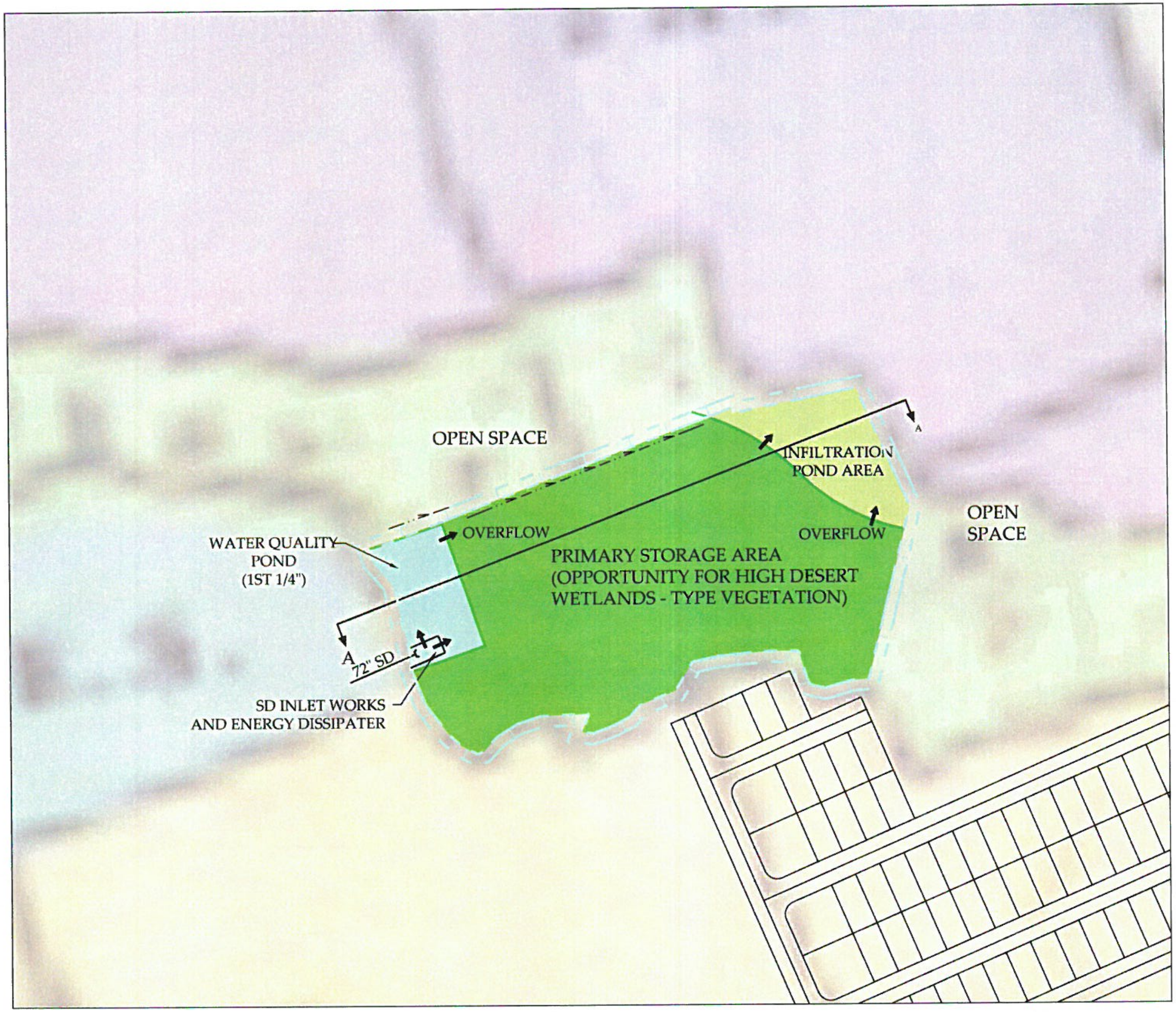


Figure B-5


DRIP POND (TYP.)
SUBBASIN A5 = 60 AC.
BASIN A
SUBBASIN A4 = 220 AC.
60" SD 180 CFS
66" SD 225 CFS
42" SD 45 CFS
SURGE POND (TYP.)
SUBBASIN A2 = 200 AC.
SUBBASIN A3 = 60 AC.
42" SD 45 CFS
60" SD 135 CFS
66" SD 225 CFS
54" SD 90 CFS
BASIN B
DRIP POND (TYP.)
SUBBASIN A1 = 110 AC.
SURGE POND (TYP.)
42" SD 45 CFS
54" SD 90 CFS
NOTE: STORM DRAIN SYSTEM SHOWN IS INTENDED TO ILLUSTRATE TYPICAL STORM DRAIN COLLECTION SYSTEM AND DRIP POND. DOES NOT NECCESSARILY APPLY TO CURRENT MASTER PLAN OR SUBDIVISION PLANNING.
Legend
SURGE POND
SD
STORM DRAIN & OUTFALL
TOTAL DRAINAGE BASIN
DRAINAGE SUBBASIN
OPEN SPACE
BASIN FLOW DIRECTION
DRIP POND (4' - 6' DEPTH)
NOTES:
• ILLUSTRATIVE ONLY.
0
400'
800'

TYPICAL DRIP POND DETAIL

Figure B-6

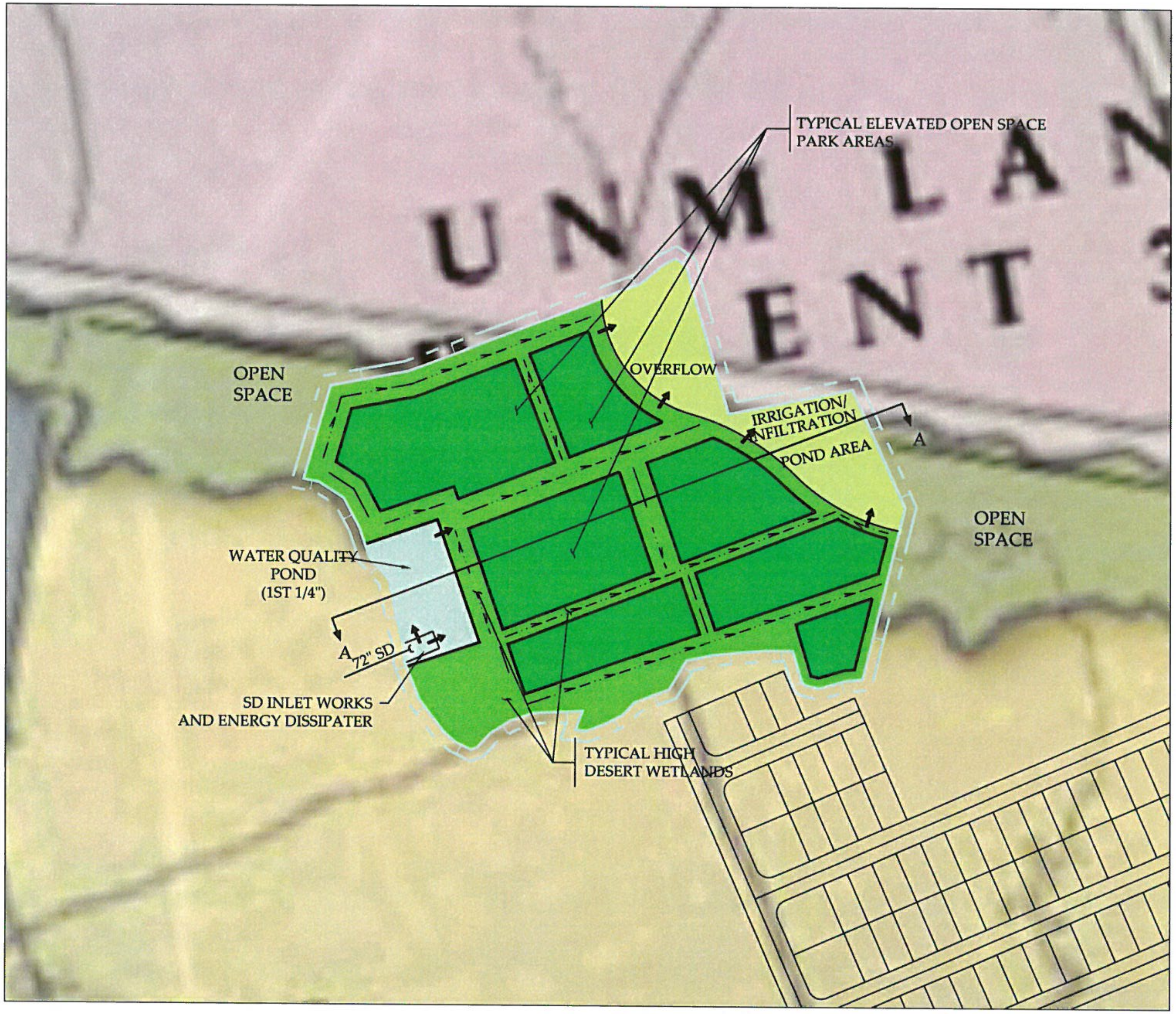


DISTRIBUTED RETENTION & INFILTRATION PONDING (DRIP)

- DISTRIBUTED RETENTION INFILTRATION POND CONSISTS OF ONSITE RETENTION PONDING LOCATED THROUGHOUT MESA TOP.
- PONDING AREA IS INTENDED TO BE USED FOR OTHER PURPOSES SUCH AS OPEN SPACE, PARKS, AND OUTDOOR RECREATIONAL AREAS, AS NEEDED.
- POND VOLUME IS DESIGNED FOR MAJOR STORM EVENTS.
- POND CONSISTS OF INLET STORM DRAIN, WATER QUALITY POND INTENDED TO FILTER STORM WATER, PRIMARY STORAGE AREA, INFILTRATION POND INTENDED TO INFILTRATE SOME PORTION OF STORM WATER DURING SMALLER, MORE FREQUENT STORM EVENTS.
- POND GEOMETRY AND LAYOUT IS INTENDED TO BE ILLUSTRATIVE OF TYPICAL POND, AND DOES NOT NECESSARILY APPLY TO CURRENT MASTER PLAN.

TYPICAL PARK POND PLAN

Figure B-7

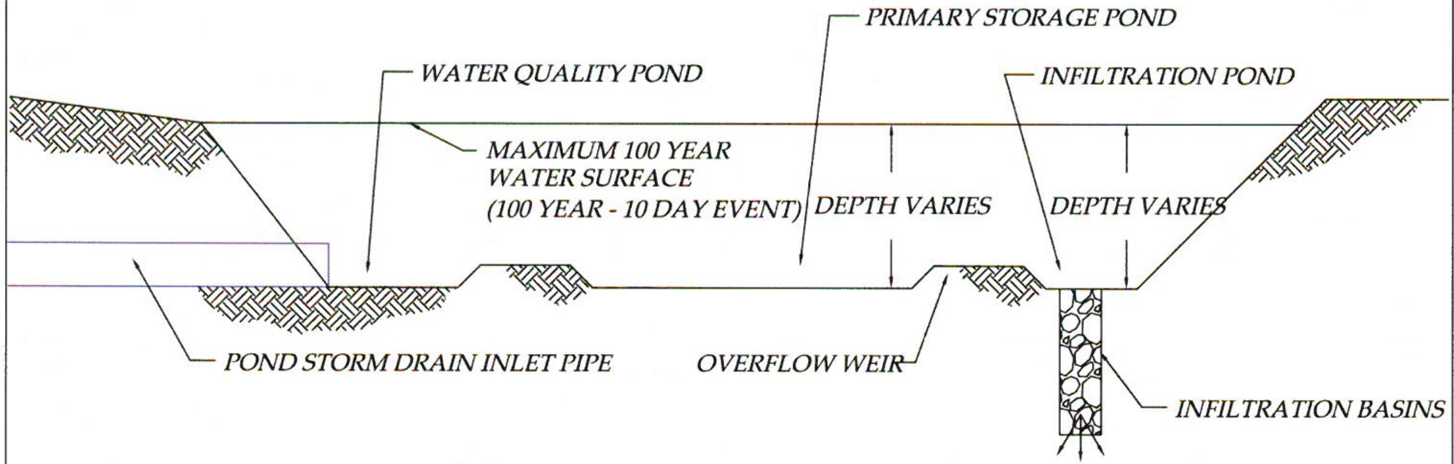


NOTES:

- ILLUSTRATIVE ONLY

TYPICAL DRIP POND SECTIONS

Figure B-8



SECTION A-A

NOTES:

- THIS SECTION ASSUMES NO OTHER USES IN THE PRIMARY STORAGE POND, SUCH AS PLAY FIELDS, ETC.

NOT TO SCALE

STREET DESIGN

LEVEL A PLAN : JUNE 2005

C

MESA DEL SOL

STREET DESIGN

A. Introduction

The Mesa Del Sol Level A Community Master Plan includes a series of standards to guide the design of streets across the site. Streets providing internal circulation to Mesa Del Sol neighborhoods are designed to reinforce an intimate, human-scale environment marked by slow vehicle traffic and ample space for pedestrians and bicyclists. To achieve this objective, many Mesa Del Sol residential streets are narrower than the wide residential streets that have typified new development since World War II. Reduced curb radii and other traffic calming treatments also act to deter rapid vehicle travel through neighborhoods and encourage pedestrian activity. Human-scale local streets do not impede the ability of automobile traffic to move efficiently through the site. Higher volumes of traffic flow are accommodated along connector roads positioned at approximately quarter-mile intervals across the site, which connect to the higher-volume roads such as boulevards and avenues.

While the characteristics of many of the streets proposed in the Level A plan are consistent with recent development throughout the region, some portions of the site's street network diverge from prevailing standards. Several of the local street types proposed in the plan have curb-to-curb dimensions narrower than current City of Albuquerque standards. However, the logic behind building slightly narrower streets is consistent with the City's Neighborhood Traffic Management Program, which aims to:

1. Improve neighborhood livability by mitigating the impact of vehicular traffic on residential neighborhoods;
2. Promote safe and pleasant conditions for motorists, bicyclists, pedestrians and residents on neighborhood streets;
3. Encourage citizen involvement and effort in neighborhood traffic management activities;
4. Make efficient use of City resources by prioritizing traffic management requests; and
5. Support the Comprehensive Plan policy that livability and safety of established residential neighborhoods be protected in transportation operations (Developing and Established Urban Areas, Policy k.)

By reducing vehicle speeds, encouraging walking and bicycling and providing adequate capacity for vehicle circulation, the local street network proposed in the Level A Plan reinforces objectives 1, 2, and 5 of the City's objectives for traffic management and neighborhood design.

This appendix provides background information on the character and performance of narrow local streets, paying particular attention to the safety, access and circulation implications of applying alternative standards. The basic premise is that narrow, human-scale local streets will make Mesa Del Sol more consistent with the City's vision for traffic management, urban design and neighborhood character. In a number of cities, existing street standards have been successfully revised to permit narrower streets without negative impacts on circulation, emergency access or safety. Streets built to prevailing standards, on the other hand, can require expensive "traffic calming" treatments to reduce neighborhood traffic impacts. Building the local streets of Mesa Del Sol to a more human scale can circumvent the need for costly retrofitting in the future. In general, the evidence suggests that local streets with curb-to-curb dimensions narrower than those currently permitted by the city's Development Process Manual perform equally well or better than wider local streets in terms of accident rates, traffic speed, circulation and access.

This appendix begins with a discussion of alternative local street standards, followed by a review of existing research and several case studies investigating built examples of narrow residential streets. A detailed source list is provided for each section.

B. Local Street Design Objectives

Narrower, more human-scale local streets are intended to both reinforce the design principles guiding the site plan and avoid many of the negative consequences associated with typical suburban street standards. Potential drawbacks of prevailing residential suburban streets include:

- Inadequate or nonexistent pedestrian circulation networks
- High travel speeds through residential areas
- Wide turning radii encouraging careless driving
- Insufficient consideration of the impact of vehicle speeds on neighborhood streets, leading in some cases to expensive retrofitting to calm traffic
- Continued dependence upon automobiles
- Negative health impacts, including obesity

Potential benefits of a network of narrower local streets marked by frequent intersections include:

- Enhancing traffic safety by reducing vehicle speeds, primarily through reduced street widths and turning radii
- Encouraging walking and bicycling by making streets safer for cyclists and pedestrians
- Improving connectivity and reducing concentration of traffic by creating a better linked network of streets
- Reducing stormwater run-off by limiting the amount of impervious surface created by streets

- Increasing the efficiency with which streets are utilized by recognizing that some street space can be utilized for multiple functions (i.e. parking and maneuvering, or waiting for an oncoming vehicle to pass)
- Reducing development costs by limiting the amount of paved area required to serve each unit
- Creating a sense of place by enclosing streets with buildings, planting and other design elements
- Increasing market value as a result of creating a sense of place, providing a unique identity that research has found leads to higher re-sale prices
- Reducing the likelihood that expensive "traffic calming" techniques will be necessary in the future to reduce vehicle speeds

Resources

Ben-Joseph, E. 1997. "Traffic Calming and the Neotraditional Street," Proceedings from the 1997 ITE International Conference.
Livable Oregon. *Skinny Streets: Better Streets for Livable Communities.*

C. Local Street Design Principles

Narrow local streets are part of a larger design and planning strategy often referred to as "neo-traditional." While the Mesa Del Sol plan does not fit squarely within any particular school of thought, its approach to local streets is broadly consistent with principles associated with "neo-traditional design."

During the past 15 years, the nation's leading engineering organizations – including the Institute of Transportation Engineers (ITE), the American Society of Civil Engineers (ASCE) and the American Association of State Highway and Transportation Officials (AASHTO) – have examined the potential for establishing Neo-Traditional local street standards. The impetus for this investigation derived from many of the concerns cited above regarding prevailing standards, but focused primarily upon accident incidence, travel speeds and vehicle and pedestrian circulation. These efforts yielded a number of principles for Neo-Traditional local street design. Although some divergence exists between the standards or guidelines developed by different organizations, the following emerge as consistent themes in proposals for alternative neighborhood street standards:

1. Narrower streets and travel lanes to encourage slower vehicle travel speeds.

One-way travel lanes nine to 11 feet wide and two-way lanes of 10 to14 feet in width are encouraged as part of a larger strategy to bring vehicle speeds to a level more consistent with neighborhood and pedestrian activity. In addition to reducing the width of lanes, the organizations propose to limit the effective street width (the dimension between parked cars or curbs that is experienced by drivers as the travel area).

The ASCE and ITE publication *Residential Streets*, authored by transportation engineer Walter Kulash, proposes curb-to-curb dimensions of 26 to 30 feet (two 8 foot parking lanes and one 10-14 foot travel lane) for bidirectional local streets with normal residential parking and 32 to 36 feet for a bidirectional residential collector. AASHTO does not provide comparable guidelines, but its *Policy on Geometric Design of Highway and Streets* states that streets with curb-to-curb dimensions of as little as 26 feet (including two seven-foot parking lanes and one 12 foot travel lane) can successfully channel bidirectional traffic through local streets.

The City of Albuquerque *Development Process Manual* (DPM) currently requires a minimum width of 36 to 40 feet for local streets with bidirectional traffic abutted by residences or other development (*DPM Section 23-8*).

The Mesa Del Sol Level A plan proposes widths of 32 to 34 feet for local streets with bidirectional traffic, as illustrated in Figure 3-2 and discussed in Chapter 7.

The proposed street system includes the following characteristics:

- *Sufficient space for comfortable pedestrian movement,* including sidewalks.
- *On-Street parking*, both to reduce the amount of off-street parking needed and to provide a buffer between pedestrian and vehicle travel. Narrow streets typically maintain the same level of on-street parking as local streets of prevailing widths.
- *Intersections designed for low speeds*. Curb radii of eight to 15 feet, as well as techniques such as bulb-outs and variations in paving surface, reduce the design speed of neighborhood intersections.
- *Frequent intersections*, to facilitate pedestrian circulation while indicating to drivers a need to stop, reducing the likelihood of driving at illegal speeds on local streets.
- *Visual signals* indicating to drivers that slow speeds are expected. This can be accomplished through a combination of planting, narrower street widths, frequent intersections, and "bulb-outs" at intersections.
- *Accommodation of utilities***.** The spatial requirements of water, sewer, sanitation and other utilities often cannot be met beneath narrow local streets. Neighborhoods served by alleys, such as Mesa Del Sol, are able to utilize this additional space to accommodate "dry" utilities such as telecommunications.

The technical details of street design that follow from these principles can be found in many of the documents listed in the resources list below.

Resources

American Association of State Highway and Transportation Officials (AASHTO). 2001. *A Policy on Geometric Design of Highway and Streets.* AASHTO. (Appendix III: pp. 394-397)

Burden, D and Zykovsky, P. 2000. *Emergency Response, Traffic Calming and Traditional Neighborhood Streets.* Local Government Commission. (Appendix IV: pp. 26-27)

Chellman, C.E. 1989. "A Discussion of Street Geometry and Design Criteria for Traditional Neighborhood Development," Proceedings of the ITE Educational Foundation Seminar: Traffic Engineering for Neo-Traditional Neighborhoods, 8/8/92-8/9/92. (Appendix V.)

Institute of Transportation Engineers (ITE). 1999. *Traditional Neighborhood Development Street Design Guidelines: Recommended Practice.* ITE. (Appendix VI: pp. 5-12; pp. 17-30).

1994. *Roadway Widths for Low-Traffic-Volume Roads.* ITE.

1994. *Traffic Engineering for* Neo-Traditional *Neighborhood Design.* ITE. (Appendix VII: pp. 8-13).

1992. "Traffic Engineering for Neo-Traditional Neighborhoods: A Synthesis Report," proceedings of the ITE Educational Foundation Seminar: Traffic Engineering for Neo-Traditional Neighborhoods, 8/8/92-8/9/92.

Kulash, W.M. 1997. *Residential Streets (Third Edition).* ULI, NAHB, ASCE and ITE. (Appendix VIII: pp. 14-17; pp. 20-27).

Lerner-Lam, E., Celnicker, S.P., G. Halbert, C. Chellman and S. Ryan. 1992. "Neo-Traditional Neighborhood Design and Its Implications for Traffic Engineering," *ITE Journal* (1/92). (Appendix IX).

D. Research on Alternative Local Street Design

What are the ramifications of applying alternative, "neo-traditional" local street standards? This section draws upon existing research in an effort to help answer this question, focusing on Vehicle Accident Rates, Pedestrian Safety, Emergency Vehicle Access, and Circulation. It is worth noting that the more intangible potential benefits of narrower streets – neighborhood identity and 'sense of place'– are not considered due to the difficultly involved in rigorously assessing the relationship between street design and these attributes.

1. Vehicle Accident Rates

Transportation Engineer Peter Swift led a research team comparing accident rates on wide and narrow residential streets in Longmont, Colorado, a Denver suburb. Included in the sample of narrower streets were both pre-war local streets and the neighborhood streets of a recently completed neo-traditional development. Controlling for other factors influencing accident rates, the study found a statistically significant relationship between street width and accident rates: wider streets were correlated with higher accident rates. In fact, street width was found to exercise greater influence on accident rate than all other factors.

Transportation Engineers James Daisa and John Peers compared traffic speeds along fifty San Francisco Bay Area residential streets of widths varying from 25 to 50 feet (curb-to-curb). Except for their widths, the characteristics of the streets surveyed were similar. The study elicited the following key findings: a) wider streets experience higher speeds for both the average and 85th percentile speeds; b) the degree to which on-street parking spaces are filled significantly affects vehicle speeds, with a higher density of parking associated with lower speeds; c) traffic volume and vehicle headways influence speeds, with higher volumes associated with lower speeds; and d) the "effective" street width available to drivers – the distance between curbs or parked cars – must be substantially reduced to achieve significant reductions in vehicle speeds. Given the fact that traffic volumes are not easily increased, the authors argue that the most effective method for reducing vehicle speeds on residential streets is a combination of reduced lane widths and increased use of on-street parking spaces. The 'upper limit' of effective street width identified to create relatively slow traffic through residential districts is 28 to 30 feet, with greater widths leading to higher vehicle speeds.

2. Pedestrian Safety

As both ITE and AASHTO publications note, the severity of injuries experienced by pedestrians tends to increase with street width. This relationship is explained by the fact that vehicles travel faster along wider streets, often exceeding posted speeds. The effective width of a street is further reduced when cars are parked along the curb. On-street parking – which can be encouraged by reducing off-street resident and guest parking requirements – can act to limit the speed of vehicle travel and buffer pedestrians from vehicles.

3. Emergency Vehicle and Service Access

The Local Government Commission's Center for Livable Communities prepared a guide delineating the benefits of neo-traditional development for emergency access and response. To adequately assess the impact of a neo-traditional approach to street design, individual streets must be considered within the context of the broader site design. Together, increased numbers of access points and more direct travel routes can provide levels of access that may actually exceed traditional suburban developments and their wider streets. Certain traffic calming measures, however, can pose negative consequences for emergency response: reduced lane widths can limit the speed of travel along some portions of the street network (although this can be outweighed by increased connectivity, as noted above), while speed bumps can cause physical harm to safety personnel.

The Swift *et al* study of Longmont, CO also included a survey of the city's fire department and review of fire reports. No differences were observed between the access and response times between narrow and wide residential streets.

Access along narrow local streets for services such as garbage and delivery trucks can be met along alleys, as well as in vacant on-street parking spaces. As noted in the Civano case study below, service access problems can arise if the shoulder area created by on-street parking spaces is not available.

4. Circulation

Intuitively, one might expect that the slower traffic created by narrow street widths would lead to greater congestion on local streets. However, research has yet to identify such an effect – perhaps due to the fact that site plans that include narrow local streets typically also include a greater number of intersections than typical developments – enhancing overall circulation across the site.

Resources

Burden, D and Zykovsky, P. 2000. *Emergency Response, Traffic Calming and Traditional Neighborhood Streets.* Local Government Commission.

Daisa, J.A. and Peers, J.B. 1997. "Narrow Residential Streets: Do They Really Slow Down Speeds?" *ITE 6th Annual Meeting Compendium of Technical Papers.*

Gattis, J.L and Watts, A. 1999. "Urban Street Speed Related to Width and Functional Class," *Journal of Transportation Engineering* May-June 1999. ASCE.

Swift, P., Painter, D., and Goldstein, M. 1997. *Residential Street Typology and Injury Accident Frequency.* Swift Associates.

E. Narrow Local Street Case Studies

1. Stapleton (Denver, CO)

Stapleton is a 4,700 acre site projected to accommodate 13,000 units on land formerly occupied by an international airport in Denver, Colorado. Surrounded by existing neighborhoods, Stapleton was designed to extend and enhance the city's urban fabric. Local streets in Stapleton typically measure 30 feet from curb-to-curb – incorporating two parking lanes of 8 feet each and a 14-foot travel lane intended to serve two-way traffic. At the time of the project, the city did not permit two-way travel in a lane of this width. In order to permit the street dimensions proposed for Stapleton, a one-time agreement was forged between the City of Denver departments of planning and public works.

It was assumed that the 14-foot travel lane would function as follows: if two vehicles were traveling down the lane at the same time, one car would pull over behind a parked car to permit the other vehicle to pass. (This practice is commonplace in many older neighborhoods throughout the country). In practice, the 30 foot curb-to-curb dimension of Stapleton's local streets has proven more than sufficient for accommodating both daily vehicle traffic and emergency vehicles. Because nearly all neighborhood parking demand is satisfied by off-street parking (provided at 2 spaces per unit), the on-street parking lanes are typically empty, leading to an effective right-of-way of 30 feet.

According to Steve Turner, project manager for the City of Denver, the observed vehicle speeds on Stapleton's local streets have been at or below the 25 mile per hour posted speed limit. Observed speeds on the local streets built to the city's conventional (wider) street standards typically exceed the posted limit. Turner expects that the Denver department of public works will introduce Stapleton's 30 foot local street as a permitted type when its street standards are officially updated.

To accommodate infrastructure requirements, "dry" utilities such as telecommunications were placed beneath alleys, while water and sanitation were placed beneath streets traveling North to South and stormwater was place beneath streets traveling East to West. This successful method could serve as a precedent for Mesa Del Sol.

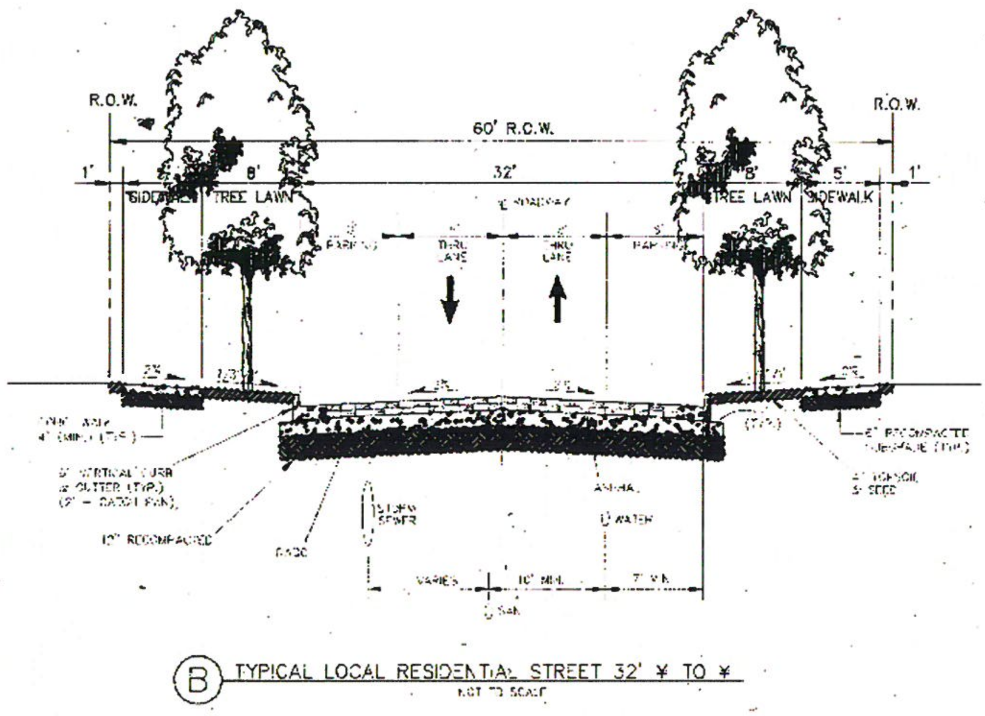


Figure C-1. Stapleton Street Sections – Local Street

Resources

Steve Turner, Stapleton Project Manager, City of Denver. Phone: (720) 913-1637

2. Civano (Tucson, AZ)

Civano is a 818-acre, 2,600-unit project located on the outskirts of Tucson, Arizona. Designed as an ecological community, Civano incorporates numerous design features intended to enhance the sustainability of the lifestyles of its residents. Among these features are local streets 20 feet in width, intended to limit the amount of impervious surface on the site and reduce travel speeds. Drainage is provided in swales at either side of the road, and pedestrian and vehicle travel are expected to mix. As in the case of Stapleton, the City of Tucson's street standards initially precluded the dimensions proposed for local streets at Civano. The city formally adopted the Institute of Transportation Engineer's *Traffic Engineering for Neo-Traditional Design* Street Standards as part of the Civano development agreement – permitting narrower street widths.

City of Tucson officials reported no problems related to safety or emergency vehicle access on Civano's local streets. The primary concern about the development's local streets has been the lack of on-street parking. Coupled with reduced off-street parking requirements, the lack of on-street parking has led to complaints that services such as plumbers are unwilling to serve the neighborhood and that residents are unable to host guests. These problems are attributed by officials to both parking policy and the site's lack of public transit access to the site. The city is continuing to utilize the ITE's Neo-Traditional Design standards for future development, but plans to require on-street parking to avoid the shortage experienced at Civano.

Contacts:
Carol Aragona, Transportation Planner, City of Tucson. Phone: (520) 791-4505
Roger Howlett, Planner, City of Tucson. Phone: (520) 791-4505

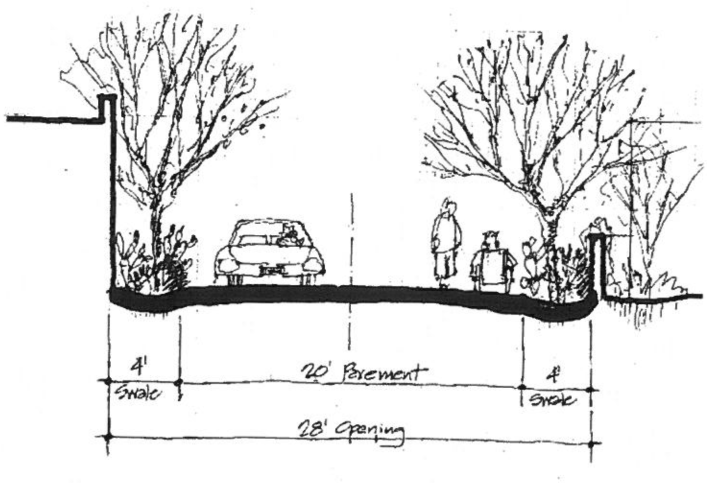


Figure C-2. City of Tucson. 2004. Civano Local Street Cross Section.

3. Cities Permitting Narrow Local Streets

The following is a sample of the cities across the country permitting narrow local streets, as well as a point of contact in each city. This list was derived from the Narrow Streets Database managed by architect Alan Cohen (http://www.sonic.net/abcaia/narrow.htm).

State	Jurisdiction	Contact	Phone#	Standard
Arizona	Phoenix, City of	Jim Slayer Transit Planner	602-262-6284	28' - prkg both sides
California	Santa Rosa, City of	Anthony Cabrera City Engineer.	707-543-3209	30' - prkg both sides, <1000ADT 26' - 28' - prkg one side 20' - no prkg 20' neck downs @ intersections
	Palmdale, City of	Tom Horne Traf/Trans. Eng.	805-267-5300	28' - prgk both sides
	San Jose, City of	David Tymn	408-277-4576	30' - prkg both sides, <21 DU, 415' 34' - prkg both sides, <121 DU
	Novato, City of			24' - prkg both sides, 2-4 DU 28' - prkg both sides, 5-15 DU
Colorado	Boulder, City of	John Hinkelman Transportation Plnr, Pub. Works	303-441-3240	32' - prkg both sides, 1000-2500 ADT 30' - prkg both sides, 500-1000 ADT and others
	Ft. Collins, City ofl	Mike Herzig Spec. Proj. Eng.	970-221-6605	30' - prkg both sides 24' Alley
Delaware	Delaware DOT	David DuPlessis	302-760-2266	Mobility friendly design guideline 200' - 500' blocks Rqd. network connectivity 21' - prkg on side, one trav., cueing for local subdiv. 22' - 29' - prkg one side, minor collector 12' alley in 20' row

Florida	Orlando, City of	Dan Gallagher Transportation Planner	407-246-2775	28' - prkg both sides, res.lots<55' wide 22' - prkg both sides, res.lots>55' wide many standards with bike lanes
Maine	Portland, City of	Sarah Hopkins Planner	207-874-8719	24' with prkg one side
Maryland	Howard County	Mike Mitchell	410-313-2420	24' - prkg unreg, <1000 ADT
	Charles County	Ham Mathur	301-645-0623	24' - prkg unregulated
Michigan	Birmingham, City of	Paul O'meara	248-644-3869 ext. 241	26' - prkg both sides 20' - prkg 1 side
Montana	Helena, City of	Paul Cartwright Dpt.of Env Quality	406-444-6761	33' - prkg both sides & traffic calming
	Missoula, City of	Steve King City Eng.	406-523-4623	26' - prkg both sides, 3-80 DU 32' - prkg both sides, 81-200 DU 12' Alley Others
New Mexico	Albuquerque	Tony Loyd Engineering	505-924-3994	28' - prkg 1 side 27' - prkg 1 side, roll curb
	Santa Fe, City of	Mark Books	505-984-6571	34' - prkg unregulated
Oregon	Eugene, City of	Jan Childs Planning Director	541-682-5208	12' - one way alley 16' - two way alley 20' - no parking 21' (7'/14') - prkg one side, <750 ADT 28' (7'/14'/7') - prkg both sides, <750 ADT 27' (7'/10'/10') - prkg one side, >750 ADT 34' (7'/10'/10'/7') - prkg both side, >750 ADT
	Forest Grove, City of	James Reitz Associate Planner	503-359-3227	32' - prkg both sides - unregulated 28' - prkg both sides if not >16 SFD or 20

				multifam. if 2 access pnts., double. DU's. 24' - prkg one side
	Gresham, City of	Sandra Doubleday Transportation Planner	503-618-2816	20' - no prkg, <150' or <11 DU 26' - no prkg, <30' from the curb return, <400' long, queuing 14' - alley, residential 20' - alley, commercial
	McMinnville	Doug Montgomery Asst. Plng. Dir.	503-434-7311	26' w/prkg both sides
	Portland, City of	Terry Bray Transportation Planner	503-823-7058	26' w/prkg both sides 20' w/prkg one side
	Washington County	Click for Website		
	Beaverton, City of	Daryl Steffen Dpt. of Trans.	503-526-2426	28' - prkg both sides, <600ADT <300
	Tigard	Brian Rager Dev. Review Eng.	503-684-7297	28' - prkg 1 side, <500 ADT 32' - Prkg both sides, <1500 ADT
	Tualatin	Engineering	503-692-2000	32' - prkg both sides
	Hillsboro, City of	Tina Baily Engineering	503-681-6146	28 - 30' prkg both sides
Tennessee	Johnson City, City of	Eric Thomas Iverser City Planner	423-434-6075	22' prkg not regulated, <240 ADT 24' - 28', prkg not regulated, 240-1500 ADT 28', prkg not regulated, >1500 ADT
Vermont	DOT			Rural - 22' w/ 3' shldrs
	Burlington, City of	Steve Goodkind City Eng.	802-863-9094	30' prkg both sides

Washingtoı	Kirland, City of	Katy Coleman	425-828-1241	12' Alley 20' - prkg 1 side 24' - prkg both sides - low density only 28' - prkg both sides
W. Virginiạ	Morgantown	William Bechtel Dir. of Plng & Dev	304-284-7413	22' prkg 1 side
Wisconsin	Madison, City of			27' - prkg both sides, <3DU/AC 28' - prkg both sides, 3-10 DU/AC

INTERSECTION DESIGN

LEVEL A PLAN : JUNE 2005

D

MESA DEL SOL

INTERSECTION DESIGN

A. Introduction

The Mesa Del Sol Level A Community Master Plan includes standards to guide the design of street intersections across the site. Intersections throughout the Mesa del Sol development will be required to serve the needs of multiple users, including pedestrians, bicyclists, automobile drivers, trucks, transit vehicles, and emergency vehicles, among others.

Street networks and intersections serving new development in the United States since World War II have been characterized by wide streets and wide turning radii. The belief was that these larger-scaled facilities would improve circulation and safety. However, recent experience and research has shown that such streets and intersections can have negative effects, reducing overall safety and at times reducing auto safety as well. In addition, they may have the effect of discouraging transportation by alternative modes to the automobile, creating congestion, reducing community interaction, and harming the health of residents who are forced to use automobiles for everyday transportation needs.

In order to create a street network with a balance between the needs of the different users, to reinforce an intimate, human-scale environment marked by vehicle traffic of reasonable speeds and ample space and safety for pedestrians and bicyclists, Mesa del Sol intersections will be narrower and have smaller turning radii than existing Albuquerque regulations allow. Reduced curb radii and other traffic calming treatments will slow traffic and will act to deter rapid vehicle travel through neighborhoods and encourage pedestrian activity. Couplets and roundabouts will be used to improve the pedestrian environment at major street intersections. At the same time, characteristics of the street network such as a high degree of interconnectivity will allow efficient access by automobiles and emergency vehicles.

The logic behind building more human-scaled intersections is consistent with the City's Neighborhood Traffic Management Program, which aims to:

1. Improve neighborhood livability by mitigating the impact of vehicular traffic on residential neighborhoods;
2. Promote safe and pleasant conditions for motorists, bicyclists, pedestrians and residents on neighborhood streets;
3. Encourage citizen involvement and effort in neighborhood traffic management activities;
4. Make efficient use of City resources by prioritizing traffic management requests; and

5. Support the Comprehensive Plan policy that livability and safety of established residential neighborhoods be protected in transportation operations. (Developing and Established Urban Areas, Policy k.)

By reducing vehicle speeds, encouraging walking and bicycling and providing adequate capacity for vehicle circulation, the local street network proposed for Mesa del Sol reinforces objectives 1, 2, and 5 of the City's objectives for traffic management and neighborhood design, and will create fewer requests for future traffic mitigations, as in objective 4.

This paper provides background information on human-scaled intersections. Human-scale intersections will make Mesa del Sol more consistent with the City's vision for traffic management, urban design and neighborhood character. In a number of cities, existing standards have been successfully revised to permit smaller-scale intersections without negative impacts on circulation, emergency access or safety.

This paper begins with a discussion of alternative intersection designs, followed by a review of existing research, intersection diagrams, and several case studies investigating built examples of human-scale intersections. Topics addressed include curb radii, bulbouts, sight triangles, couplets and roundabouts. A source list is provided for each section.

B. Intersection Design Objectives

Narrower, more human scale intersections are intended to both reinforce the design principles guiding the site plan and avoid many of the negative consequences associated with typical suburban standards. Potential drawbacks of prevailing intersection standards include:

- Poor, intimidating and dangerous pedestrian connections.
- High auto travel speeds through intersections.
- Wide turning radii encouraging careless driving.
- Insufficient consideration of the impact of vehicle speeds on neighborhood streets, leading in some cases to expensive retrofitting to calm traffic.
- Increased maintenance requirements to due large amounts of paved area.

Potential benefits of human-scale intersections include:

- Enhancing traffic safety by reducing vehicle speeds, primarily through visual cues, reduced widths and turning radii.
- Encouraging walking and bicycling by making streets safer for cyclists and pedestrians.
- Reducing stormwater run-off by limiting the amount of impervious surface created by streets.
- Reducing development and maintenance costs by limiting the amount of paved area required to serve each unit.
- Creating a sense of 'place' by enclosing intersections with buildings, street trees and other design elements.

- Increasing market value as a result of creating a "sense of place," providing a unique identity that research has found leads to higher resale prices.
- Reducing the likelihood that expensive "traffic calming" techniques will be necessary in the future to reduce vehicle speeds.

C. Intersection Design Principles

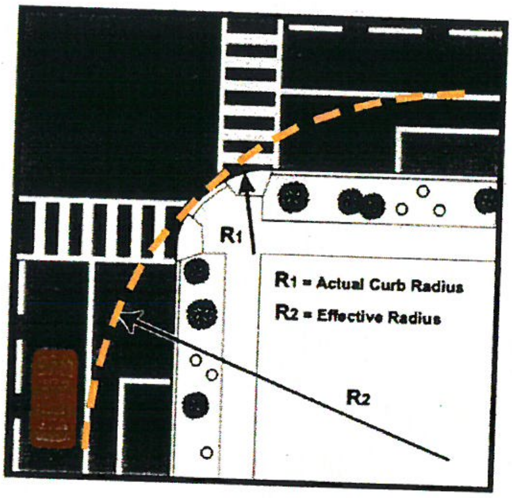
Human-scale intersections are part of a larger design and planning strategy often referred to as "neo-traditional." While the Mesa Del Sol plan does not fit squarely within any particular school of thought, its approach to streets is broadly consistent with principles associated with "neo-traditional design." Several characteristics of intersections are essential to control in order to allow creation of human-scale, balanced intersections. These are curb returning radii, the use of bulbouts, reasonable sight triangles, couplet configurations, roundabouts, and street parking near intersections.

Curb Returning Radii

The radius of the joined curbs at the intersection of streets is important for a variety of reasons. Among these reasons is the need to accommodate the turning movements of various vehicles which will use the streets. A curb radius which is too small may make it unreasonably difficult or even impossible for vehicles to make common turning movements.

On the other hand, a curb radius which is too large may have a variety of negative effects on the intersection. Large curb radii lengthen the distance required for pedestrians to cross the intersection, making the crossing more dangerous and requiring greater pedestrian crossing times at signalized intersections which reduces their efficiency. At the same time, large curb radii allow vehicles to make turns at higher speeds, which also makes pedestrian crossing more dangerous and is in contradiction to livable streets goals of slowing traffic. Large curb radii also may make it more difficult to construct directional ADA ramps from the sidewalk to the street. They increase the amount of impervious surface necessary for the intersection, and may force the corner property lines to be beveled or rounded, reducing the amount of land available for development.

An important distinction to make is the difference between *actual curb radii* and *effective radii*. In an intersection between streets with no parking or bike lanes, the actual and effective radii may be the same. Parking lanes, bike lanes and tapers, however, give turning vehicles additional room and can significantly increase the functional turn radius available. See the AASHTO Exhibit 5-10 for explanation.



AASHTO Exhibit 5-10 (page 405) showing Actual vs. Effective curb radii

The justification for regulating curb radii is on the functional grounds listed above, that is, allowing vehicles to negotiate intersection corners safely. However, what is most important for this function is the effective, not actual radius. Thus, it is the effective radius which should be the subject of regulation. If regulation of the effective radius is separated from the actual radius, and the actual radius is much smaller than the effective radius, many of the negative effects of large curb radii can be mitigated to some degree. In general, because of the negative effects of large turning radii as listed above,

"the radius of the curb return should be no greater than that needed to accommodate the design turning radius." (AASHTO 2001, p. 405)

The tables which follow show existing Albuquerque curb radii standards and proposed standards for Mesa del Sol.

Current Standards: DPM Table 23.3.3

	Principal Arterial	Minor Arterial	Collector	Major Local	Local Residential	Local Ind/Comml
Principal Arterial	flare + 25' radius					
Minor Arterial	flare + 25' radius	35'				
Collector	flare + 25' radius	35'	25'			
Major Local	30'	30'	25'	20'		
Local Residential	30'	30'	25'	20'	20'	
Local Ind/Comml	30'	30'	30'	30'	N/A	30'
Alley returns	24' minimum, more per design vehicle					

Proposed Maximums

	Boulevard (primary roadway)	Boulevard (access roadway)	Avenue	Connector	Local Residential	Local Ind/Comml	Alley
Boulevard (primary roadway)	25' Effective max, 25' actual maximum						
Boulevard (access roadway)	10' maximum	10' maximum					
Avenue	25' effective maximum, 15' actual maximum	10' maximum	25' effective maximum, 15' actual maximum				
Connector	25' effective maximum, 15' actual maximum	10' maximum	25' effective maximum, 15' actual maximum (2)	25' effective maximum, 10' actual maximum (2)			
Local Residential	25' effective maximum, 10' actual maximum	10' maximum	25' effective maximum, 10' actual maximum	25' effective maximum, 10' actual maximum	15' effective maximum, 10' actual maximum		
Local Ind/Comml	30' effective maximum, 15' actual maximum (2)	10' maximum	30' effective maximum, 15' actual maximum (2)	30' effective maximum, 15' actual maximum (2)	15' effective maximum, 15' actual maximum	30' effective maximum	
Alley	n/a	3' maximum	22' effective maximum, 5' actual maximum	22' effective maximum, 5' actual maximum	3' maximum	22' effective maximum, 15' actual maximum	22' max.

Notes:
1) in cases where bulbouts are used, "actual maximum" is defined as a curb configuration that covers all of the area of the intersection that would be covered by a curb with the stated maximum radius which extended (without bulbouts) directly to the intersection from the flowlines.
2) Actual radius equals effective radius where street parking not provided

These effective curb radii should allow vehicles to complete turns within their dedicated or shared lane. However, it is inevitable and very desirable that in some cases vehicles will be required to move very slowly and yield to other vehicles while making turns. This may be the case for the occasional truck which is making a turn from one small street to another. The Institute of Transportation Engineers' *Traditional Neighborhood Development – Street Design Guidelines* notes the cases of passenger vehicles on small turning radii as well as the experience of trucks in these situations in the following two quotes:

- "Most passenger cars operating at low speeds on streets 18 to 20 feet or more in width are able to make a right turn with a curb return radius of 15 feet without crossing the center of the street." p. 27
- "If the proportion of large vehicles is few, then it is usually acceptable to allow these vehicles to swing across the centerline of the street, meaning either the street the vehicle is turning from or the street it is turning into. When this occurs if a vehicle is approaching along the street the larger vehicle is turning into, either the larger vehicle or the approaching vehicle will have to

stop to let the other complete its turn, or the turning vehicle has to wait to let the oncoming vehicle pass by." p. 8

These small turning radii will have the effect of calming traffic in Mesa del Sol while allowing essential turning movements to be made.

Examples of Curb Radii:

Stapleton (Denver, Colorado)

Stapleton is a 4,700 acre site projected to accommodate 13,000 units on land formerly occupied by an international airport in Denver, Colorado. Surrounded by existing neighborhoods, Stapleton was designed to extend and enhance the city's urban fabric.

Stapleton Curb Radii (actual radii)

Arterials with any other street	25'
Two neighborhood streets	15'
Two alleys	22'

Contact:

Steve Turner, Stapleton Project Manager, City of Denver. Phone: (720) 913-1637

Portland Metro (Portland, Oregon)

Portland, Oregon's elected regional government, known as Metro, estabalished a livable streets program to support implementation of its regional growth by providing tools to better integrate street designs with nearby land uses. The Metro handbook, *Creating Livable Streets: Street Design Guidelines for 2040,* includes the following curb radius guidelines:

Portland Metro Curb Radii

Typical Urban	10 - 25' Maximum
Freq. Truck/Bus	40' Effective Max.

Resources:

Creating Livable Streets: Street Design Guidelines for 2040. Second edition. http://www.metro-region.org/article.cfm?articleID=261

D. Bulbouts

Bulbouts at intersections help to reduce the width of the intersection while leaving the portion of the road needed for auto circulation unimpeded. Properly configured, bulbouts create safer pedestrian crossings by shortening the total crossing distance. Additionally, the narrowed apparent width of the street gives drivers visual signals to slow down through an intersection.

Because they project beyond the standard flowlines, bulbouts may have larger corner radii, approaching or equaling that of the effective radii, without adversely affecting the intersection size and pedestrian safety (see Diagram 2). For a variety of reasons (e.g. the need for left turn lanes) it will not be possible for some intersections to have bulbouts. In these instances, the maximum actual corner radii will apply. The additional pavement within the intersections due to the lack of bulbouts will allow for turning movements of larger vehicles, including the occasional encroachment on other lanes when necessary.

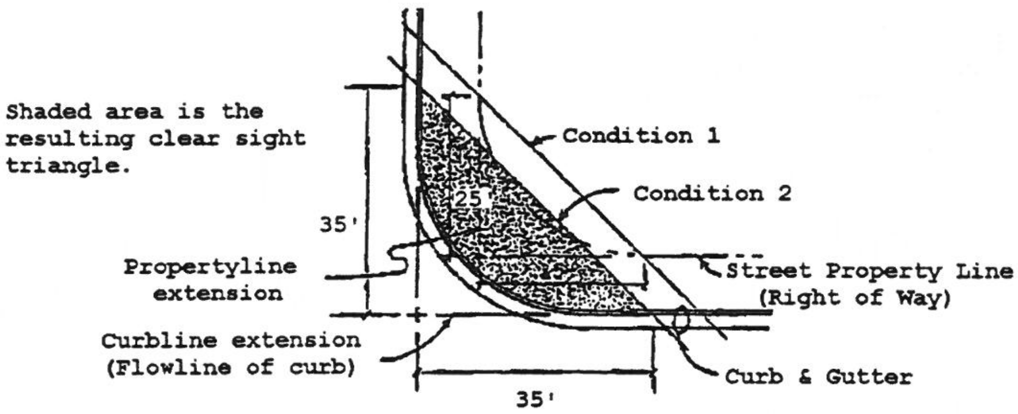
E. Sight Triangles

The concept of intersection sight triangles is to create safe sight distances for drivers approaching and proceeding through intersections. By limiting buildings and vegetation within a specified area, sight triangles should allow drivers sufficient time to react to other approaching vehicles in time to avoid an accident.

The Albuquerque Development Process Manual (section 23.3.D.5 (page 23-28)) says, referring to Section 2-15 of the Traffic Code,

"No such obstruction to view between three and eight feet above the gutter line shall be placed or maintained within a triangular area at the street corner, which area is bounded by: (1) the street property lines of the comer lot and a line connecting points twenty-five feet distant from the intersection of the property lines of such lot, or (2) the curb lines of an intersection and a line connecting points thirty-five feet distant from the corner of the intersection and such corner is determined by projecting the curb lines out to a specific point, whichever is the lesser."

The corresponding clear area is illustrated in Diagram 1, Current Requirements, and the diagram in the Development Process Manual (below).



Albuquerque DPM illustration of Intersection Sight Distance, page 23-28

As noted in the AASHTO manual (A Policy on Geometric Design of Highways and Streets, 2001), however, the necessary sight triangles are not the same for every intersection. Rather, the distances necessary for a particular safe sight triangle are functions of the design speeds of the intersecting roadways and the type of traffic control used at the intersection. In addition, there are two types of sight triangles to be considered – approach sight triangles and departure sight triangles. Approach sight triangles are useful for drivers of moving vehicles approaching the intersection and allow them to see vehicles approaching along intersecting roads. Departure sight triangles are useful for drivers who have stopped at the intersection on the minor-road approach to the intersection to observe vehicles approaching to which the driver must yield.

Approach sight triangles will not typically be needed in Mesa del Sol. Per AASHTO, "approach sight triangles … are not needed for intersection approaches controlled by stop signs or traffic signals. In that case, the need for approaching vehicles to stop at the intersection is determined by the traffic control devices and not by the presence or absence of vehicles on the intersecting approaches." (page 656-657) Because intersections in Mesa del Sol will be controlled by stop signs or signals, approach sight triangles will not be necessary.

Departure sight triangles, on the other hand, are necessary both in controlled and uncontrolled intersections, and so will be necessary in Mesa del Sol. For departure sight triangles, there will be three situations, as shown in the AASHTO guide:

1. Intersections with stop signs on the minor road
2. Intersections with four-way stop signs
3. Intersections with signal control

The necessary dimensions for departure sight triangles are illustrated below.

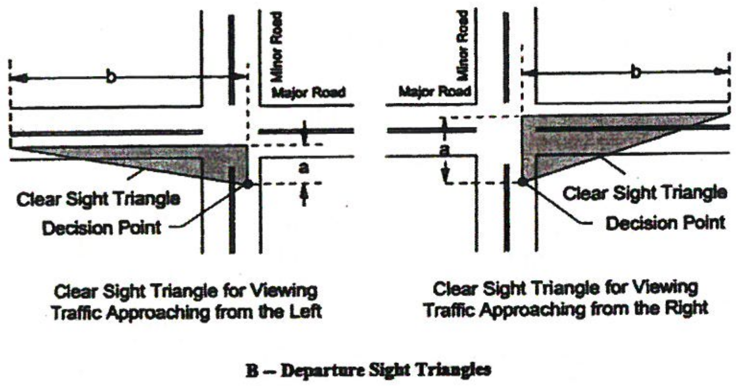


Exhibit 9-50 from AASHTO, Intersection Sight Triangles

In each case, the vertex of the triangle which represents the beginning of the driver's line of sight (the "decision point") will be 14.5 feet from the edge of the major road's traveled way. This figure from AASHTO, page 660, is based on the calculated average distance of the driver from the edge of the traveled way. It is important to note here that the traveled way is "the portion of the roadway for the movement of vehicles" (AASHTO, page 309); thus, a parking lane would not be included in the traveled way, while a bicycle lane would be included.

While it is possible based on the AASHTO formulas to calculate the necessary sight triangles for each intersection based on the width of the road and the design speed, in no cases except where roads go through open space and on bridges do streets proposed for Mesa del Sol have 14.5 feet or less of distance from the right of way line to the edge of the traveled way. Thus, in no case will the sight triangle intersect land outside the public right of way or necessitate restricting buildings or vegetation on land outside the public right of way.

As an example, see Diagram 2, showing the sight triangle calculation for an intersection with stop signs on the minor road and no stop signs on the major road. This type of intersection requires consideration of three situations, per AASHTO: 1) left turns from the minor road, 2) right turns from the minor road, and 3) crossing the major road from the minor road. In the example, a sight triangle for left turns from the minor road, the longest required sight distance, is shown for a 30 mph design speed on the major road. This triangle requires 335 feet of sight distance in both directions along the major road. The other two conditions (right turns and crossing the major road) require less distance, so their sight triangles are within the one shown and are not illustrated. The sight triangle does not intersect the property outside the right of way.

F. Couplets

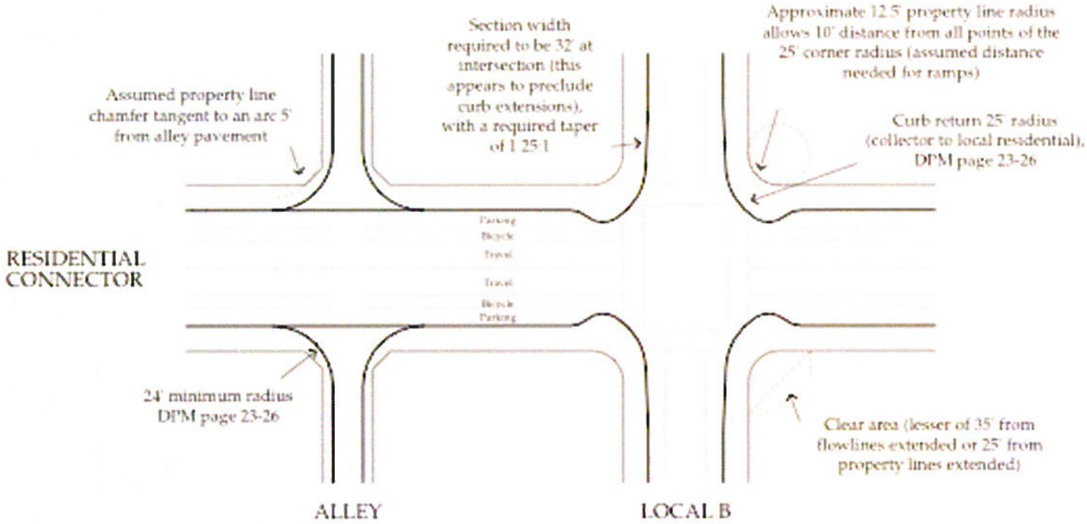
Couplet street systems, which are larger avenues and boulevards which have been split into one-way pairs, create several advantages compared to a facility sized to handle the same amount of traffic in a single large street. In general, couplets allow an urban grid to organize an area and provide for a pedestrian-scale environment. At the same time, couplets have the traffic flow advantages of other one-way streets in that they allow easier turning movements and smoother traffic flow. Also, couplets have been found to reduce pedestrian accident rates due to fewer conflicting movements that pedestrian need to negotiate.

1. Examples of Couplets:

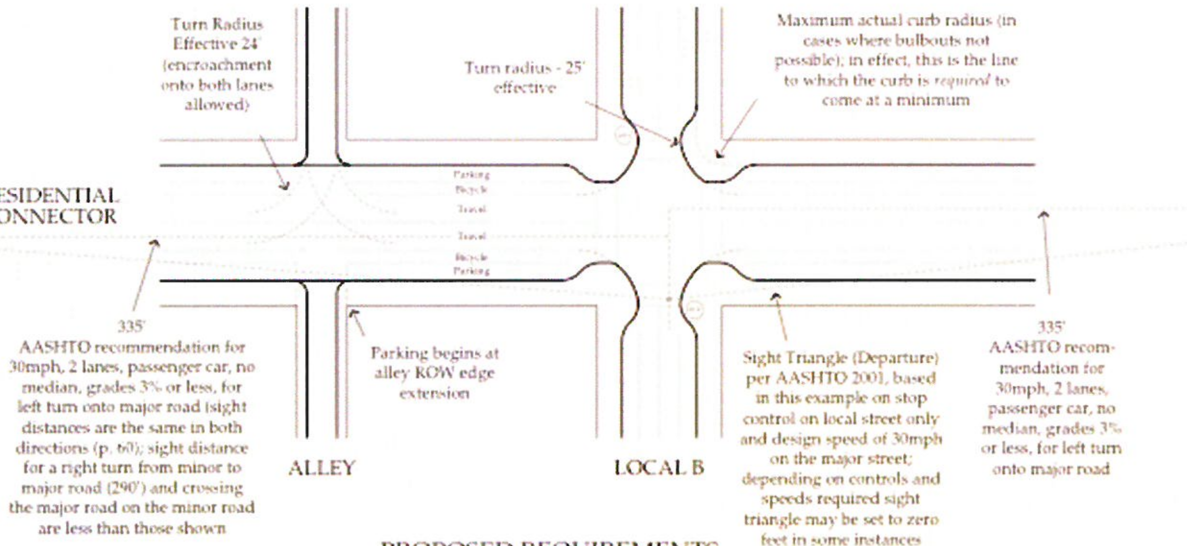
Otay Ranch, Chula Vista, CA

For Otay Ranch, a 5,300-acre master planned community in San Diego County, California, a technical evaluation of couplet and single-point intersections by Fehr & Peers Associates transportation engineers noted these circulation benefits:

- reduced intersection conflicts and delays and thus improved operating conditions
    - no need for protected left turn phasing
    - left and right turns on red
- a pedestrian friendly environment
    - reduced pedestrian crossing distances due to reduced number of traffic lanes
    - slower traffic speeds due to provision of on-street parking and wider sidewalks



CURRENT REQUIREMENTS
Diagram 1



PROPOSED REQUIREMENTS
Diagram 2

60'

Issaquah Highlands Town Center, Issaquah, WA

Fehr & Peers Associates also prepared a traffic operations analysis of a couplet intersection design for a major arterial in the Issaquah Highlands Town Center in Issaquah, Washington. This study found that the couplet functioned well, even with the addition of street parking. Both the Otay Ranch and Issaquah Highlands studies are unpublished, but copies have been provided to Mesa del Sol's transportation engineers.

The road network in Mesa del Sol will have couplets at selected locations, typically within the mixed-use centers. Outside the centers, boulevards and avenues in standard two-way configurations will be more typical.

G. Roundabouts

While still unusual in the United States, modern roundabouts are gaining increasing acceptance in this country and are very common in many European countries. Modern roundabouts, unlike rotaries or traffic circles, are designed for safety and smooth traffic flow. Chief among the operational benefits of roundabouts is the complete elimination of delays due to left turn signal phases. Roundabouts require entering vehicles to yield, removing the risk that the intersection might lock up. In addition, vehicle paths are deflected to a degree that vehicles enter the roundabout at safe speeds.

Modern roundabout intersections will be used at various locations in Mesa del Sol, typically on higher-volume roadways. Traffic circles (circular roadways with entry controlled by stop or yield signs) may be used on some minor, low-volume local streets.

1. Roundabout Safety

Many international studies have found that one of the most significant benefits of a roundabout installation is the improvement in overall safety performance.

Specifically, in the United States, it has been found that single-lane roundabouts operate more safely than two-way stop-controlled intersections. The frequency of crashes might not always be lower at roundabouts, but the injury rates are reduced. Pedestrians and bicyclists require specific design treatments to improve their safety.

A recent Federal Highway Administration publication ("Roundabouts: An Informational Guide") reports that experience in the United States shows a reduction in crashes after building a roundabout of about 37 percent for all crashes and 51 percent for injury crashes. If only small to moderate single lane roundabouts are considered, the reductions are 51 percent for all crashes. Additionally, reductions are 73 percent for injury crashes.

Mean reductions in crashes after converting to a modern roundabout from other traffic control devices have been similar in several other countries: in Australia, 41 to 61 percent for all crashes and 45-87 percent for injury crashes; in France, 57 to 78 percent for injury crashes; in Germany, 36 percent for all crashes; in the Netherlands, 47 percent for all crashes; and in the United Kingdom, 25 to 39 percent for injury crashes (p. 112, Exhibit 5-9).

In probably the most comprehensive US study to date, in 2000 the Insurance Institute for Highway Safety completed an in-depth study of 24 intersections which were converted from stop control and signals to modern roundabouts during the past decade. These 24 intersections were a mix of urban, suburban and rural environments. Overall, the study found reductions of 39 percent for all crash severities combined, 76 percent for all injury crashes and an approximate 90 percent reduction in fatal and incapacity injury crashes.

Resources:
Roundabouts: An Informational Guide. USDOT/FHWA Publication No. FHWA-RD-00-067, Washington, D.C., June, 2000.
http://www.tfhrc.gov/safety/00068.htm

Crash Reduction Following Installation of Roundabouts in the United States. Insurance Institute for Highway Safety, Arlington, VA, March, 2000

Kittelson Associates, Roundabout / Traffic Circle Inventory Database, http://roundabouts.kittelson.com/dbase/queries/inv.cgi

PARKING

LEVEL A PLAN : JUNE 2005

E

MESA DEL SOL

PARKING

At Mesa del Sol, standards for off-street parking will be similar to those of other walkable, mixed-use neighborhoods in Albuquerque. For non-residential uses, the City's standard parking requirements will apply, along with the standard reductions for shared parking in mixed-use areas and for areas served by transit.

Chapter 7, Development Standards, includes proposed parking standards for residential uses. All single-family dwellings at Mesa del Sol will have at least two non-tandem off-street parking spaces (tandem spaces are those where two vehicles are parked front-to-back). Since houses with rear garages served by alleys do not require curb cuts, on-street parking will be more plentiful on such streets than on typical streets with frequent driveways. In such neighborhoods, including many existing Albuquerque neighborhoods, the demand for visitor parking and for residential parking in excess of two spaces per dwelling unit can be accommodated by on-street parking. This Appendix includes analysis of the amount of on-street and apron parking that will be provided for the various housing types proposed at Mesa del Sol.

Historically, planners created minimum parking requirements for various uses based on national studies, such as the Institute of Traffic Engineers' *Parking Generation,* and standards from other jurisdictions. Too often, local data on actual parking demand are not available and planners may set minimum parking standards higher than necessary in order to be on the "safe" side. However, requiring an oversupply of parking has distinct disadvantages - it consumes more land, creates more stormwater runoff, and perpetuates a spread-out suburban land use pattern that discourages walking, bicycling, and transit use by creating a built environment that is hostile to pedestrians.

Cities such as Portland, Oregon, San Diego, California, and Denver, Colorado are adopting alternative approaches to the ITE parking standards not unlike some of the strategies adopted or in the process of adoption by the City of Albuquerque. Reducing parking minimums, crediting on-street parking toward parking requirements, planning for parking that is shared by different uses, metering curb parking to encourage turnover, and creating parking districts rather than requiring each site or building to provide its own dedicated parking area encourage compact, connected, and human-scale development in both urban and suburban areas.

The City of Albuquerque zoning code already includes several components that address deficiencies in ITE standards and others in the approval process. Current zoning reduces parking spaces by up to 25 percent in transit accessible, mixed-use zones. Two other amendments of note are pending council approval, SU-1 Zone Amendment and an Amendment 14-16-3-1 Off-Street Parking Regulations.

This appendix reviews several, but not all, of the best practices and case studies of parking management practices occurring around the country. Section 1 discusses approaches for residential on-street parking and Section 2 discusses reductions for mixed use and transit proximity. Though not an exhaustive list of parking management techniques, it applies techniques approved or in the approval process by the City of Albuquerque which are proposed for Mesa del Sol.

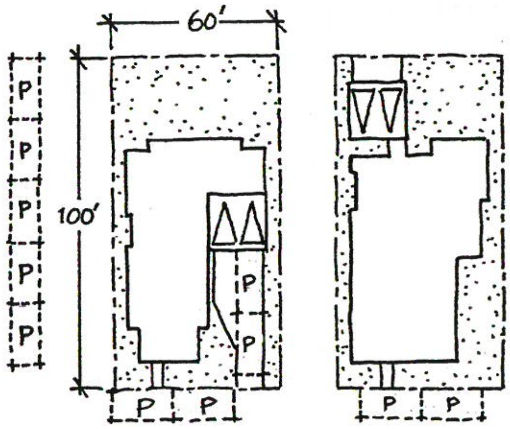
A. Residential Parking Management

This section examines some of the many jurisdictions focusing on techniques to moderate the impact of residential parking. Jurisdictions are reducing residential parking ratios and allowing on-street parking both to manage demand and create human-scale environments.

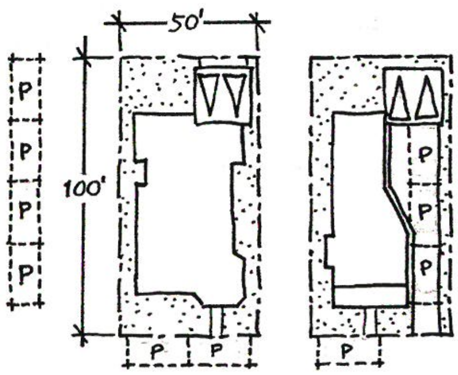
Though the majority of residential parking in the Mesa Del Sol project will be provided off-street, efficient use of on-street parking provides an opportunity to capitalize on already existing right-of-way resources. With convenient access to the adjacent uses, on-street parking has the added benefits of slowing traffic, providing a barrier between traffic and pedestrians, and reducing the amount of impervious surface by utilizing existing infrastructure. A proposed amendment to the zoning code moves to address this issue recommending up to 50 percent of the off-street parking requirement to be accommodated on-street for residential projects of 10 units per acre or more.

The Albuquerque zoning codes sets forth residential parking requirements of one off-street space per bathroom, with a maximum of 6. Many peer cities such as Denver, San Diego, Salt Lake City, Santa Fe, and Phoenix have significantly lower overall maximums of two to three off-street spaces per dwelling unit.

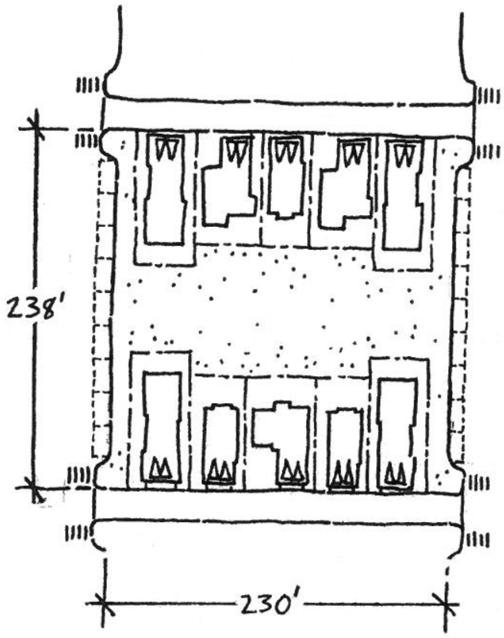
The following diagrams illustrate typical residential lot configurations for the Mesa Del Sol project and demonstrate the number of off-street parking stalls provided as well as additional on-street spaces. The figures show an abundance of on-street parking spaces due to fewer curb cuts, frequent use of alleys, and narrow side-drive driveways.



Estate Parking
2 Garage Spaces
0-2 Apron Spaces
2 Curb Spaces (7 @ Corner Lot)



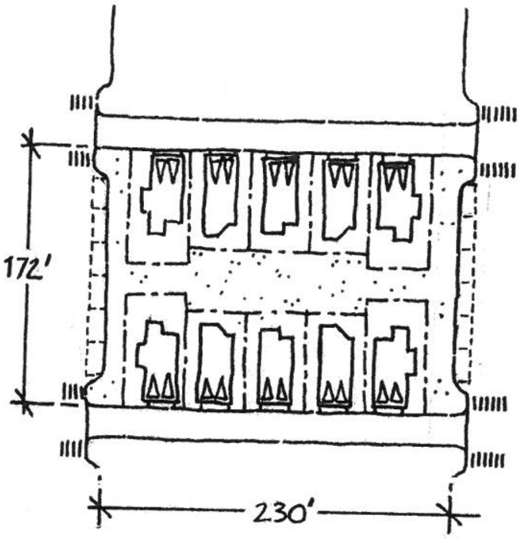
Large Lot Parking
2 Garage Spaces
0-3 Apron Spaces
1-2 Curb Spaces (6 @ Corner Lot)



Large Green Court (10 Units)

20 Garage Spaces

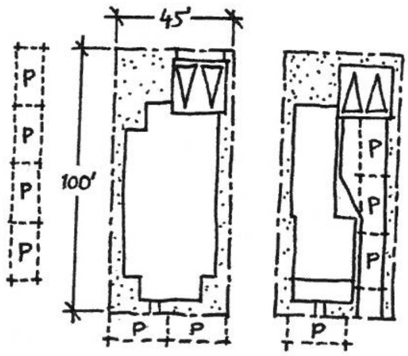
18 Curb Spaces



Small Green Court (10 Units)

20 Garage Spaces

12 Curb Spaces

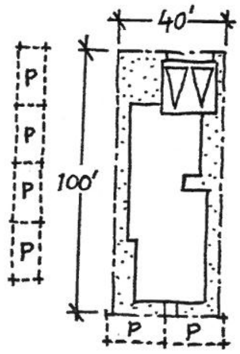


Medium Lot Parking

2 Garage Spaces

0-3 Apron Spaces

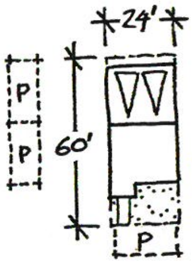
2 Curb Spaces (5 @ Corner Lot)



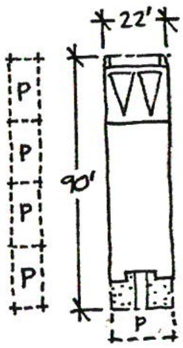
Small Lot Parking

2 Garage Spaces

2 Curb Spaces (5 @ Corner Lot)



Small Lot Townhouse Parking
2 Garage Spaces
1Curb Space (2@ Corner Lot)



Large Lot Townhouse Parking
2 Garage Spaces
1 Curb Space (4 @ Corner Lot)

1. Case Studies - Residential Parking

a. Stapleton, Denver, Colorado

Stapleton is a 4,700-acre site projected to accommodate 13,000 units on land formerly occupied by an international airport in Denver, Colorado. The City of Denver specifies 1 to 2 off-street parking stalls per multifamily unit and 2 off-street parking stalls for each single-family detached unit. Off-street parking requirements fulfill the majority of needs at Stapleton while on-street parking is underutilized.

Resources:
Heidi Majerik, Stapleton-Denver, HMajerik@stapletondenver.com
Dehan Glanz, Associate, Calthorpe Associates, (510) 548-6800, danno@calthorpe.com
City of Denver Municipal Code. http://www.denvergov.org/Zoning_Code/default.asp
Stapleton General Information. http://www.stapletondenver.com/main.asp
Stapleton Design Guidelines. http://198.202.202.66/admin/template3/forms/StapDesGuide04.pdf

b. Daybreak, South Jordan, Utah

Located in the Southern Salt Lake Valley, the 4,000-acre, 13,000-unit Daybreak master plan provides 1.25 to 2.25 parking stalls per multifamily unit and 2 per single-family dwelling unit. The design guidelines reduce overall parking requirements for transit zone and guest parking in accordance with South Jordan zoning code.

Resources:
Contact: Roger Hodges, Associate, Calthorpe Associates, (510) 548-6800, roger@calthorpe.com
Daybreak General Information. http://www.daybreakutah.com/
South Jordan Municipal Code: http://sjc.utah.gov/municipalcode.asp

c. Salt Lake City, Utah

The City of Salt Lake sets a maximum of 4 outdoor parking spaces on an individual single-family detached lot while allowing a credit of up to 50 percent for on-street spaces adjacent to the use.

Resources:

Salt Lake City Municipal Code.
http://66.113.195.234/UT/Salt%20Lake%20City/index.htm

d. City of Sisters, Oregon

The City of Sisters is a historic downtown and surrounding residential area located in central Oregon. Rewritten in 2001, the City of Sisters code allows up to a 30 percent credit for on-street parking adjacent to any use, to accommodate new and infill development in and around the downtown.

Resources:
Bill Adams, Planning Director, (541) 549-6022 x4 - badams@ci.sisters.or.us
City of Sisters Development Code, Chapter 3.3,
http://www.ci.sisters.or.us/zoning.shtm
Stein Engineering. 1997. *Shared Parking Handbook*. Portland Metro.
http://www.metro-region.org/library_docs/land_use/sharedpark.pdf.

e. King Farm, Rockville, Maryland

A mixed-use traditional neighborhood development in suburban Montgomery County, Maryland County, King Farm uses a number of techniques to manage parking in the residential areas. In particular, the developer, King Farm Associates, maintains the street right of ways as private space. This allows the developer to use adjacent right of ways to count towards the overall off-street parking requirements.

Resources:
Governor's Office of Smart Growth. *Driving Urban Environments: Smart Growth Parking Best Practices*.
Tumlin, Jeffery and Adam Millard-Ball. "How to Make Transit Oriented Development Work." Planning. May 2003, p.14-18.
Urban Land Institute. The New Shape of Suburbia – Trends in Residential Development. 2003, p.214-221.
City of Rockville Code, Chapter 15,
http://www.rockvillemd.gov/government/citycode.htm

Contact:
Jim Wasilak, Community Planning and Development Services, City of Rockville, (240) 314-8200, jwasilak@ci.rockville.md.us

Other cities, including the City of Los Angeles and San Diego, allow on-street parking to be credited toward residential off-street parking requirements if it fits a certain set of criteria, such as lot depth or lot slope.

B. Commercial and Mixed Use Parking Management

There are a significant number of parking management strategies that can be applied to Mesa Del Sol's commercial and mixed-use areas, including shared or mixed-use parking reductions and transit proximity reductions. The City of Albuquerque Development Framework Code lays out the framework for both reductions.

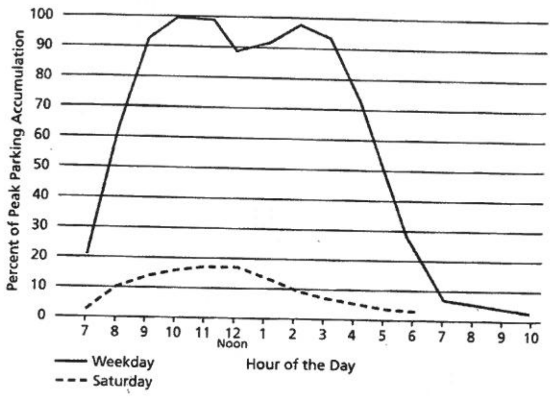
Shared parking is defined as parking that can be utilized between two or more land uses because of variations in the peak accumulation of parked vehicles as the result of time of day, day of week, or season. Relationships among a diversity of uses in Mesa Del Sol centers can attract users to park once and walk between two or more land uses on a single auto trip and provide a good opportunity limit the overall supply of parking.

The Urban Land Institute delineates different use cycles in the 1983 publication, *Shared Parking*, and the Institute of Transportation Engineers' *Shared Parking Planning Guidelines*. Examples of the weekday and Saturday peak periods follow.

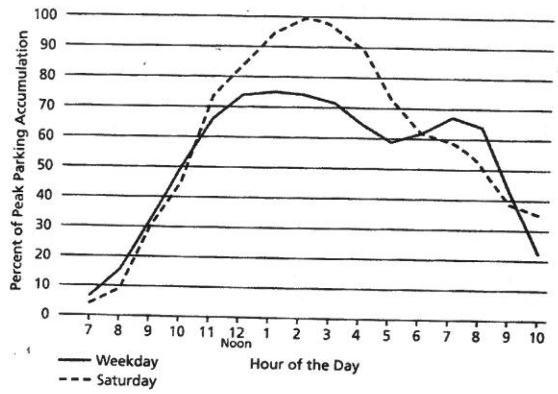
Land Use	Single Use Peak Hour Demand (spaces)	Percentage of Peak Demand for Key Times [1]									
		Weekdays					Saturdays				
		10 AM	1 PM	5 PM	8 PM	10 PM	10 AM	1 PM	5 PM	8 PM	10 PM
Retail	3/1,000 sq. ft.	50	75	75	65	25	50	100	90	65	35
Office	3/1,000 sq. ft.	100	90	50	5	5	15	15	5	0	0
Restaurant	10/1,000 sq. ft.	20	70	70	100	95	5	45	60	100	95
Cinema	1/3 seats	0	60	60	85	85	0	70	70	100	100
Health Club	5/1,000 sq. ft.	10	80	100	30	10	60	80	60	30	10
Hotel	1/room	45	30	60	90	100	40	30	60	90	100
Residential	1-2/ unit (see requirements)	85	80	85	95	100	70	65	75	95	100

[1] Source of peak demand percentages is the Urban Land Institute's *Shared Parking Standards*.

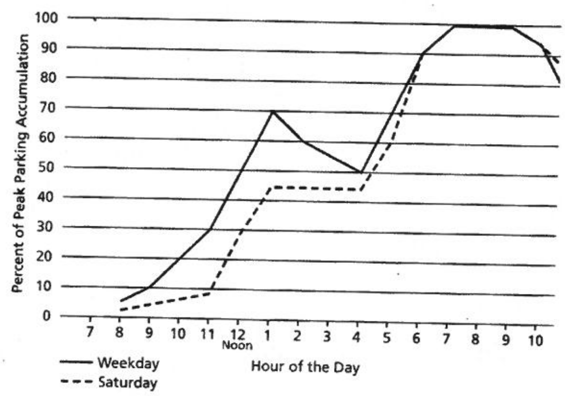
Office Parking Accumulation



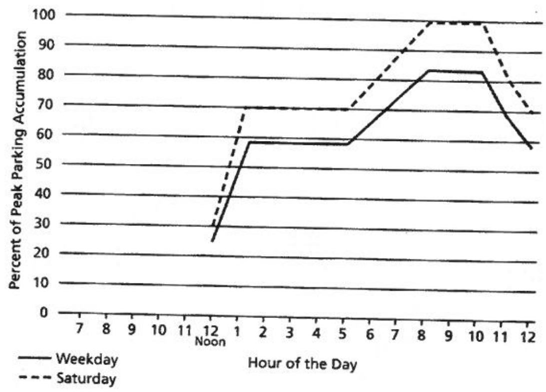
Regional Retail Parking Accumulation



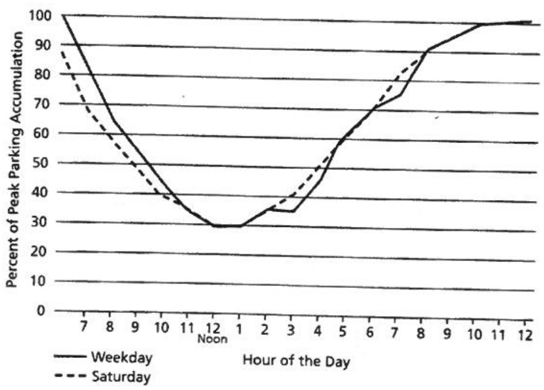
Restaurant/Lounge Parking Accumulation



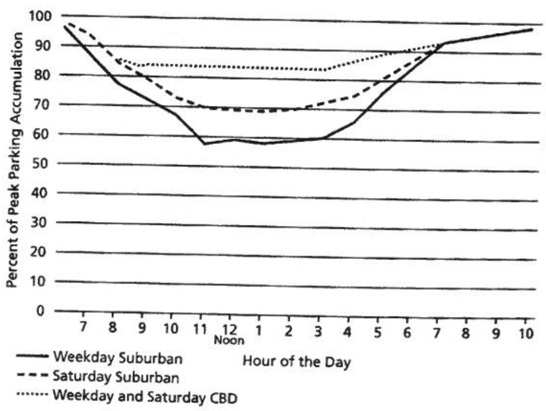
Cinema Parking Accumulation



Hotel Parking Accumulation—Guest Rooms and Employees



Residential Parking Accumulation



Source: *Mixed-Use Development Handbook, Urban Land Institute, 1987, p.86. Appendix VI.*

1. Case Studies - Commercial and Mixed Use Parking

a. Montgomery County, Maryland

The Montgomery County Zoning Ordinance allows for shared parking when any building is under the same ownership or under a joint use agreement and is used for two or more purposes. The uses must be within 500 feet of the shared parking facility.

Resources:
Governor's Office of Smart Growth. *Driving Urban Environments: Smart Growth Parking Best Practices.*
http://www.smartgrowth.state.md.us/pdf/Final%20Parking%20Paper.pdf
Montgomery County Department of Public Works and Transportation

b. Bethesda Row, Bethesda, Maryland

A multi-phased, mixed-use town center project in a first-ring suburb of Washington, D.C., Bethesda Row provides over one million square feet of leasable office, retail, and residential space. On-site parking includes a 900-space parking structure paid for by the county and ample on-street parking surrounding Main Street. Parking structures are hidden in the center of blocks and parking stalls are shared between the uses.

Resources:

Governor's Office of Smart Growth. *Driving Urban Environments: Smart Growth Parking Best Practices.*
http://www.smartgrowth.state.md.us/pdf/Final%20Parking%20Paper.pdf

Hoover, Kent. "Suburbs 'next step' for 'smart growth,'" Sacramento Business Journal. January 25, 2002.
http://sacramento.bizjournals.com/sacramento/stories/2002/01/28/focus2.html

Urban Land Institute. The Smart Growth Toolkit. 2000. Appendix IV.

Francine Waters, Kerry Daly, Kristen Fink, Bethesda Transportation Solutions, 301-656-0868

c. King Farm, Rockville, Maryland

A mixed-use traditional neighborhood design in suburban Montgomery County, Maryland. King Farm uses a number of techniques to manage parking. In particular, the developer, King Farm Associates, proposed an amendment to the City of Rockville Municipal Zoning Code allowing for shared parking between commercial tenants.

Resources:
Governor's Office of Smart Growth. *Driving Urban Environments: Smart Growth Parking Best Practices.*
http://www.smartgrowth.state.md.us/pdf/Final%20Parking%20Paper.pdf

Tumlin, Jeffery and Adam Millard-Ball. "How to Make Transit Oriented Development Work." Planning. May 2003, p.14-18.
Urban Land Institute. The New Shape of Suburbia – Trends in Residential Development. 2003, p.214-221. Appendix V.
City of Rockville Code, http://www.rockvillemd.gov/government/citycode.htm
Jim Wasilak, Community Planning and Development Services, City of Rockville, (240) 314-8200, jwasilak@ci.rockville.md.us

d. Lloyd District, Portland, Oregon

A predominately office district in Northeast Portland including the Lloyd Center mall, the Lloyd District has added over a million square feet of gross leasable space, yet the market and developer have decreased the overall number of parking spaces without City of Portland regulation.

Resources:

Stein Engineering. *Shared Parking Handbook*. Portland Metro. 1997. http://www.metro-region.org/library_docs/land_use/sharedpark.pdf

e. Tualatin Commons, Tualatin, Oregon

A ten-year-old mixed-use project located south of Portland, Oregon, Tualatin Commons utilizes shared and district parking to accommodate the City's parking requirements. Two Class A office buildings, a restaurant, and hotel share a set of surface parking stalls. Development agreements signed between the City and developer specify the hours of parking use for each building use.

Resources:

Doug Rux, Community Development Director, City of Tualatin, (503) 691-3018

Stein Engineering. *Shared Parking Handbook*. Portland Metro. 1997. http://www.metro-region.org/library_docs/land_use/sharedpark.pdf

Tualatin Commons Unsprawl Case Study. http://www.terrain.org/unsprawl/4/

f. Lakeview District, Chicago, Illinois

Chicago's popular Lakeview District devised an approach to increase access to parking during the weekend. A theatre and several restaurants rent a school parking lot to accommodate parking needs.

Resources:

Wormser, Lisa. Summer 1997. "Don't Even Think of Parking Here." *Planning*.

g. City of Monrovia Old Town, California

The City of Monrovia built a 2,400-seat cinema in the heart of Old Town without providing a parking structure to support it. While street redesign added several on-street spaces, the cinema shares parking with the surrounding offices and businesses that close between 5-7 PM.

Resources:

City of Monrovia Zoning Code. http://www.amlegal.com/monrovia_ca/

Victoria Transport Policy Institute. 2004. *Online TDM Encyclopedia.* http://www.vtpi.org/tdm/tdm28.htm

2. Transit Proximity Reduction

A transit proximity reduction allows any use within a specified distance of a transit stop to reduce the number of off-street parking spaces provided. The City of Albuquerque development code permits parking reductions (up to 20%) if the development is within 300 feet of a regular Albuquerque transit system route.

Chapter 3 discusses current and anticipated future transit service at Mesa del Sol. The street network at Mesa del Sol is designed to smooth the progress of vehicles between centers of activity. In addition to Mesa del Sol Boulevard, avenues and some connector streets will be designed with the expectation that they will become public transit routes as service is extended to Mesa del Sol. Public transit routes will be designed with street sections, intersection treatments, and streetscape elements that will support transit. Mesa del Sol Boulevard will be designed to accommodate a dedicated transit right-of-way. Technologies such as signal pre-emption, prepaid boarding, and boarding platforms at the level of the vehicle floor have great potential for improving the speed and convenience of transit service.

Since development at Mesa del Sol is expected to be served by transit, and since commercial parking areas are typically underutilized on all but a few days per year, Mesa del Sol's mixed-use centers are proposed to be planned using the transit proximity reduction from the outset.

3. Case Studies - Transit Proximity Reduction

a. City of Seattle, Washington

Seattle Municipal Code allows for a reduction in required parking minimums if a work location is within 800 feet of transit and employees are provided with transit passes.

Resources:

Governor's Office of Smart Growth. *Driving Urban Environments: Smart Growth Parking Best Practices.* http://www.smartgrowth.state.md.us/pdf/Final%20Parking%20Paper.pdf

City of Seattle Municipal Code, http://clerk.ci.seattle.wa.us/~public/code1.htm

b. *City of Concord, North Carolina*

The Unified Development Ordinance of the City of Concord in suburban Charlotte details parking regulations for transit oriented development zones. The ordinance reduces the minimum parking requirements by 50 percent within 500 feet of a light rail alignment.

Resources:

Governor's Office of Smart Growth. *Driving Urban Environments: Smart Growth Parking Best Practices.* http://www.smartgrowth.state.md.us/pdf/Final%20Parking%20Paper.pdf

City of Concord Unified Development Ordinance. http://www.ci.concord.nc.us/devserve/UDO_0.asp

c. *City of Phoenix, Arizona*

The City of Phoenix Municipal Parking Code specifies a parking reduction if transit service available within one-quarter mile of the site with rush hour frequencies of thirty (30) minutes or less.

Resources:

Phoenix Municipal Code. http://phoenix.gov/PLANNING/zonord.html

Resources:

Barton-Aschleman Associates. 1983. *Shared Parking.* Urban Land Institute.

ITE. *Parking Generation, 3rd Edition*. 2004.

ITE. *Shared Parking Planning Guidelines*. 1995.

O'Neil, David et al. 2003. *The Smart Growth Toolkit: Trends in Residential Development.* Washington D.C.: Urban Land Institute.

Everett-Lee, Reed. 1999. *Parking Management*, Transportation Tech Sheet, Congress for New Urbanism. http://www.cnu.org/cnu_reports/CNU_Parking_Management.pdf.

San Francisco Planning and Urban Research (SPUR). 1998. *Reducing Housing Costs by Rethinking Parking Requirements*. http://www.spur.org/documents/spurhsgpkg.pdf.

Schmitz, Adrienne, et al. 2000. *The New Shape of Suburbia*. Washington D.C.: Urban Land Institute.

Shoup, Donald. Winter 1995. "An Opportunity to Reduce Minimum Parking Requirements," *Journal of the American Planning Association*, Vol. 61, No. 1, pp. 14-28.

Shoup, Donald. 1999. “The Trouble with Minimum Parking Requirements.” Victoria Transport Policy Institute. http://www.vtpi.org/shoup.pdf.

Urban Land Institute. 1987. *Mixed-Use Development Handbook.*

ULI. 2000. *Parking Dimensions, 4th Edition.*

Willson, Richard. Winter 1995. “Suburban Parking Requirements; A Tacit Policy for Automobile Use and Sprawl,” *Journal of the American Planning Association*, Vol. 61, No. 1, pp. 29-42.

TRANSPORTATION

LEVEL A PLAN : JUNE 2005

F

MESA DEL SOL

TRANSPORTATION

A. Introduction

This Appendix F to the *Community Master Plan* discusses the transportation system proposed for Mesa del Sol. The safety and comfort of people walking, bicycling and using transit will be paramount considerations in the design of the transportation system, in keeping with the sustainability concept being employed for the entire development. Automobile considerations will not be neglected; on the contrary, the safe and efficient movement of automobiles is actually enhanced by the balanced, intermodal transportation system proposed for Mesa del Sol.

The Mesa del Sol transportation system is planned to be truly multi-modal, reflecting the progressive values of the City of Albuquerque and the New Mexico Department of Transportation. The transportation system will balance the needs of motorists, transit users, bicyclists, and pedestrians, and integrate all of these systems into the major and minor transportation corridors proposed for the development.

B. Planned Communities Criteria

The Mesa del Sol project is being developed in accordance with planning policy established by the City of Albuquerque and Bernalillo County. The applicable policy is the *Planned Communities Criteria: Policy Element*, dated February 1991, adopted by resolution by the City of Albuquerque on November 5, 1990 and by Bernalillo County Commissioners on October 23, 1990. The adoption of this policy is intended to provide a framework in which large planned communities can be developed to better meet certain community planning goals, while improving on the standard planning and subdivision practices that have been in common use in this area, region and country. In regards to transportation, these planning goals include "Provision for better access and mobility as well as alternative modes of transportation. …Planned community developments usually aim to improve on approaches of the past—to do a better job, more sensitive to environmental concerns and the provision of a comprehensive mix of land uses." This is the approach being taken at Mesa del Sol.

In regards to transportation, the requirements described under Level A Community Master Plan in the *Planned Communities Criteria: Policy Element* include the following:

"A comprehensive transportation system plan which discusses major street continuity and phased analyses of travel demand and supply, identifies major travel corridors, and considers private and public responsibilities for on-site and off-site improvements must be conducted…". This document is intended to fulfill these requirements.

Following Level A Plan submittal and adoption, Level B and Level C plans will also be submitted for each specific "takedown area" and subdivision of the development. The Master Plan submitted herein addresses the requirements of the Level A Plan. The Level B Plan, for the urban, community or employment center, will include specific traffic studies for the particular plan area being submitted, details on the traffic circulation system, typical roadway cross-sections for the major roadways, and type and location of pedestrian, bicycle and transit elements. This Plan will be developed and submitted as a more detailed and phased analysis of the particular "takedown area" planned. The subsequent Level C Plan, for a subdivision or particular site development, will include a site-specific traffic impact study, along with specific platting and dedication of street and trail rights-of-way, and full details on access, parking and circulation systems. With the more detailed effort that will be placed into the Level B and C Plans in the future, this Level A Plan provides an overview of the macro-level planning approach for Mesa del Sol and introduces the basic concepts, which will be applied for the overall development.

C. Application of "New Urbanism" Concepts

"New Urbanism" concepts will be applied to the planning, layout and development of the transportation system within Mesa del Sol. This transportation system will mix differing types of vehicle uses with transit, biking and walking. This will include a road network that reinforces access to walkable neighborhoods, urban town centers and transit.

Key concepts of New Urbanism applied to Mesa del Sol will include the following:

- Planning and development of transportation facilities that are truly multi-modal, with the blending and encouraged use of transit, bike lanes, pedestrian walkways and trails, and roadways that fit the scale of the neighborhoods and communities through which they traverse. Such a system will offer the user fundamentally different choices in mobility and access.
- Use of a grid of connector streets that will disperse traffic so that no one street becomes overloaded, the environments along them are thus more "liveable", and so that bicycle and pedestrian uses on those connectors are emphasized with equal importance to vehicle uses.
- Use of one-way couplets at urban, employment and community centers, dividing up the major boulevards into split one-way pairs, to allow urban development adjacent to and possibly within the major intersections. In so doing an environment that is much more pedestrian friendly will be created.
- Use of roundabouts at major intersections, providing greater traffic capacity and improved pedestrian and vehicular safety, compared to traditional signalized intersections.

These concepts fit precisely with "Smart Growth" strategies, and will form the cornerstone for planning, engineering and implementation of Mesa del Sol's transportation system.

D. Existing Conditions

1. Location and Terrain

The Mesa del Sol site is located in the southeast part of Albuquerque, in Bernalillo County. It is bordered by Interstate Highway I-25 to the west, the Albuquerque Sunport and Kirtland Air Force Base to the north, the Kirtland Air Force Base and the Manzano Mountains to the west and the Isleta Pueblo to the south. (Refer to the Project Location Map in Figure F-1.) The area encompassed by the site is generally located on top of the mesa, at elevations ranging from approximately 5400 to 5200 feet. As illustrated by this narrow range of elevation difference, the mesa top is flat with no significant relief in the terrain. I-25 to the west of the site ranges in elevation from approximately 5100 to 5000 feet, from north to south.

2. Primary Access

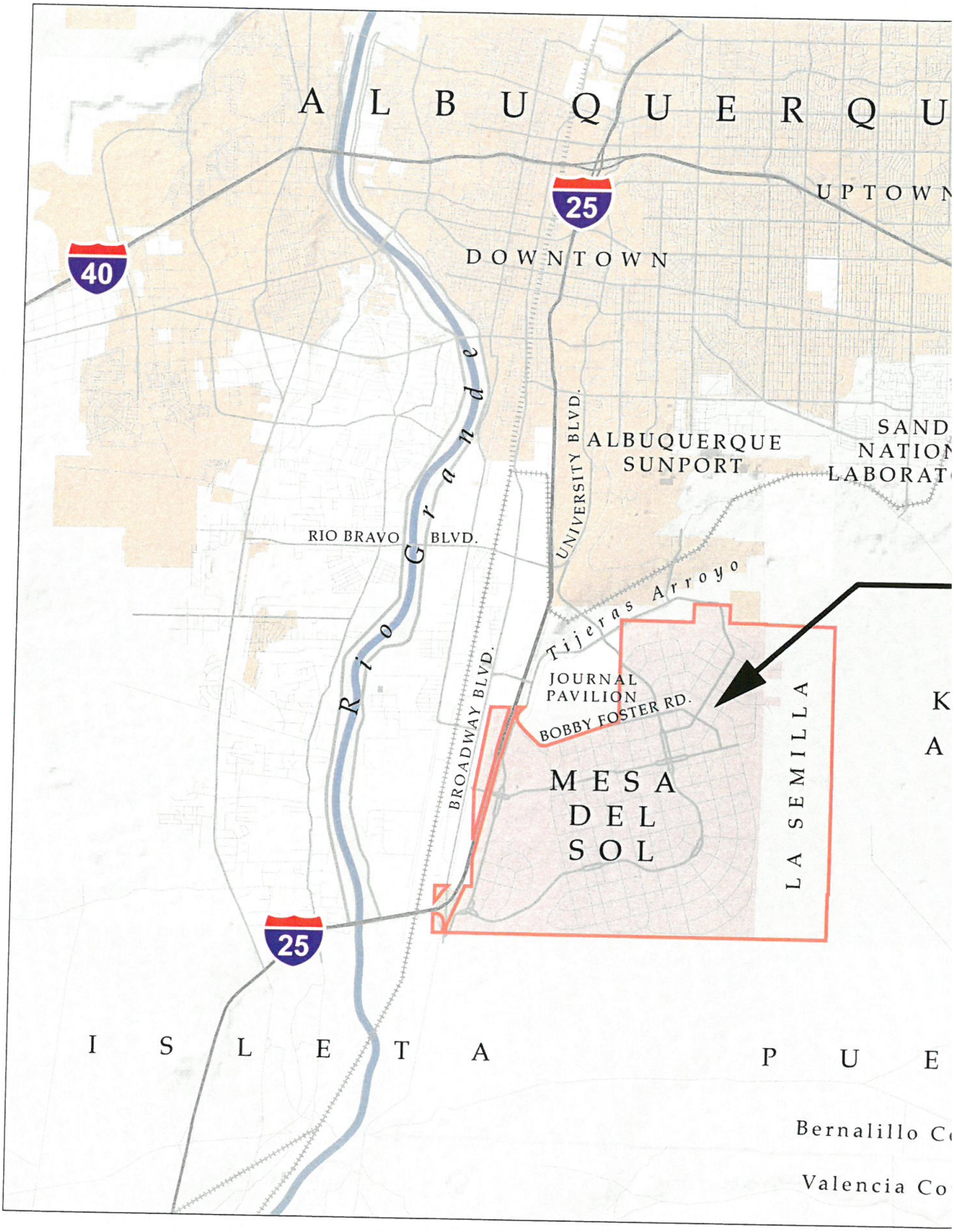
University Boulevard

University Blvd. is an existing four lane minor arterial roadway that extends south from the Albuquerque Sunport to Rio Bravo Blvd., intersecting with Rio Bravo Blvd. just east of its interchange with I-25. (Refer to the Project Location Map in Figure F-1.) The extension of University Blvd. is the subject of a separate study and project, being performed for the City of Albuquerque. The extension of University Blvd. extends from Rio Bravo Blvd. south to the north side of Mesa del Sol, connecting with the existing roadway, Bobby Foster Road, which provides current access to the Journal Pavilion Amphitheater. The extension of University Blvd. is being designed as a four-lane urban type section, to include curb and gutter and a raised median separating north and southbound lanes. The Environmental Assessment and Finding of No Significant Impact have been completed for this project. At this time, final construction documents are being prepared for anticipated construction to commence in the late Spring or early Summer of 2005. Construction funding for this project is programmed, with a portion of the funding coming from the New Mexico Department of Transportation's (NMDOT) GRIP funding program.

The extension of University Blvd. will provide the initial access to the Mesa del Sol site for the first phase of development, and will continue to serve as the primary north-south arterial access in the future.

I-25 and Interchanges

I-25, which parallels and is located on the western edge of the Mesa del Sol site, consists of four through lanes, two lanes in each direction northbound and southbound. Further north, I-25 becomes six lanes north of the Sunport Interchange (MP 221.8). South of the Sunport Interchange, at MP 220.2 is the Rio Bravo Interchange. This interchange is a standard diamond configuration. Continuing south, the next interchange on I-25 is located at Broadway / NM 47.



A L B U Q U E R Q U
UPTOWN
25
40
DOWNTOWN
Rio Grande
UNIVERSITY BLVD.
ALBUQUERQUE SUNPORT
SAND
NATION
LABORAT
RIO BRAVO BLVD.
Tijeras Arroyo
BROADWAY BLVD.
JOURNAL PAVILION
BOBBY FOSTER RD.
MESA DEL SOL
LA SEMILLA
K
A
25
I S L E T A
P U E
Bernalillo Co
Valencia Co

This interchange is a more complicated configuration due to the presence of directional ramps for major movements, requiring a larger interchange area. The southwest corner of the Mesa del Sol site lies adjacent to the Broadway / NM 47 interchange.

I-25, with the interchanges described above, and with addition of another interchange to be discussed in later chapters of this report, will serve as the primary access to the Mesa del Sol site.

Bobby Foster Road / Los Picaros

Bobby Foster Road begins at an intersection with Broadway, west of I-25, and continues on an overpass bridge structure over I-25, climbing the mesa, and presently terminating at the entrance to the Journal Pavilion Amphitheater. Bobby Foster Road consists of two lanes west of and over I-25, widening to three lanes with a lane added east of I-25. This added lane has been striped as a westbound, or outbound lane leaving the Journal Pavilion Amphitheater parking area.

Bobby Foster Road will serve as a secondary access to the Mesa del Sol site, providing a direct connection from Mesa del Sol to Broadway (NM 47).

Broadway / NM 47

Broadway, also designated as New Mexico Highway 47, runs parallel and west of I-25. Broadway served as the original highway connecting Albuquerque with villages and pueblos to the south, prior to construction of the interstate highway system. Broadway crosses I-25 near the south end of the Mesa del Sol site. Access to the land now identified as the Mesa del Sol development was originally envisioned and right-of-way was dedicated with the development of the interstate highway and the interchange between I-25 and Broadway. A stub access road presently exists just south of the I-25 / Broadway interchange, which extends east from Broadway for approximately 0.1 mile. This access road is located at a signalized intersection that also serves the golf course of the Isleta Pueblo to the west of Broadway.

Broadway will serve as a south access to the Mesa del Sol site, linking with the primary north-south roadway within Mesa del Sol.

3. Programmed Improvements

Several improvements to the existing transportation network in the vicinity of Mesa del Sol are programmed in the Mid-Region Council of Government's (MRCOG) Metropolitan Transportation Plan (MTP) and in MRCOG's Transportation Improvement Program (TIP). These are based on current projections of transportation needs without Mesa del Sol in place.

The MTP is a long-range transportation planning document, projecting planned projects over a 20 year planning horizon, currently through 2025. The

TIP is a short-range transportation planning document, programming planned projects for the upcoming six years, presently for 2004-2009. The first three year period, 2004, 2005, and 2006, are defined as "fiscally constrained", i.e. these projects are based on actual funding in place. The final three years of the TIP, and the projects shown in the MTP, are based on anticipated flow of funds at present rates extrapolated into the future. Actual projects presently programmed in the TIP and the MTP are presented in the following sections.

In the short range plan, the 2004—2009 TIP, two major projects in the vicinity of Mesa del Sol are Commuter Rail between Belen and Bernalillo and University Blvd. extension to Mesa del Sol. Both of these projects are projected for completion and operation within the near future: Belen to Bernalillo Commuter Rail is slated to start passenger service in the Fall of 2005. University Blvd. is anticipated to be completed in late 2006. University Blvd. will dramatically improve access to Mesa del Sol and will accommodate the traffic demands for Mesa del Sol for the first years of development. In a recent amendment to the TIP, approved by MRCOG in May of 2005, the I-25 / Mesa del Sol Blvd. Interchange was added to the TIP.

Projects identified in the 2025 MTP, MRCOG's long range transportation plan, include the Mesa del Sol interchange on Interstate 25 and "Mesa del Sol Parkway", the main boulevard leading from I-25 to the Mesa del Sol town center. The 2025 MTP also has planned improvements to I-25 north of the Mesa del Sol site, from Rio Bravo to Gibson. These improvements include additional lanes to increase capacity and reconstruction of existing lanes.

Projects Included in TIP:

- University Blvd. Extension, Preliminary Design and Right of Way preservation project, $1,847,680; funds in 2004 and prior to 2004.
- Mesa del Sol Interchange, Mesa del Sol Blvd. / I-25, new interchange, $2.2 M total, recently included in an amendment to the TIP with funding available in fiscal year 2006 (STIP incorporation pending)
- I-25 Belen to Santa Fe, Commuter Rail Implementation between Belen and Santa Fe, Preliminary Engineering, $1.5 M, funds in 2005.
- I-25 Belen to Bernalillo, Commuter Rail Implementation, purchase of Right of Way, rolling stock, upgrades, $ 75.0 M, funds in 2004 and 2005.

Projects Included in MTP

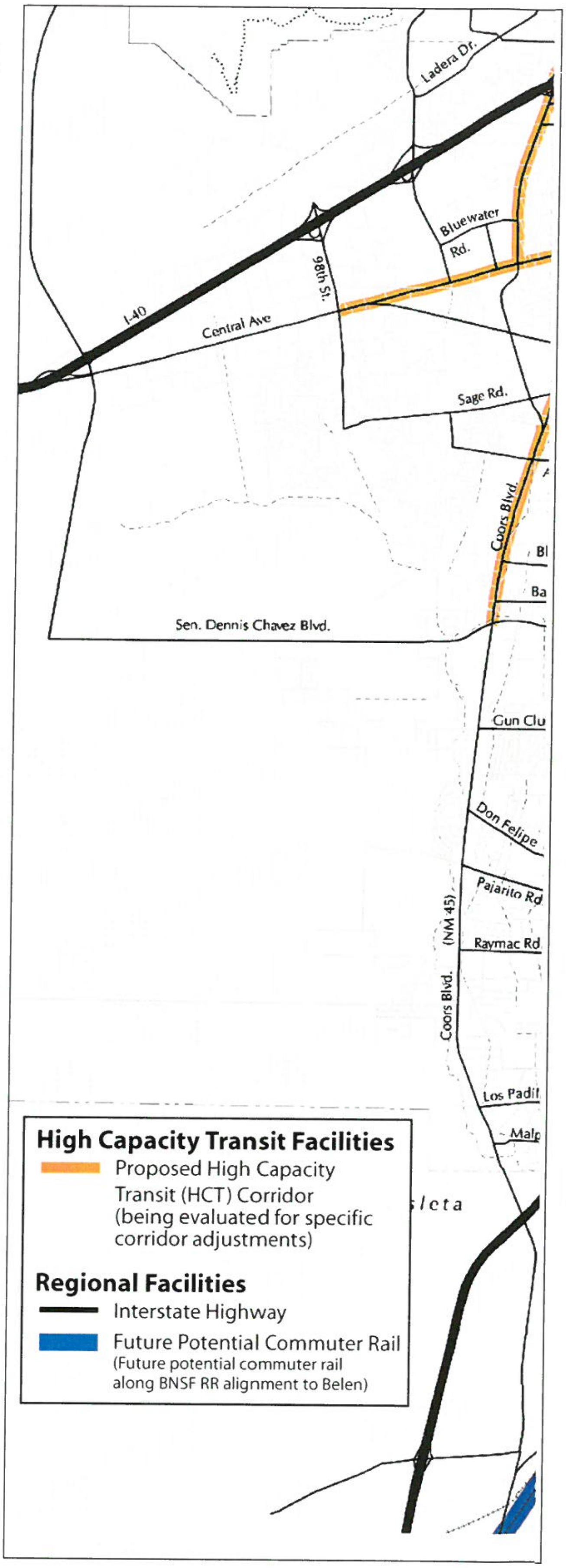
- University Blvd. Extension, Rio Bravo to Mesa del Sol, new four lane roadway and interchange reconstruction, $23.5 M total, including additional $6 M from GRIP program; included in 2006 to 2010 Roadway Network.
- I-25 Rio Bravo to Gibson, reconstruction and additional lanes, $21.3 M total; included in 2016 to 2025 Roadway Network.
- Mesa del Sol Interchange, Mesa del Sol / I-25, new interchange, $21.3 M total; included in 2016 to 2025 Roadway Network.
- Mesa del Sol Parkway, I-25 to Loop Road, new four lanes, $8,008,800 total; included in 2016 to 2025 Roadway Network.

4. Current Status of Transit in the Vicinity of Mesa del Sol

The City of Albuquerque public transit system is known as ABQ Ride. This system consists of on-street buses, both single unit local buses and articulated commuter buses, primarily operating in the immediate Albuquerque metropolitan area. There are presently two routes in the vicinity of Mesa del Sol. The Local / All Day Bus Route 51, Atrisco-Rio Bravo is presently in place on Rio Bravo Blvd., with the south end of this route terminating at 2nd Street and Rio Bravo. The other line is Local / All Day Bus Route 50, Airport-Downtown, on Yale Blvd., with the south end of this route terminating at the Albuquerque Sunport (Airport).

Future planning for transit, as currently shown on the Long Range High Capacity Transit System map for the Albuquerque Metropolitan Planning Area, prepared by MRCOG, contains "possible corridors that have good potential for development". There are two possible future "high capacity transit" routes in the vicinity of Mesa del Sol (see Figure F-2). A possible future route is shown on Isleta Blvd. terminating at Rio Bravo Blvd., located west of the Rio Grande. Another possible future route is shown on Yale Blvd., and as with present service, terminating at the Albuquerque Sunport.

Mesa del Sol is generally located at the very southeast edge of existing transit service routes, and will likely require the extension of service from one of these existing routes, from either Rio Bravo Blvd. or Yale Blvd., to provide service and connections to Mesa del Sol.



LONG RANGE HIGH CAPACITY TRANSIT

Figure F-2

E. Proposed Transportation System

1. Circulation Plan

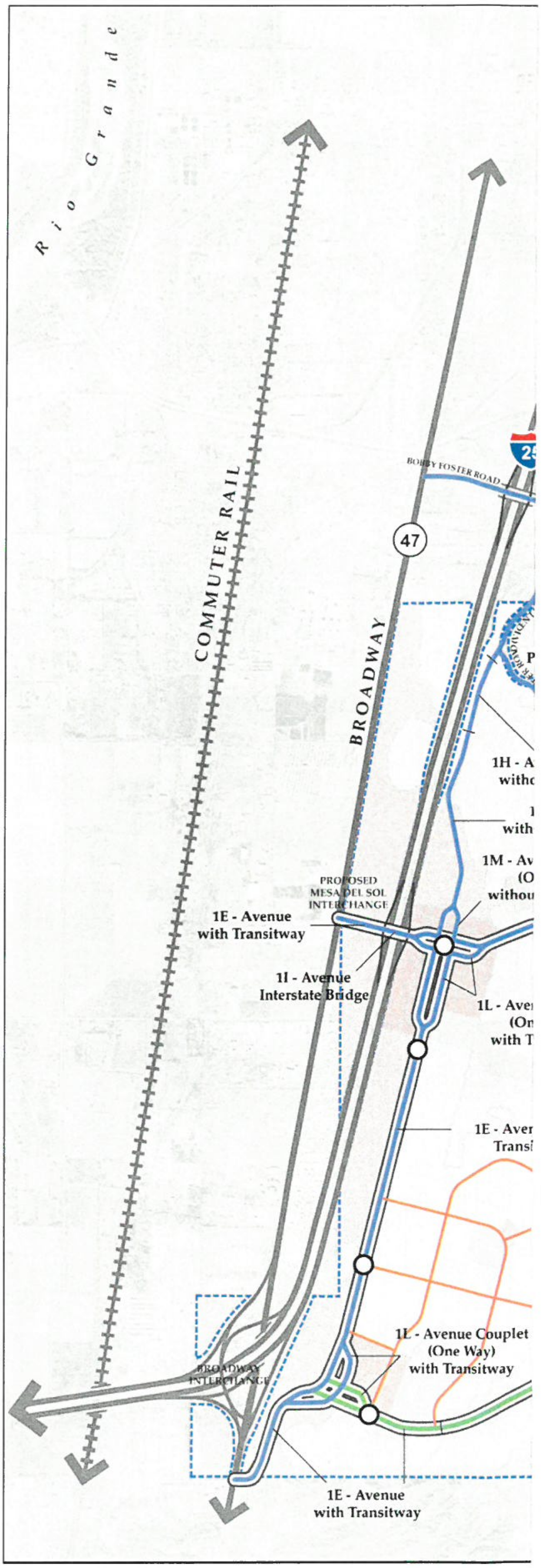
The circulation plan for Mesa del Sol follows a "new urbanism" concept, thus far new and unique to Albuquerque. Elements associated with this concept include a more densely developed network of continuous streets than is typically found in new development elsewhere in the region, therefore distributing traffic demands across a number of parallel facilities and thereby reducing the capacity requirements on each one individually. These streets are referred to as "connectors", in the land use planner's terminology. Other elements of the circulation plan include one-way couplets through the centers, which reduce the scale of the boulevards and avenues to a more pedestrian friendly scale, and also function to reduce the necessity for additional widening to accommodate left turn lanes.

The proposed transportation network consists of several major corridors, designated as "boulevards" and "avenues" in the land use planner's terminology. The principal corridor that bisects Mesa del Sol, "Mesa del Sol Blvd.", has been designated as a main transit corridor, to connect to the city's transit system via University Blvd., the other main transit corridor planned in Mesa del Sol. Mesa del Sol Blvd. will not only serve as an east-west spine for transit on site, but also is likely to provide a key link to a possible Commuter Rail station located to the west of I-25 (see the following section on Transit).

The circulation system connects to I-25 at four locations: (1) at the existing Broadway/NM 47 interchange, (2) at a new interchange proposed for Mesa del Sol, (3) at a new interchange proposed for Bobby Foster in the long term "Build-Out" Scenario, and at (4) the existing interchange with Rio Bravo. These locations are shown in Figure F-3. In addition, a system of frontage roads along I-25 between the Broadway and Rio Bravo interchanges is also proposed at "Build-Out".

2. Transit

The street network at Mesa del Sol is designed to facilitate the movement of transit vehicles between centers of activity. In addition to the Transit Blvd., Avenues and some Connector streets will be designed with the expectation that they will become transit routes as service is extended to Mesa del Sol. Transit routes will be designed with street sections, intersection treatments and streetscape elements that will support transit. The Transit Blvd. will be designed to accommodate a dedicated transit right- of-way. Technologies such as signal pre-emption, prepaid boarding, and boarding platforms at the level of the vehicle floor could be incorporated into the future system, and have great potential for improving the speed and convenience of transit service.



AUTO AND TRANSIT CIRCULATION

Figure F-3

Legend

Primary Transit Nodes

Trunk Transit Routes

Primary Roadways (Boulevards and Avenues)

2 or 3 Lanes Each Direction

2 Lanes Each Direction

Connector Roads *(specific section configurations to be assigned at a more detailed planning level)*

Note: these road configurations and lane totals are preliminary. The final transportation study will dictate actual laneage. Some roadways may have phased construction.

0 2,000' 4,000'

0 ¼ Mile ½ Mile

A Commuter Rail system is planned for implementation on existing BNSF Railway track between Belen and Bernalillo, in late 2005; funding for this system is shown in the previous section under Programmed Improvements. The Commuter Rail line will include a station stop in Albuquerque's South Valley, currently planned to be located on Rio Bravo Blvd. near Second St. This station, located approximately two miles northwest of Mesa del Sol, would provide an important regional transit link. As Mesa del Sol develops, there may be enough demand to create another Commuter Rail stop that would have more direct access to Mesa del Sol. A Commuter Rail stop in line with Mesa del Sol Blvd. would be less than one mile from the Mesa del Sol interchange and Urban Center. Transit vehicles could enter Mesa del Sol from the north via University Blvd., traverse the Employment Center and Community Center, pass through a Transit Corridor lined with higher-density residential uses, continue down the escarpment to the Urban Center, and continue on to the commuter rail station.

3. Bicycle Use

Bicycling is ideally suited to travel conditions within Mesa del Sol, particularly on the mesa top with its flat topography, extensive open space corridors, and limited distances. At a comfortable cycling speed of 12 miles per hour, a cyclist will be able reach any part of the mesa top in less than 30 minutes. No home will be more than a mile and half from a Village Center, making daily destinations reachable by bicycle in ten minutes or less. This will give all residents opportunities to exercise while running simple errands. More importantly, Mesa del Sol's bicycle route system will give teenagers and young adults much greater independence by freeing parents from the need to drive them to every destination.

A range of bicycle routes will accommodate cyclists of all ages and abilities. Off-street paths in linear open space corridors will provide recreational cycling opportunities and safe routes for beginners. Connector streets will provide comfortable, low-pressure on-street routes to schools, Community Centers and other nearby destinations. Avenues and Boulevards, in keeping with City policies, will typically have dedicated bicycle lanes to accommodate more experienced cyclists, who tend to move at higher speeds and seek more direct routes. Bicycle routes at Mesa del Sol will be clearly marked and well-integrated with designated City bicycle routes.

A Long Range Bikeway System map for the Albuquerque Urban Area has been developed for planning purposes by MRCOG. There is the potential for a connection from Mesa del Sol to the existing and future Albuquerque Bikeway System via a proposed trail along Los Picaros Road / Tijeras Arroyo (see Figure F-4). The future trail from Los Picaros / Tijeras Arroyo would extend under I-25, connect with an existing trail along the South Diversion Channel, and then connect to the Bosque Trail along the Rio Grande. The Bosque trail is the major north-south spine of the Albuquerque trail system and it provides connections to many other trails / bike lanes in the rest of the City. Therefore, with the addition the Los Picaros / Tijeras Arroyo trail, and a connection to Mesa del Sol via University Blvd. Extension, the Mesa del Sol bike system can connect to the entire City trail system.

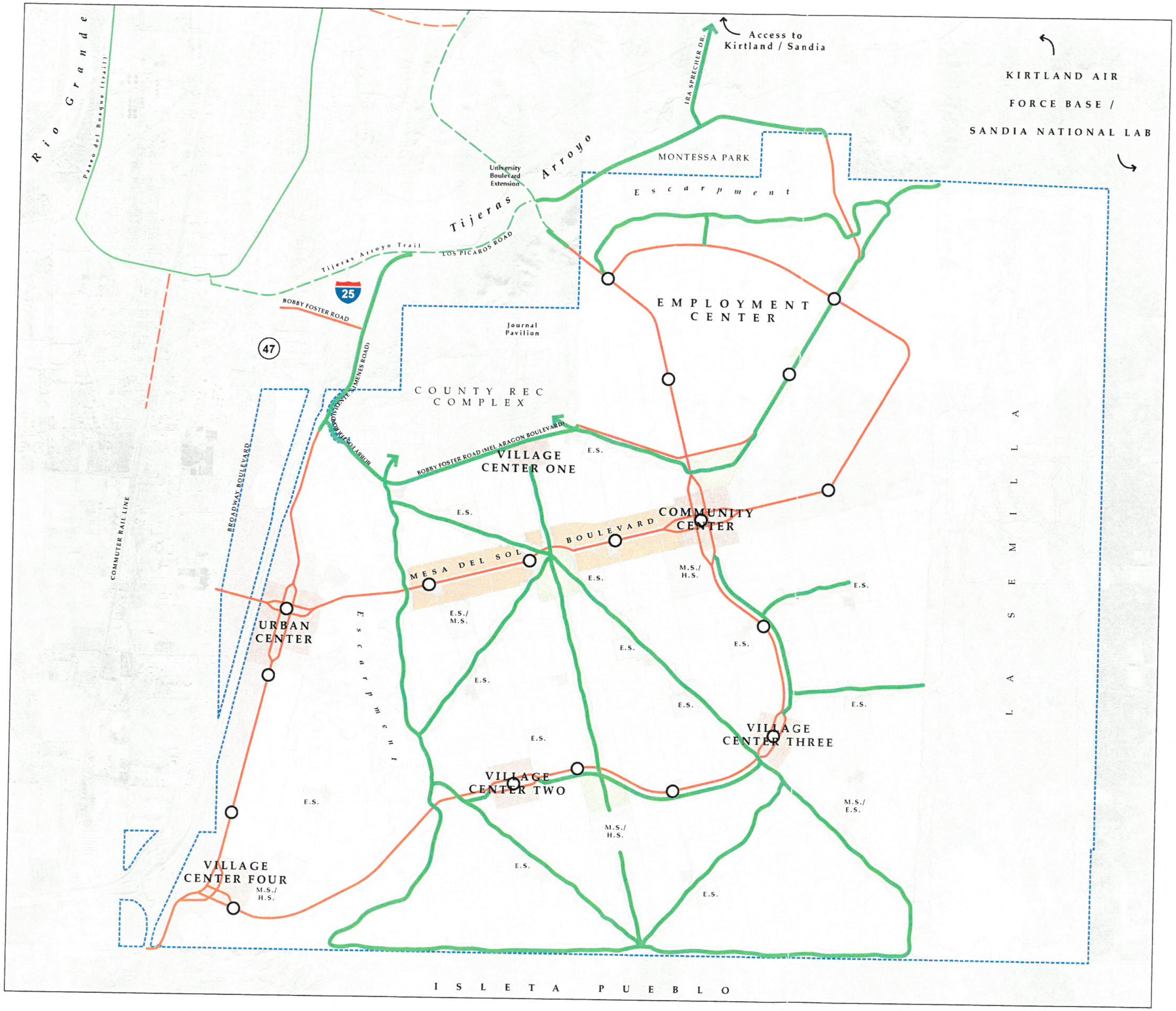
4. Pedestrian Facilities

Fulfilling Mesa del Sol's sustainability and community-building goals requires making walking safe, comfortable and convenient. Transit trips all begin with a walk to the transit stop. Schools, parks and other neighborhood destinations will be a short walk from many homes. Walking will be the primary means of circulation within the mixed-use centers. In keeping with the "park once" policy, even those who arrive by car will be encouraged to park once and walk between destinations within the center.

Features that will make walking comfortable at Mesa del Sol, include narrow local streets, continuous sidewalks, on-street parking, street trees, well-marked crosswalks, and innovative intersection treatments of higher-capacity streets, such as splitting larger streets into one-way couplets. The couplet approach greatly reduces pedestrian crossing distances by eliminating the need for most dedicated turn lanes. Instead of crossing ten or more lanes at an arterial-arterial intersection, pedestrians navigating a couplet system will never cross more than three lanes of traffic at once. Also, in one-way couplet systems, pedestrians have fewer directions of traffic to be concerned with, simplifying their crossing maneuvers.

F. Land Use

Mesa del Sol covers roughly 12,440 acres. The land use plan for Mesa del Sol is shown below, in Figure F-5. Also shown in this graphic is the proposed circulation system serving Mesa del Sol. In addition, the land use plan shows the introduction of 15 "neighborhood centers" that will provide recreational features (e.g., swimming pool) and a small amount of retail space. Table F-1 summarizes the areas covered by the various land uses proposed in the plan. Table F-2 summarizes the build-out development proposals for those land uses.



PEDESTRIAN AND BICYCLE CIRCULATION

Figure F-4

Legend

Primary Transit Nodes

Pedestrian / Bicycle Paths

Bicycle Lanes

Sidewalks are not noted on this map; all streets are assumed to have sidewalks and / or pedestrian / bicycle paths (see street sections)

Bike Facilities - Site Context

Existing

Planned

Path

Lane

Source: Mid-Region Council of Governments Long-Range Bikeway System map, 2004

0 2,000' 4,000'

0 ¼ Mile ½ Mile

Table F-1: Land Use Areas (Acres) at Build-Out

	Commercial					Residential				Total
Land Use	**Retail**	**Office**	**R&D**	**Ind'l**	**Total**	**SF**	**TH**	**MF**	**Total**	**Built**
Community Center	33.0	7.3			40.3			20.8	20.8	61.1
Urban Center	63.6	14.6			78.2			13.8	13.8	92.1
Village Center 1	3.6	1.4			5.0		7.9	11.1	19.0	24.0
Village Center 2	8.7	3.3			12.0		18.0	10.0	28.0	40.0
Village Center 3	8.7	3.3			12.0		18.0	10.0	27.9	39.9
Village Center 4	8.7	3.3			12.0		18.0	10.0	28.0	40.0
Neighborhood Centers	38.4				38.4				0.0	38.4
Industrial	20.0			365.3	385.4				0.0	385.4
Office		551.8			551.8				0.0	551.8
Office/R&D			889.1		889.1				0.0	889.1
Emp Ctr Residential					0.0			48.4	48.4	48.4
UNM			440.0		440.0				0.0	440.0
UNM Urban Center		39.8			39.8				0.0	39.8
Residential					0.0	4,148.0			4,148.0	4,148.0
Corridor Residential					0.0	74.4	116.0	24.0	214.5	214.5
Total	***184.7***	***624.9***	***1,329.2***	***365.3***	***2,504.1***	***4,222.5***	***177.9***	***148.1***	***4,548.4***	***7,052.5***

Figure F-5: Mesa del Sol Land Use Plan

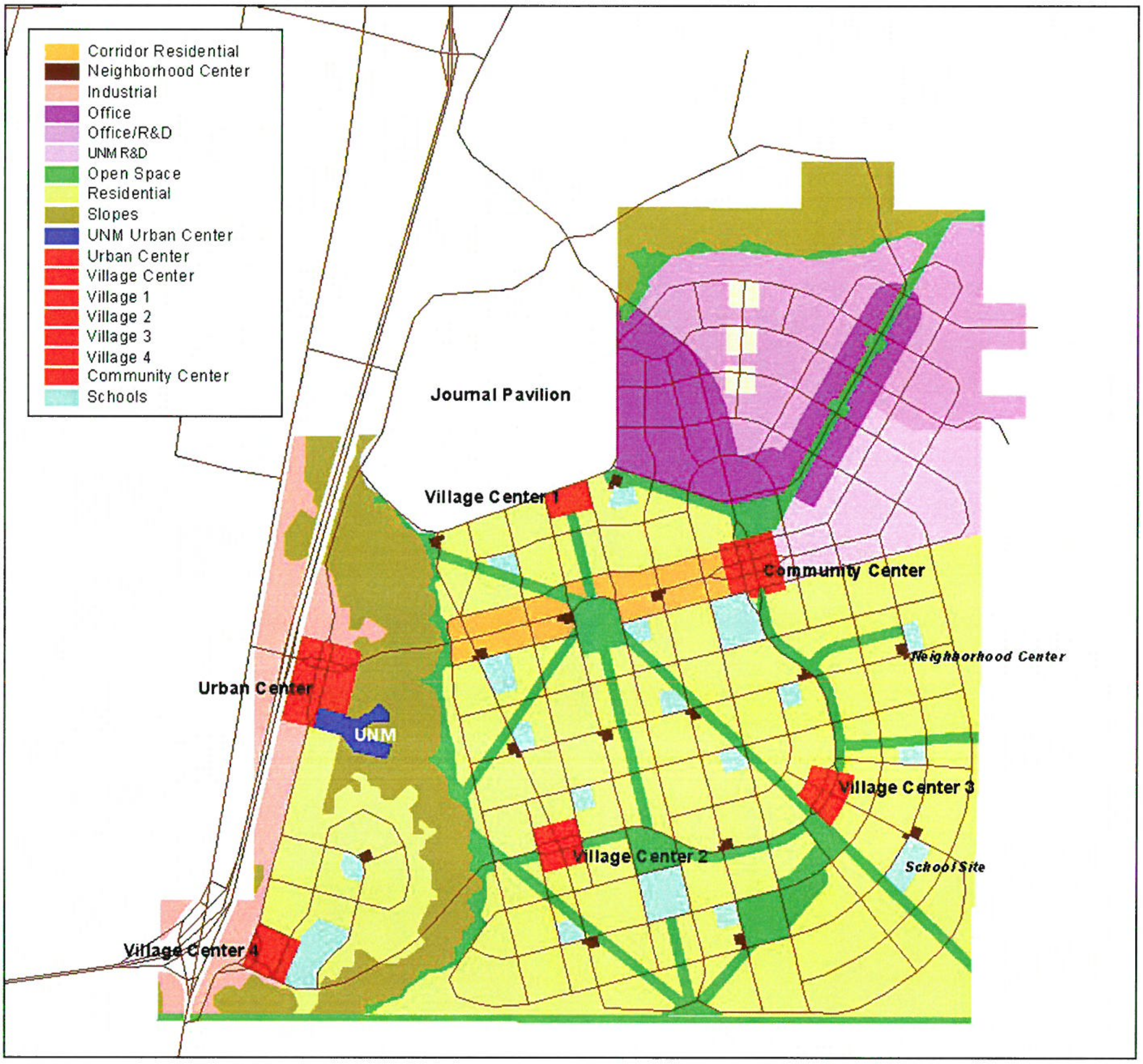


Table F-2: Residential and Commercial Development in Land Uses at Build-Out

	Commercial (SF x 000)					Residential (DUs)			
Land Use	Retail	Office	R&D	Ind'l	Total	SF	TH	MF	Total
Community Center	553	148			**701**			820	**820**
Urban Center	1,252	249			**1,501**			828	**828**
Village Center 1	144	55			**199**		158	334	**491**
Village Center 2	144	55			**199**		360	300	**660**
Village Center 3	144	55			**199**		359	299	**659**
Village Center 4	144	55			**199**		360	300	**660**
Neighborhood Centers	75				**75**				**0**
Industrial	256			3,740	**3,995**				**0**
Office		4,254			**4,254**				**0**
Office/R&D			4,803		**4,803**				**0**
Emp Ctr Residential					**0**			1,485	**1,485**
UNM			2,204		**2,204**				**0**
UNM Urban Center		298			**298**				**0**
Residential					**0**	27,460			**27,460**
Corridor Residential					**0**	493	2,796	1,158	**4,447**
Total	**2,712**	**5,169**	**7,007**	**3,740**	**18,628**	**27,953**	**4,033**	**5,524**	**37,510**

The 2025 "phased development" scenario and the "Build-Out" scenario are summarized here, in Table F-3.

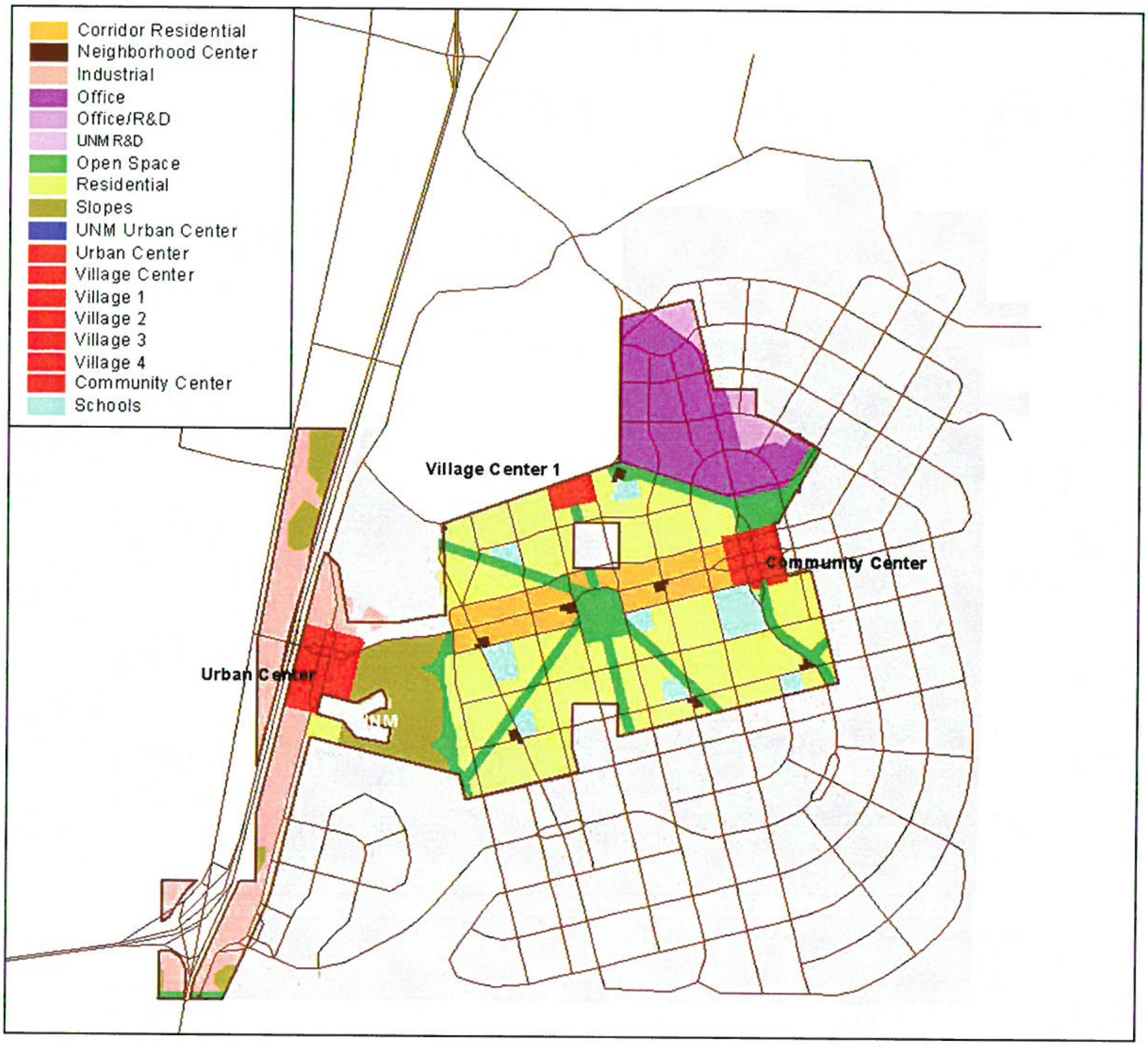
Overall, the phasing plan anticipates that residential development will proceed at a slightly more accelerated rate than the commercial aspects of the project -- 33% of the residential part of the development is projected to be built out by 2025, in comparison to about 27% of the commercial part.

According to the phasing plan through 2025, development will take place within the "Takedown" region of Mesa del Sol, covering roughly 2,268 acres, or about 32% of the land area ultimately proposed to be developed. The "Takedown" region is shown in Figure F-6. By definition, this "Takedown" area will be almost fully built-out by 2025.

Table F-3: Development Proposal for Mesa del Sol

	Build-Out	2025	% "Takedown"
Commercial	**SF (000)**	**SF (000)**	
Retail	2,712	820	30.2%
Office	5,169	2,186	42.3%
R & D	7,007	250	3.6%
Industrial	3,740	1,840	49.2%
Total Commercial	**18,629**	**5,096**	27.4%
Residential	**Units**	**Units**	
SF	27,953	7,210	25.8%
TH	4,033	2,788	69.1%
MF	5,524	2,457	44.5%
Total Residential	**37,510**	**12,454**	33.2%

Figure F-6: "Takedown" Area for 2025



A summary of the amount of development targeted for the individual developments in Mesa del Sol is given in Table F-4, for the year 2025. The summaries indicate that development will be confined to villages and developments within the "Takedown" area, although not all of these land uses will be fully built-out.

Table F-4: Residential and Commercial Development in Land Uses in 2025

Land Use	Commercial (SF x 000) Retail	Office	R&D	Ind'l	Total	Residential (DUs) SF	TH	MF	Total
Community Center	276	74			351			512	512
Urban Center	238	47			285			642	642
Village Center 1	144	55			199		87	184	270
Village Center 2	0	0			0		0	0	0
Village Center 3	0	0			0		0	0	0
Village Center 4	0	0			0		0	0	0
Neighborhood Centers	36				36				0
Industrial	126			1,840	1,965				0
Office		2,009			2,009				0
Office/R&D			250		250				0
Emp Ctr Residential					0			0	0
UNM			0		0				0
UNM Urban Center		0			0				0
Residential					0	6,734			6,734
Corridor Residential					0	476	2,701	1,118	4,296
Total	**820**	**2,186**	**250**	**1,840**	**5,096**	**7,210**	**2,788**	**2,457**	**12,454**

1. Mesa del Sol Socio-Economic Summary

Table F-5 summarizes total socio-economic data findings for the Mesa del Sol Project. (Detailed socio-economic data on a TAZ by TAZ basis for both the phased 2025 and "Build-Out" scenarios is available from the Project Planning Team.)

Table F-5: Socio-Economic Summary

Attribute	Build Out	2025
Residential		
Population	89,681	29,214
Households	35,151	11,606
SF Dwelling Units	31,986	9,998
MF Dwelling Units	5,524	2,457
Commercial		
Basic Employment	13,145	4,618
Retail Employment	3,517	1,060
Service Employment	35,669	8,166
Total Employment	52,330	13,844
Enrollments		
Elementary/Mid School	9,301	3,071
High School	2,898	957

The overall magnitude of the land use proposals associated with the two "build" scenarios are summarized in Table F-5. By 2025, Mesa del Sol is planned to develop as a "balanced" community, roughly providing almost as many jobs on-site as there are workers living in the community, thereby hoping to achieve a reduction in the amount of traffic leaving the site than normally would be associated with a community this large, as well as hoping to achieve other transportation benefits associated with balanced sustainable communities, such as overall reductions in vehicle-miles-of-travel. The "Build-Out" scenario envisions additional development of commercial properties, gradually transforming Mesa del Sol into a major regional employment center, importing workers from elsewhere in the region, many from Valencia County.

G. Travel Demand Modeling Methodology

Travel Demand modeling for Mesa del Sol has been accomplished using the best available tool: the existing regional travel demand computer model maintained by the Mid-Region Council of Governments (MRCOG) that functions as MRCOG's primary transportation planning tool for the Albuquerque metropolitan area. This model has been used to estimate traffic loads, capacity needs, and network impacts associated with the proposed Mesa del Sol development. This section describes the procedures that have been used to run the travel demand model.

MRCOG staff have been responsible for actually operating the travel model, using input developed and provided to MRCOG by the Mesa del Sol Planning Team. Results from the network forecasts provide the traffic projections on which the balance of the traffic impact analysis is predicated. This section describes the various land use and network databases that have been constructed to depict conditions on which the travel model forecasts are based.

1. Scenarios

The analysis is predicated on several scenarios:

A "2005 Existing" Scenario: a "2005 Scenario", with no development at Mesa del Sol, depicts existing conditions. It provides a baseline by which capital infrastructure needs related to Mesa del Sol unfolding over the next 20 years can be identified.

A "2025 No-Build" Scenario: a "2025 No-Build Scenario" depicts anticipated conditions on regional highways that will arise over the next 20 years, forthcoming from general growth in the region and unrelated to any specific development at Mesa del Sol.

A "2025 Phased Development" Scenario: a "2025 Phased Development Scenario" depicts capacity requirements and impacts on the highway system related specifically to the development proposal at Mesa del Sol.

A "Build-Out" Scenario: a "Build-Out" Scenario depicts the capacity requirements for the circulation system at Mesa del Sol as it will ultimately be built. This scenario is run against a backdrop of "2025" projections for the rest of the region (as they relate to both land use and network capacity) since there is no comparable MRCOG "build-out" scenario that applies to the distant future. The objective of the "build-out" scenario is to assure that the right-of-way provisions on-site are sufficient to support the ultimate development in the very long term. Inasmuch as it may be 50-80 years before this ultimate build-out scenario is achieved, it is inappropriate to look at off-site impacts related to this scenario – there is no related long range plan for the region that reaches this far into the distant future.

For regional assumptions off-property, the official MRCOG assumptions for the adopted Metropolitan Transportation Plan (MTP) have been assumed. All development proposals on the Mesa del Sol property itself are considered to be additions to development in the region.

There are two "build" scenarios of interest – (1) one depicting both on-site and off-site impacts for the year 2025, and (2) another depicting on-site capacity needs at Build-Out. The other two scenarios are "baselines" to provide a basis for comparison.

2. Current MTP Assumptions at Mesa del Sol

The MTP plans from MRCOG currently carry some representation of network and land use development in Mesa del Sol. The project area is currently covered in the travel model by 9 traffic analysis zones (TAZs), as shown below, plus a small undeveloped portion of an additional TAZ (54210) that is only covered in a minor way by the project.

Figure F-7: Traffic Analysis Zones in Mesa del Sol (Currently in MTP)

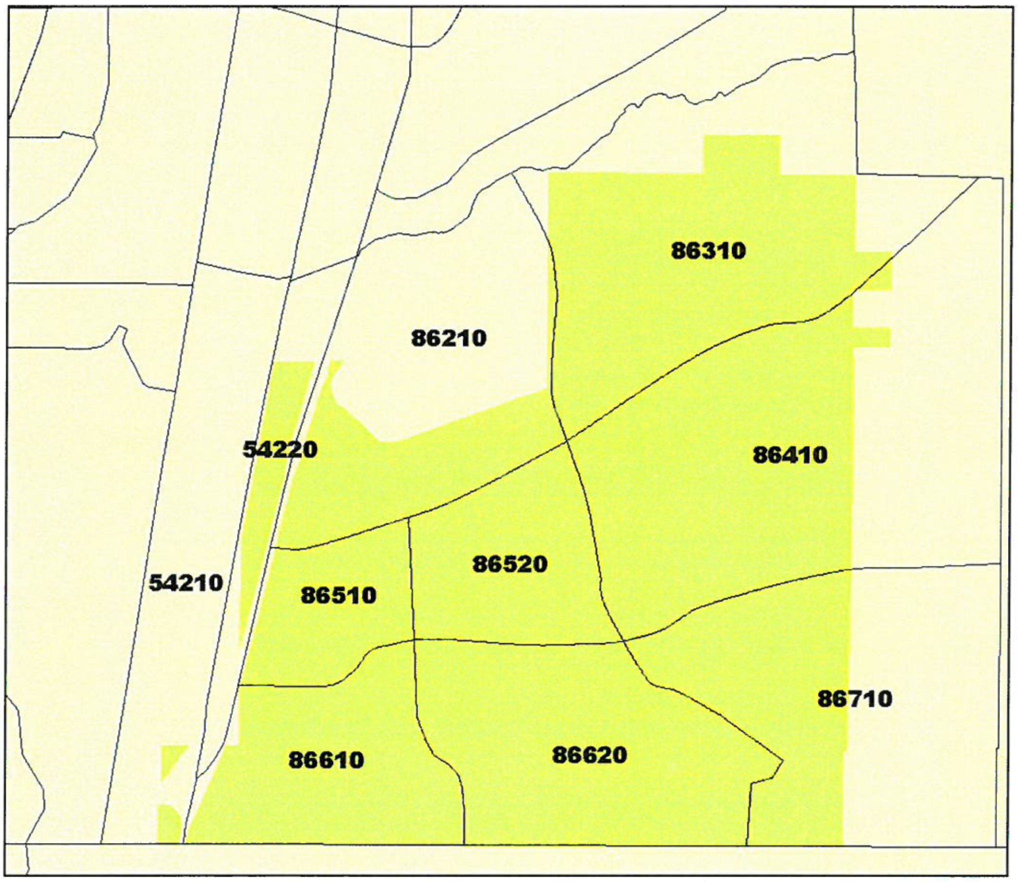


Table F-6 below includes a profile of land use inside the project area for the years 2005 (existing) and 2025, as it is currently depicted in the MTP.

In 2005, the MTP depicts Mesa del Sol as essentially undeveloped – the small amount of residential and commercial development shown in the table here is almost all confined to TAZ 54220 west of I-25.

Table F-6: MTP Mesa del Sol Forecasts

	2005	2025
Residential:		
Population	40	9,315
Households	17	4,335
Employment:		
Basic	236	3,147
Retail	38	1,318
Service	81	5,009
Total	**355**	**9,474**

In the 2025 MTP, MRCOG has portrayed a moderate amount of development in Mesa del Sol, as shown in the table.

Table F-7: MTP Regional Forecasts

	2005	2025
Residential:		
Population	771,436	1,017,370
Households	306,295	422,769
Employment:		
Basic	123,099	130,298
Retail	77,783	93,197
Service	221,685	321,728
Total	**422,567**	**545,223**

This information is provided purely as background. In consultation with City staff, it has been agreed that the 2005 and 2025 "no build" scenarios identified above will be run with ***no development*** in Mesa del Sol.

Forecasts of population for the region in the MRCOG MTP run roughly 770,000 in 2005, growing by 32% to 1.017 million in 2025. (Refer to Table F-7 for specific projections of population and employment for the region.)

Transportation Networks

In terms of networks, the MRCOG MTP depicts some network development in the project area. This is described below and shown in Figures F-8 and F-9.

MRCOG shows the existing roadways serving the area around Journal Pavilion in the 2005 MTP scenario – Los Picaros is represented as a collector and Bobby Foster Road is represented as a minor arterial. Note that Bobby Foster Road is coded with "1.3" lanes in each direction in the MRCOG model, representing the existence of a third lane on this roadway. In 2025, MRCOG shows the expected extension of University Blvd (a minor arterial). In addition, the 2025 MTP network includes a new proposed interchange with I-25, connecting to a short section of the planned arterial serving Mesa del Sol, coded as an "access controlled" high capacity facility. MRCOG uses this "access controlled" roadway designation to suggest a cross-section similar in concept to Tramway Blvd. and sections of Paseo del Norte.

Figure F-8: Transportation Network in Mesa del Sol (2005 MTP)

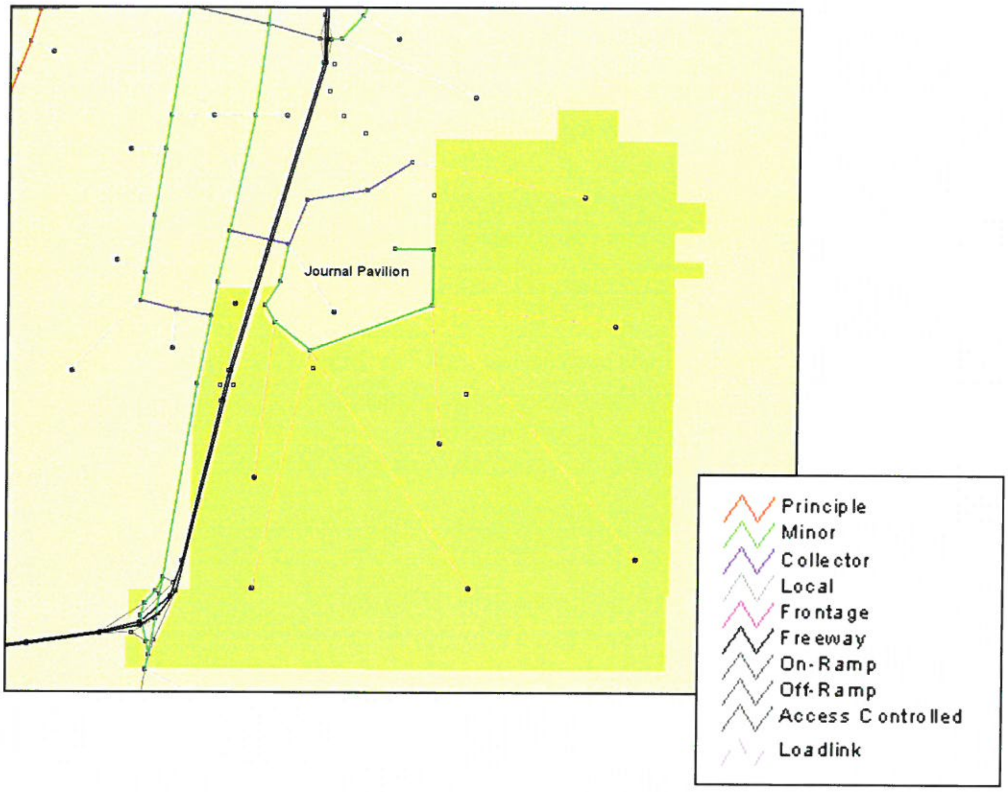
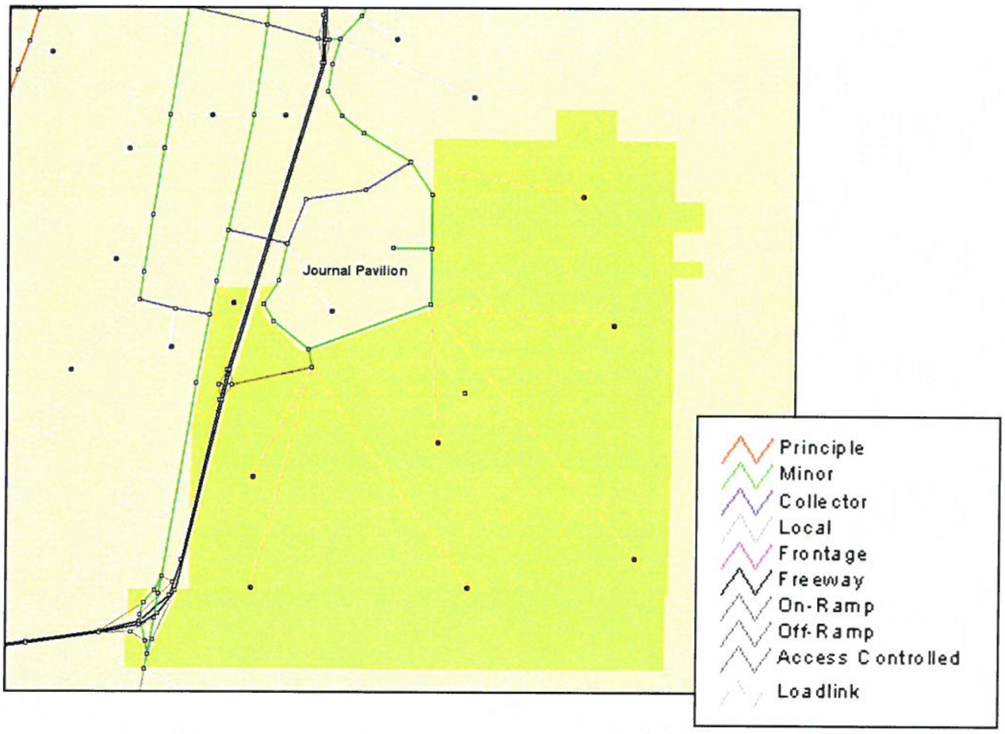


Figure F-9: Transportation Network in Mesa del Sol (2025 MTP)



3. General Approach

For the model runs supporting the Level A Transportation Analysis, we have developed a much more detailed representation of Mesa del Sol than has been done in the past – both in terms of the transportation network as well as in terms of the TAZs describing land use. Based on consultation and concurrence with City staff, this approach was devised to provide information relevant to the "new urbanism" concept of network development that includes, among other things, a strategy to provide a more densely developed network of "smaller" through streets. To support this approach, we have developed databases for the various scenarios that:

- Include roadway proposals for Mesa del Sol that correspond with the proposed transportation network as shown in the Master Plan. The intent will be to replace (actually, extend) the network that MRCOG already has in the MTP for 2025 in Mesa del Sol with one that represents the current Mesa del Sol proposal.
- Include a detailed TAZ system that captures the land use proposal. The intent will be to create a database that substantially increases the number of TAZs covering Mesa del Sol – from the 9 that MRCOG currently has coded in the model to roughly 200.

4. Model Representation

Network features appearing in the MRCOG travel model need to be characterized by "link type" codes that reflect a close relationship to roadway functional classes defined for the Albuquerque metropolitan area. The definition of functional classes in this region are not exactly the same as expressed by the "new urbanism" designations defined later in Section 10 of this document. In consultation with MRCOG, we arrived at the following functional class designations:

- The concept behind the east-west central transit corridor (Mesa del Sol Blvd.) envisions high capacity and limited access features, similar in intent to Tramway Blvd., if not necessarily similar in design approach. This corridor was designated as a "limited access arterial" (link type code 10).
- The extension of University Blvd. that runs through the development from north to south, terminating at Broadway south of the I-25 interchange, was designated as a "principal arterial" (link type code 2). *Note that MRCOG references University Blvd. off-site as a "minor arterial".*
- Other "avenues" associated with the circulation plan were all designated as "minor arterials" (link type code 3).
- All of the "connectors" associated with the circulation plan were all designated as "collectors" (link type code 4).

The functional class designations (i.e. the "link types") are important, as they relate to the capacities associated with these facilities. Link capacities coded in the MRCOG model were used as the basis for much of this analysis. These capacities vary by functional class, or "link type", as shown in Table F-8. MRCOG considers these capacities to be capacities at "Level of Service E".

Table F-8: Capacity

Functional Class	Link Type	Lane Capacity
Principal Arterial	2	800
Minor Arterial	3	750
Collector	4	675
Local	5	600
Frontage Roads	6	850
Freeways	7	1,900
Off-Ramps	8	700
On-Ramps	9	700
Limited Access	10	1,100

Link speeds and lanes were all coded to reflect elements of the circulation plan as described above. Other link attributes pertinent to the model include:

- Link Length (in miles): as measured via the GIS
- Mode Specification: All coded "abe", per MRCOG practice
- Volume-Delay Function: Ignored, as this is not used anymore in the MRCOG model
- Area Type: All coded to district "12", except portions of the network west of I-25, which is in district "6"
- In addition, note that we also provided a system connection to the future Los Pajaritos Road to the west. This is shown in the EMME/2 network map that appears as Figure F-10.
- MRCOG considers the following volume-to-capacity ratios to define levels of service, as shown in Table F-9.

Table F-9: Level of Service Definitions

Level of Service	Volume-to-Capacity Ratio
A	<= 0.32
B	<= 0.52
C	<= 0.74
D	<= 0.90
E	<= 1.00
F	Over 1.0

For example, a regional "standard" for "Level of Service D" traffic operations is met in the MRCOG model when volume-to-capacity ratios on links are less than 0.90..

Figure F-10: "Build-Out" EMME/2 Network for Mesa Del Sol (Functional Classes)

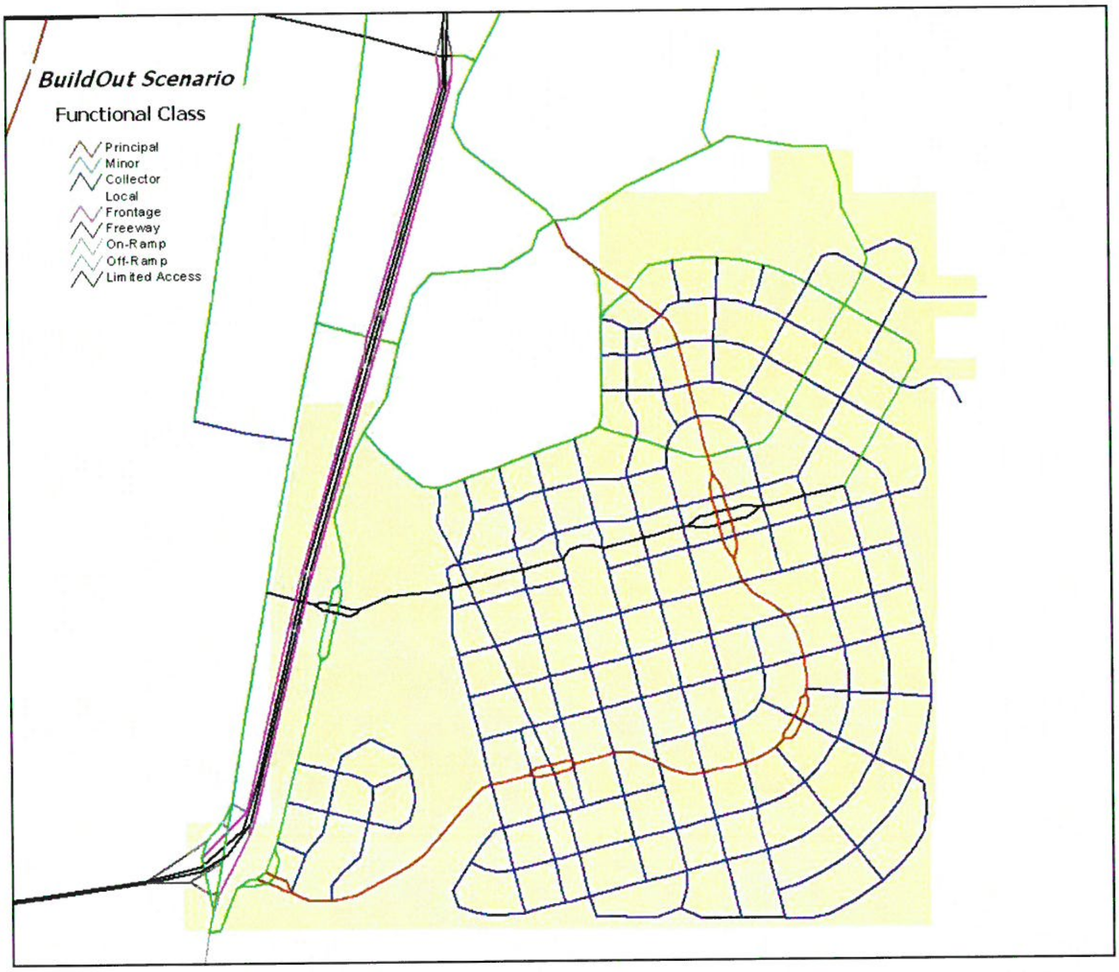


Figure F-11: Lane Configurations for the "Build-Out" Scenario

Capacity: For the build-out scenario, the "connector" roadways ("Collector" class) in the network were all coded with 1 lane in each direction. Minor arterials were coded with 2 or 3 lanes in each direction.

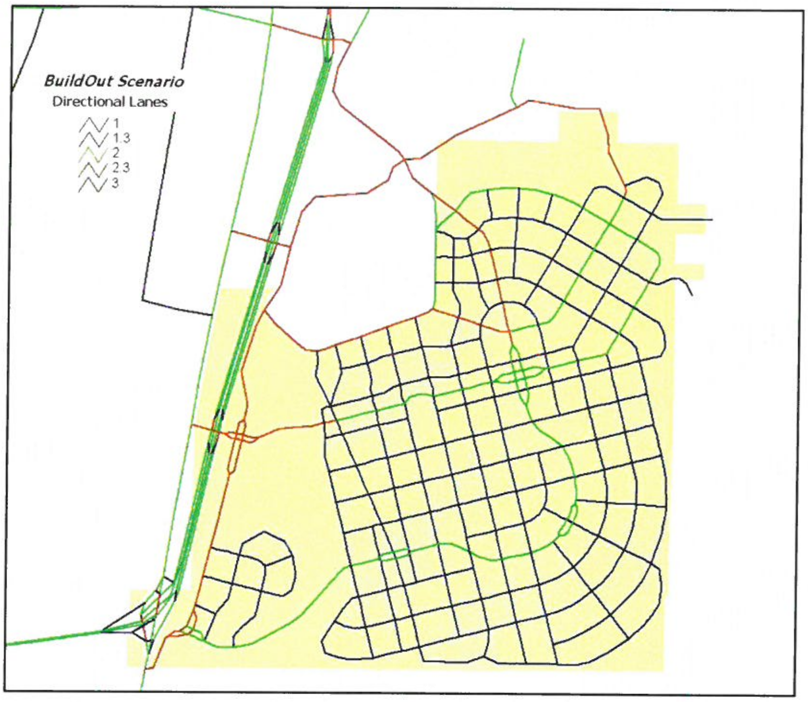
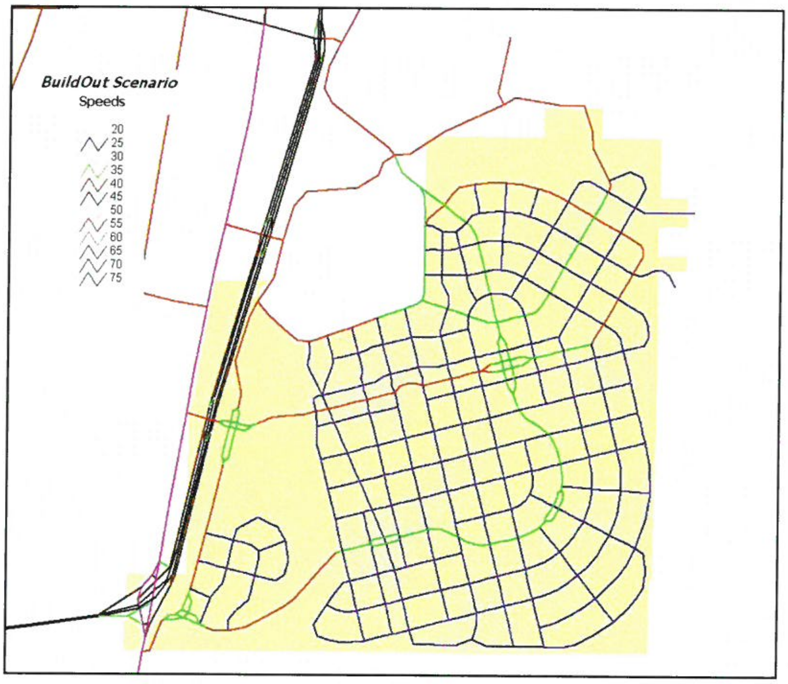


Figure F-12: Posted Speeds for the "Build-Out" Scenario

Posted Speeds: For the "Build-Out" scenario, all "connectors" were coded with posted speeds of 25 mph. Other arterials, both "minor" and "principal", were coded with posted speeds of 40 mph except within the limits of the centers and where on-street parking is to be provided. There, speed limits dropped to 35 mph.



2025 Phased Development Network

For 2025, a "phased" subset of the full build-out network was assumed, as shown in Figure F-13. The network envisioned in this scenario consists of roadways that fall into the "Takedown" area, along with several others that reside somewhat outside of the "Takedown" area but are needed to provide continuity and connections with the region.

The "phased" development plan for 2025 assumes ONLY the new interchange on I-25 with the east-west transit corridor road, Mesa del Sol Blvd.. Frontage roads, and the Bobby Foster interchange, are NOT proposed for 2025.

The functional class declarations for individual roadways in this scenario are the same as for Build-Out.

Figure F-13: 2025 Network for Mesa del Sol (Functional Class)

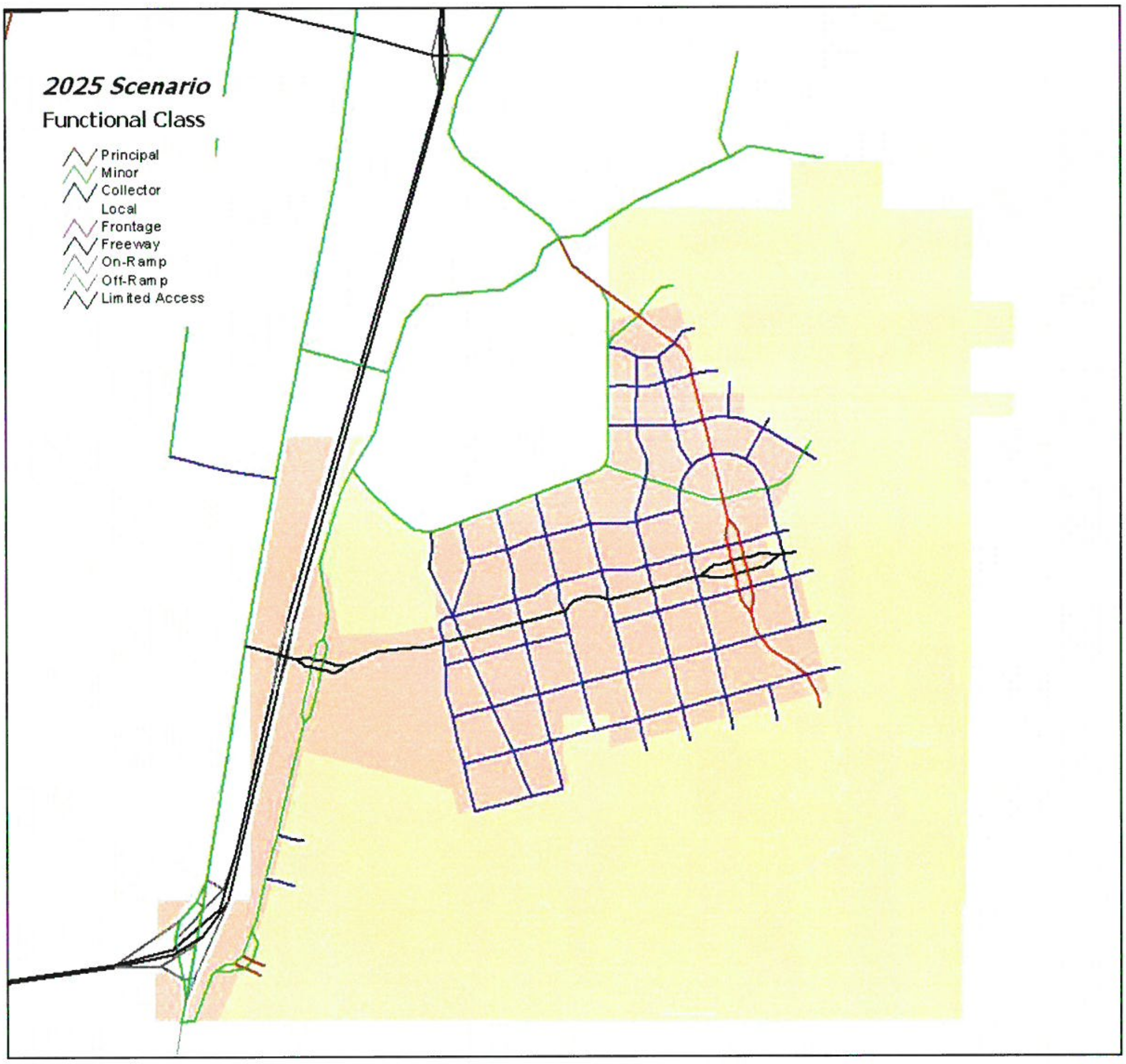


Figure F-14: Lane Configurations for the 2025 Scenario

Capacity: Lane configurations for the "2025 scenario" are the same as for the "Build-Out" scenario – except, the two major corridors bisecting the development (Mesa del Sol Blvd. and the University Blvd. extension) are configured to 4 lane thoroughfares (compared with 6 lanes in the "Build-Out"). This is the only difference between the two scenarios.

Figure F-14 depicts the lane configurations on the Mesa del Sol Network in 2025.

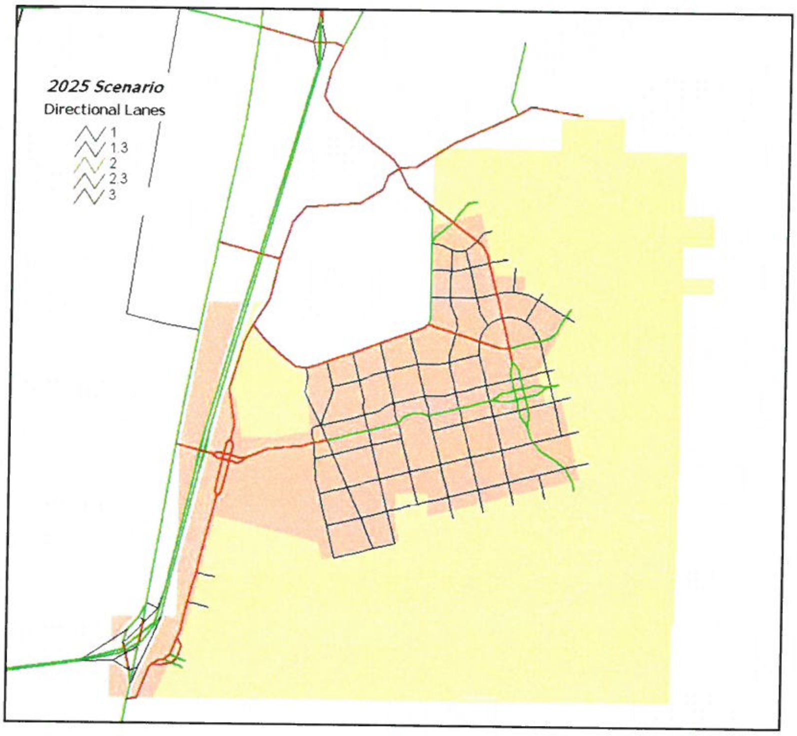
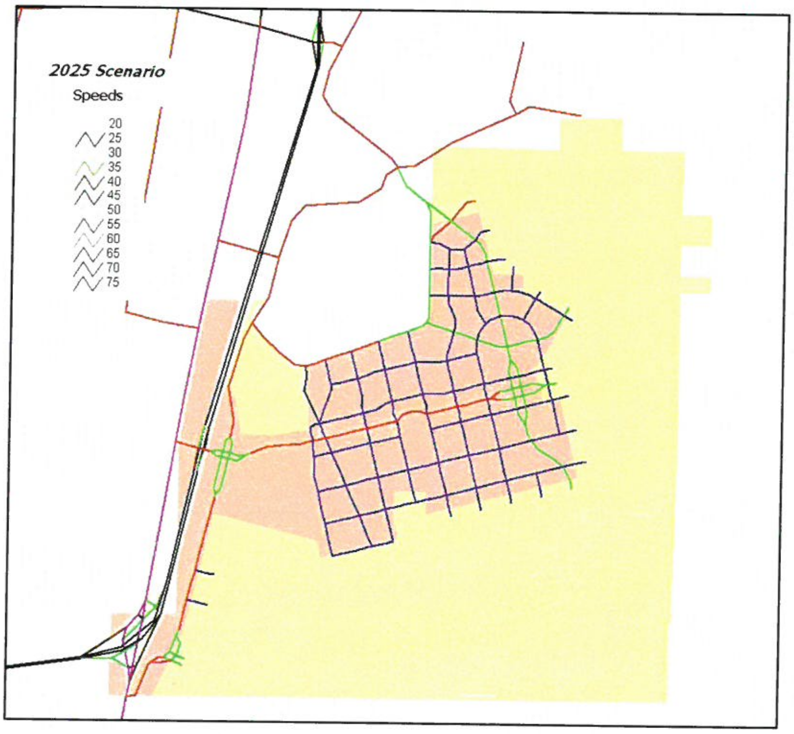


Figure F-15: Posted Speeds for the 2025 Scenario

Posted Speeds: Posted-speeds for the 2025 network scenario are the same as in the "Build-Out" scenario. Figure F-15 illustrates posted speeds on roadways in the 2025 network scenario.



Transit Assumptions

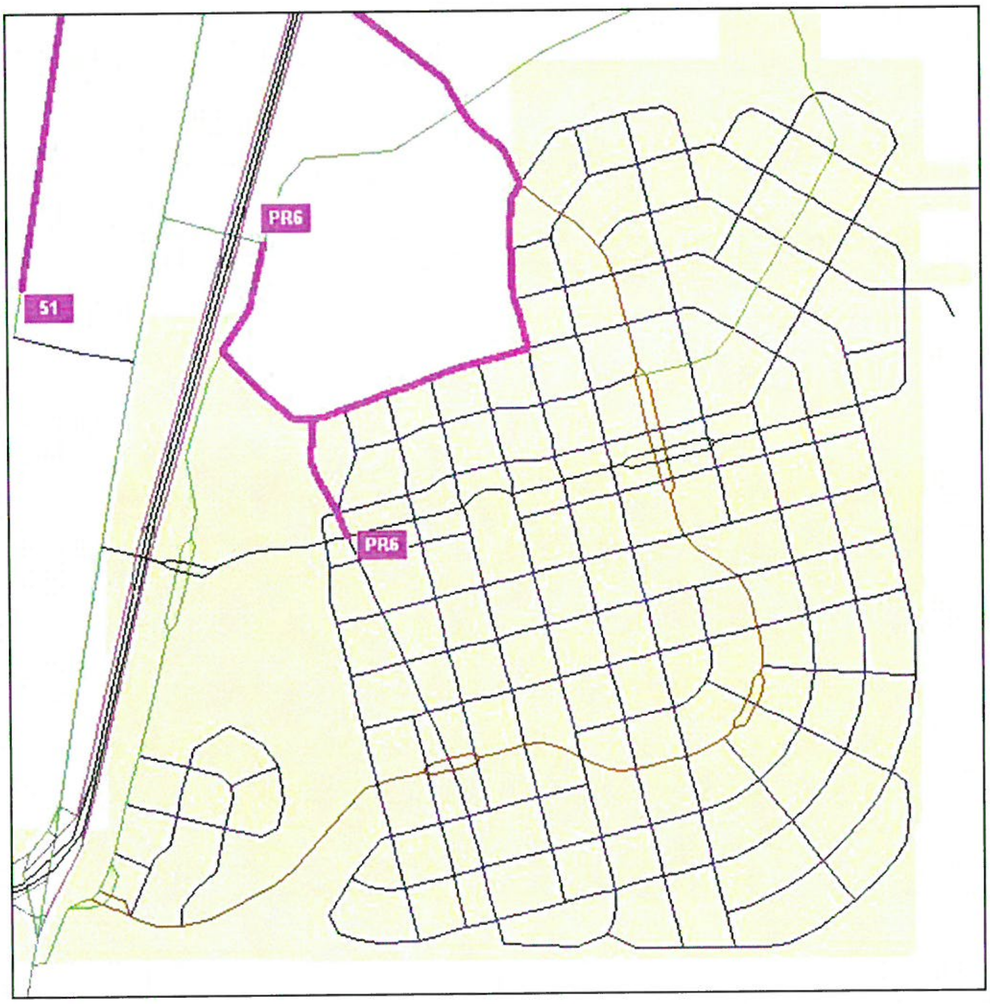
The MRCOG MTP network for 2025 includes two transit routes that operate in the vicinity of Mesa del Sol:

Route 51, an existing route, operates on 2nd Street, as far south as the Bobby Foster overpass. This route operates all day long, at 60 minute headways.

A new proposed route that MRCOG refers to as "PR6" operates into the Mesa del Sol complex on the University Blvd. extension. This route is represented as a "commuter route", which means that it operates during peak hours only, at 30 minute headways.

The alignment of these routes is shown in Figure F-16 below. Both of these routes were left in both of the "2025" and "Build-Out" scenarios for Mesa del Sol, since they already appear in the MTP.

Figure F-16: Transit Lines in the Vicinity of Mesa del Sol



Transit plays a very important role in the transportation strategy for Mesa del Sol. The planning approach associated with "new urbanism" in general is based on the application of multi-modal transportation facilities and "transit oriented design". From a service perspective, the following are specific transit design features that are associated with the circulation plan:

The east-west transit corridor (Mesa del Sol Blvd.) will link with I-25 to the west, and possibly to a Commuter Rail station, and serve as a primary transit corridor through the heart of the development. A very large right of way is planned for this corridor, to include dedicated transit lanes, separated from through travel lanes by raised medians, that serves transit modes equally with private vehicles.

ABQ Ride has indicated that they favor future transit (possibly light rail) development in the corridor served by the extension to University Blvd.

MRCOG is currently developing a commuter rail project along the existing BNSF Railroad line, located approximately 2 miles west of Mesa del Sol. This commuter rail line is projected to be operational by the late fall of 2005.

Although the planned Mesa del Sol community is planned to be transit based as stated above, no provisions for expanded transit services have been incorporated into the EMME/2 model runs, beyond the routes that MRCOG currently carries in the MTP. The primary reason for this is that there are no dedicated funding sources for transit in this region at the present time. Although a number of different transit initiatives are underway in this region, their ultimate implementation is not assured. Another equally important reason based on consultation with City staff, is that we are taking a "worst case scenario" perspective on this analysis, and therefore are not depending on proposals for future transit to reduce the capacity requirements of the roadway circulation system.

5. Traffic Analysis Zones

A traffic analysis zone (TAZ) system has been formulated for the MRCOG EMME/2 model. Inasmuch as we are providing considerable network detail in the project area, it is common practice to provide a zone system that matches the network in scale and resolution. It is common that network streets themselves form the boundaries of TAZs. The MRCOG EMME/2 TAZs in Mesa del Sol were therefore deleted from the regional TAZ system, and were replaced by a much more detailed system consisting of 211 TAZs. In addition, TAZs were also designed to isolate different kinds of land uses to a certain extent, for example to isolate the village centers and distinguish them from adjacent TAZs outside of the centers. Since TAZ boundaries are formed by roadways in the proposed network, village centers are typically "quartered" into four adjacent TAZs formed by the arterials that bisect them. The resulting TAZ system for Mesa del Sol is illustrated in Figure F-17.

Figure F-17: TAZs in the Mesa del Sol Area

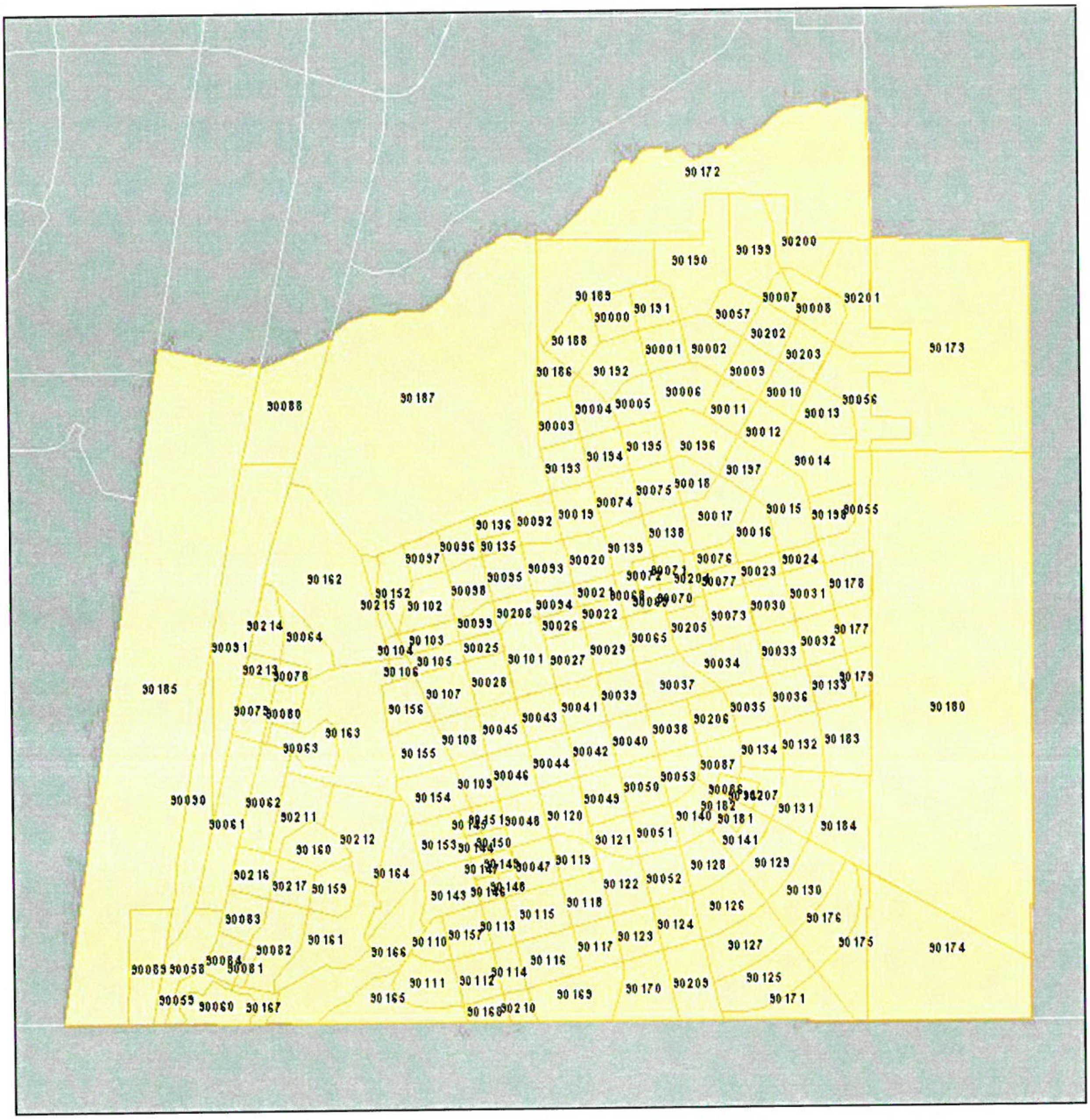


Figure F-18: TAZ Detail in Vicinity of Village Center 3

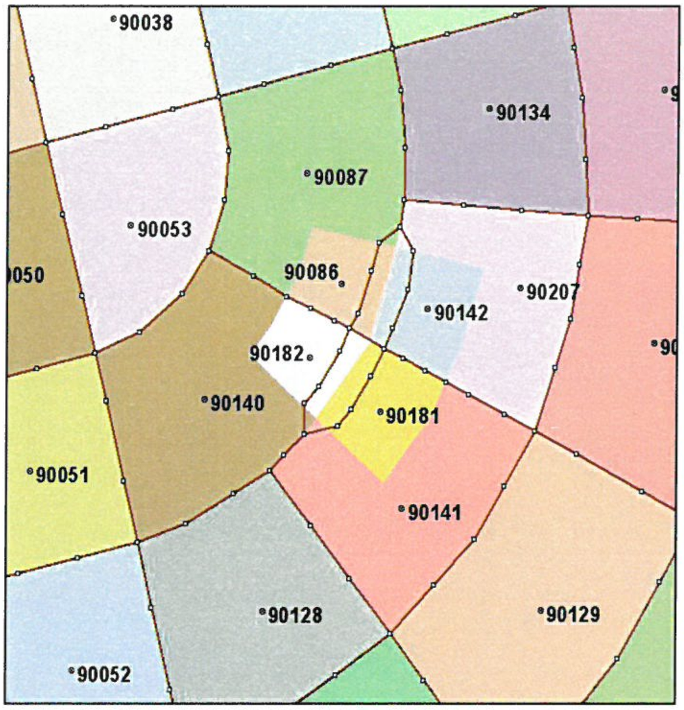


Figure F-18 shows a detail of the TAZ system, showing how TAZ's were "quartered" in the vicinity of village centers, bisected by streets crossing the center.

Aggregating Outlying Regional Zones

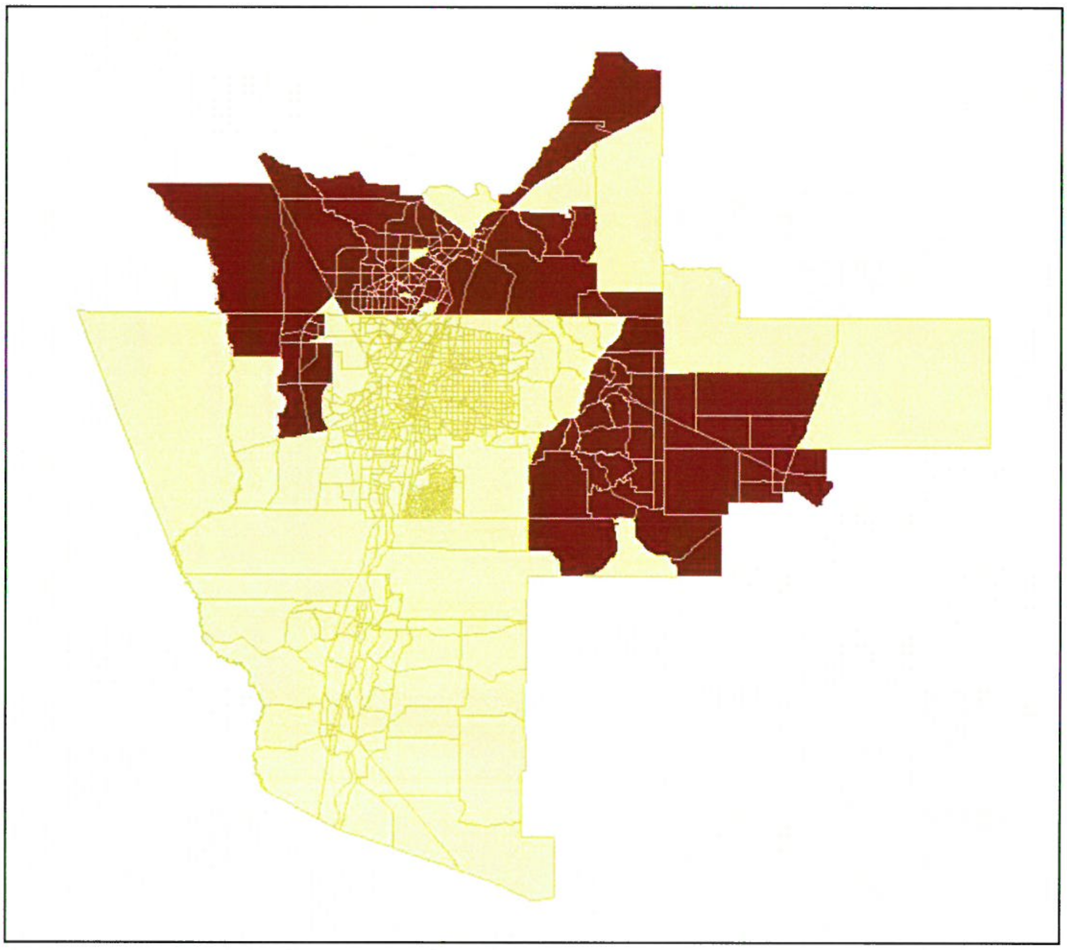
The MRCOG EMME/2 license carries with it a limit of 1,000 zone centroids (some devoted to "pseudo centroids" that represent external cordon stations and park-and-ride lots). With the addition of the 211 Mesa del Sol zones, the 1,000 zone threshold was exceeded. Therefore, we needed to aggregate some of the regular MRCOG zones in the model to make up the difference and bring the overall regional zone count below 1,000.

Aggregating regional zones is fairly easy – the polygons themselves only need to be spatially joined, and the socio-economic attributes associated with these zones have to be aggregated as well. The underlying network of centroids and centroid connectors has to be amended also. MRCOG coding of "school sites" and their respective "school districts", however, complicates the task.

In order to do this, we selected sets of TAZs that were remote from Mesa del Sol – mostly in the far northern part of the modeling area (in Sandoval County) and also in the far east (East Mountain area). Figure F-19 on the next page illustrates the TAZs in the regional model that were aggregated.

The final merged TAZ system, including regional TAZs as well as those in the project area, numbered 934. Along with the "pseudo centroids" associated with park-and-ride lots and external cordon stations, the final networks carried 959 centroids.

Figure F-19: Regional TAZs Aggregated



6. Summarizing Land Use for TAZs

Once the TAZ system was designed, development proposed for the various land uses in Mesa del Sol was then summarized for them. This involves a basic GIS operation calling for an intersection between the two spatial data layers – one for the Master Plan itself with the one for TAZs. Densities associated with the different developments were then migrated to TAZs, and the quantity of development in each one could then be computed for each type of development.

"Build-Out" Scenario: For the "Build-Out" Scenario, the projected levels of development in the various land uses need to be expressed in terms of densities, so that they can be assigned to the TAZs in which they reside. Housing densities are needed for the residential uses, expressed in terms of dwelling units per acre. Floor-area-ratios (FAR) are needed for the commercial uses.

A number of the different developments in the project area are mixed use. So, in addition to densities, we also have to establish the proportion of land area that will be dedicated to the various different kinds of dedicated land uses.

This information was used to populate the TAZs with the development proposals targeted for them – the result being estimates of housing and commercial square footage for each type of development in each TAZ.

2025 Scenario: The targeted levels of development indicated above for 2025 suggest that a number of the individual land use developments in Mesa del Sol will only be partially built out. These were estimated, and then the same net density levels were assumed for the phased 2025 scenario as explained above for build-out.

Each land use, and each TAZ in which it fell, were then characterized by these three properties: (1) net densities, (2) percentage of land area in each development devoted to dedicated sectors, and (3) percent build-out. These three parameters were combined to depict the total amount of development in each TAZ.

H. Transportation Analysis

1. 2005 "No Build" Scenario (Existing)

The current 2005 MTP network is the basis for the Base Case, or "Existing Conditions". This scenario depicts the region as it currently exists, with *NO* development in Mesa del Sol. Note that I-25 which traverses the western edge of the site, is depicted as a 4 lane facility – two northbound and two southbound lanes. This information is drawn directly from the MRCOG 2005 model run for the MTP.

Figure F-20: Existing Capacity Deficiencies (2005)
PM Peak

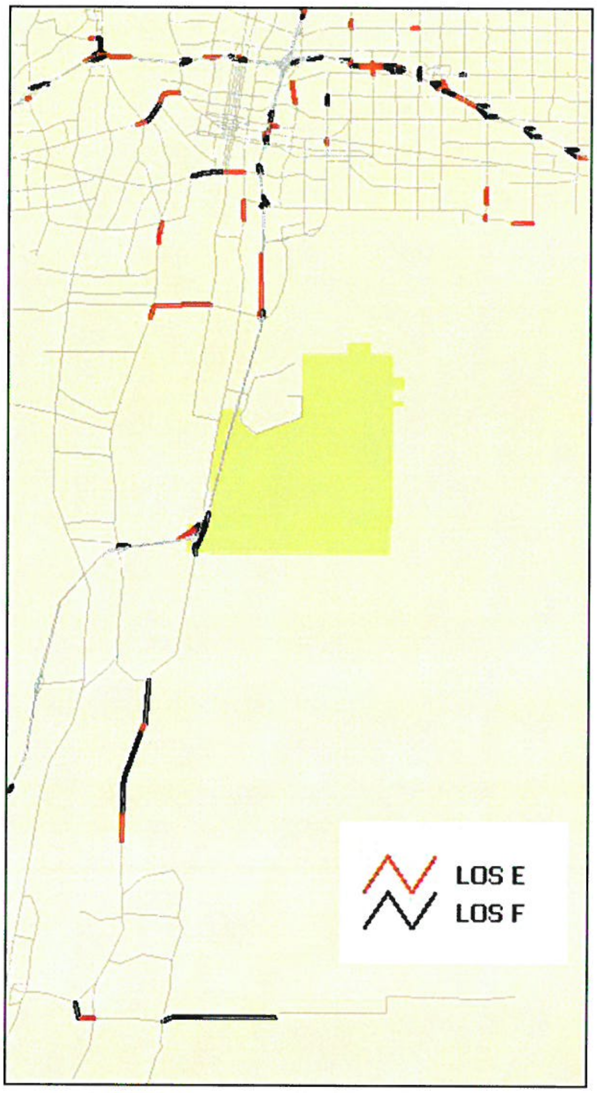


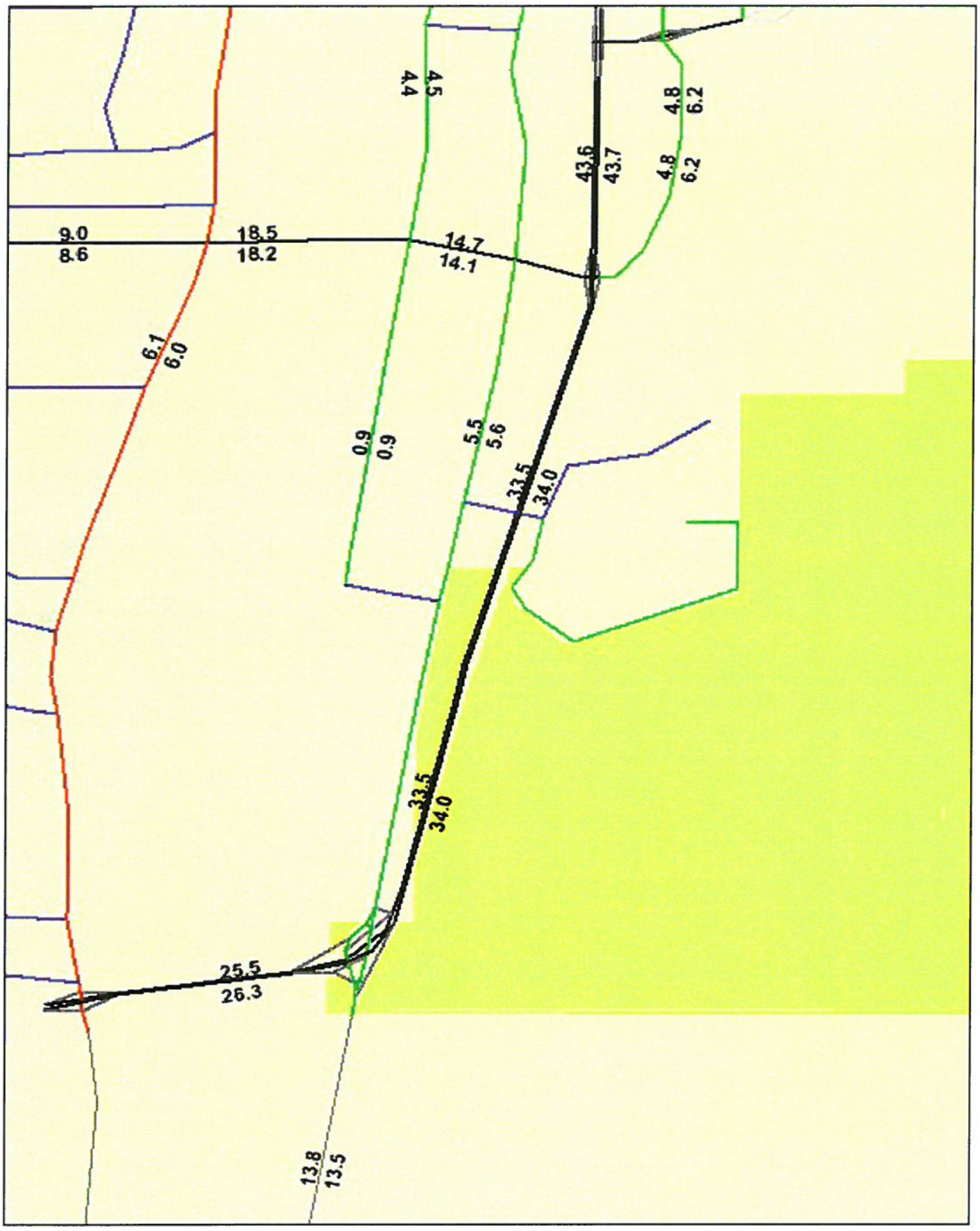
Figure F-20 illustrates the scope of existing capacity problems in the general vicinity of Mesa del Sol, as depicted by the 2005 MTP model run, and expressed in relation to level of service "D" conditions. Looking generally at the area south of I-40, there are a number of spot locations where there are capacity issues along the freeways, with respect to river crossings, and at other isolated locations.

In the immediate vicinity of Mesa del Sol, capacity problems are shown specifically on I-25, north of the Rio Bravo/University Blvd. interchange. Also, there are capacity problems portrayed at the Broadway interchange (not on the I-25 mainline, however).

Figure F-21, illustrates present-day ADTs on facilities in the immediate vicinity of the project. As the figure illustrates, rounded ADTs are as follows:

I-25: 68,000
University: 11,000
Rio Bravo: 28,000
2nd Street: 9,000
Broadway, west of the project: 11,000
Broadway, south of the project: 27,000

Figure F-21: Existing (2005) ADTs on Highways in the Immediate Vicinity of Mesa del Sol (Each Direction)



2. 2025 "No Build" Scenario

The MRCOG EMME/2 model was also run for the "2025 No Build" Scenario. In this scenario, **no development** in Mesa del Sol was assumed to have taken place. This model run was performed specifically for this analysis, since the regular adopted MRCOG MTP for 2025 does assume a moderate development in Mesa del Sol, and therefore, based on the methodology and approach stated in the previous Section 7, it could not be used.

Figure F-22: Capacity Deficiencies in the Vicinity 2025 "No Build" Scenario (PM Peak)

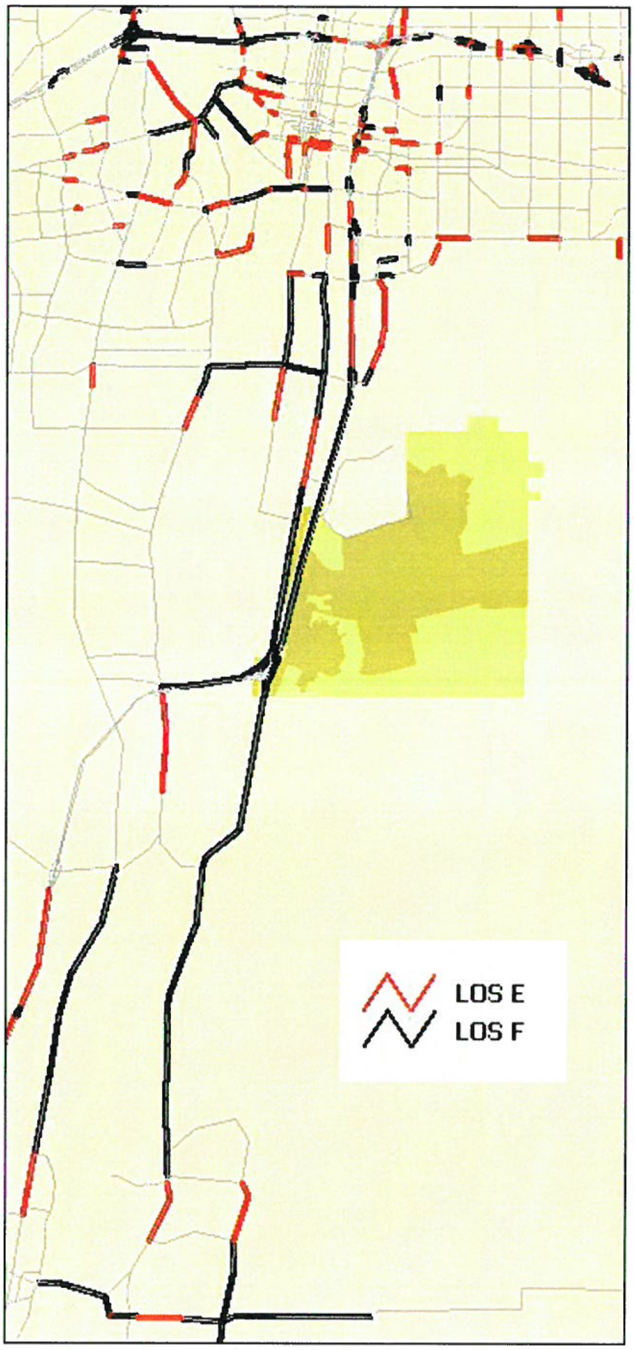
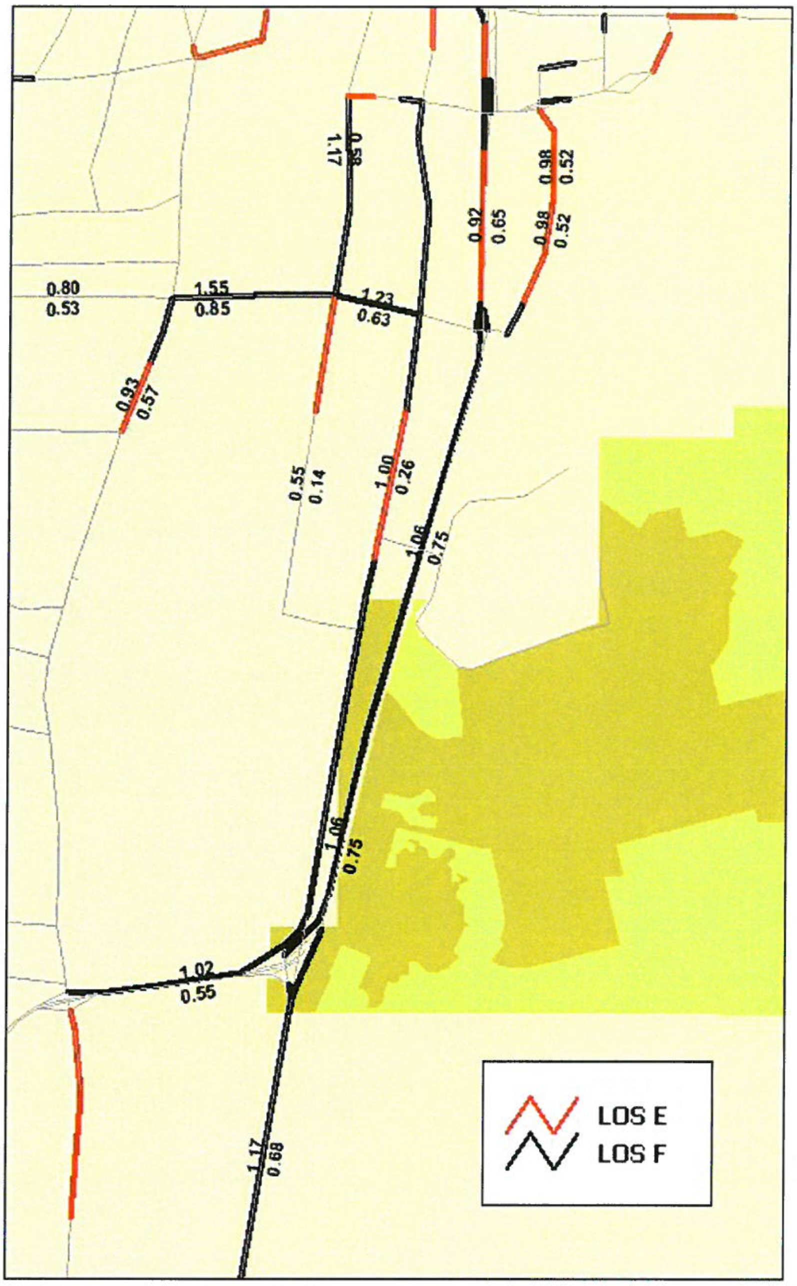


Figure F-22 illustrates the capacity deficiencies forecast in the MRCOG model by the year 2025 – these deficiencies are completely unrelated to any development in Mesa del Sol and merely indicate the environment anticipated by that time. There is considerable growth in traffic expected over the next 20 years, and significant and widespread capacity problems related to it. Virtually all of the roadways in the immediate vicinity of Mesa del Sol are expected to be operating over capacity, including the I-25 mainline itself.

Figure F-23: PM Peak Hour V/C Ratios in 2025 "No Build" Scenario



Specific V/C ratios are shown for area highways in the vicinity of the proposed project in Figure F-23, to illustrate the point that there is little, if any, excess capacity available in this vicinity to support further development in the area.

These traffic conditions are largely expected to arise due to population growth in Valencia County over the next 20 years.

Figure F-24: 2025 ADTs on Highways in the Immediate Vicinity of Mesa del Sol

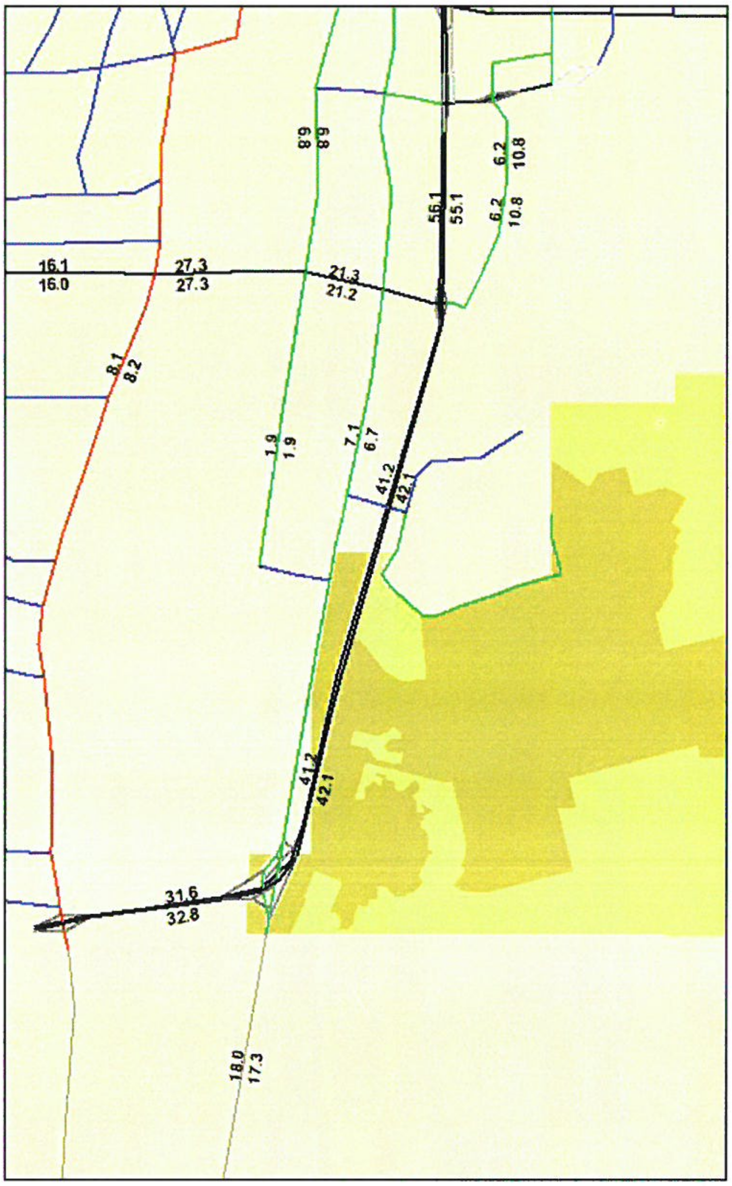


Figure F-24 illustrates the growth in ADT anticipated on highways in the general vicinity of Mesa del Sol by 2025. This growth in traffic results in deteriorating traffic flow conditions.

I-25: Traffic on I-25 will almost double, to over 110,000 vehicles per day north of Rio Bravo.

University: 55% growth to 17,000

Rio Bravo: Traffic on Rio Bravo itself will almost double, to 54,000

2nd Street: Double to 18,000 north of Rio Bravo

Broadway, west of the project: moderate (27%) growth to 14,000

Broadway, 31% growth south of the project: 27,000

The MRCOG MTP anticipates capacity improvements on I-25 north of Rio Bravo, where the freeway will be widened to 6 lanes. There are no other improvements planned in the network, other than a new interchange to serve Mesa del Sol, in the general vicinity of Mesa del Sol site by 2025.

3. 2025 "Build" Scenario

The "Build" Scenario looks at traffic operations and impacts forthcoming from the development of Mesa del Sol, as envisioned in the "phased development plan" through 2025. The magnitude of land use associated with this plan, targeting the initial "Takedown Area", was previously summarized in Section 6 of this document.

The circulation system for 2025 is essentially a reduced version of the full "build-out" network. This reduced network generally does not provide roadways outside of the "Takedown Area". In addition, the frontage road access treatment of I-25 associated with the "build-out" network is considered a post-2025 improvement. By 2025 only the addition of the interchange with the central transit corridor is proposed, consistent with the way MRCOG depicts access to Mesa del Sol in the 2025 MTP. Details connected with the circulation system for 2025, functional classes and lane configurations, are provided in Appendix F-2.

Balanced Community

As was pointed out earlier, Mesa del Sol is proposed to achieve "jobs housing balance" by 2025, whereby there are roughly an equivalent number of jobs available on-site as there are workers residing in the community. This should have the effect of retaining a substantial amount of traffic on-site, and reducing the volume of commuting from the site than otherwise might be expected to occur.

Table F-10: Commuting Trips Retained in MDS

	2025	Build-Out
HBW Productions in MDS	17,827	55,908
HBW Attractions in MDS	17,852	60,088
Retained in MDS	5,849	34,505
% of Residents Working On-Site	32.8%	61.7%
% of Workers Living On-Site	32.8%	57.4%

This is demonstrated in Table F-10, which reports the total number of home based work (HBW), or commuting trips, that are generated in Mesa del Sol. "Productions" are work trips associated with the residence location of workers. "Attractions" are work trips associated with the job location of workers. In 2025, about one-third of the workers living in Mesa del Sol also work there. In 2025, about one third of the jobs are filled by local residents. The "Build-Out" statistics are also shown in this table, by comparison. In the "Build-Out" scenario, Mesa del Sol assumes the posture of a major regional employment center and a net importer of workers from throughout the region. Close to 60% of the workers living at Mesa del Sol are found to also work there.

Reach of Impact

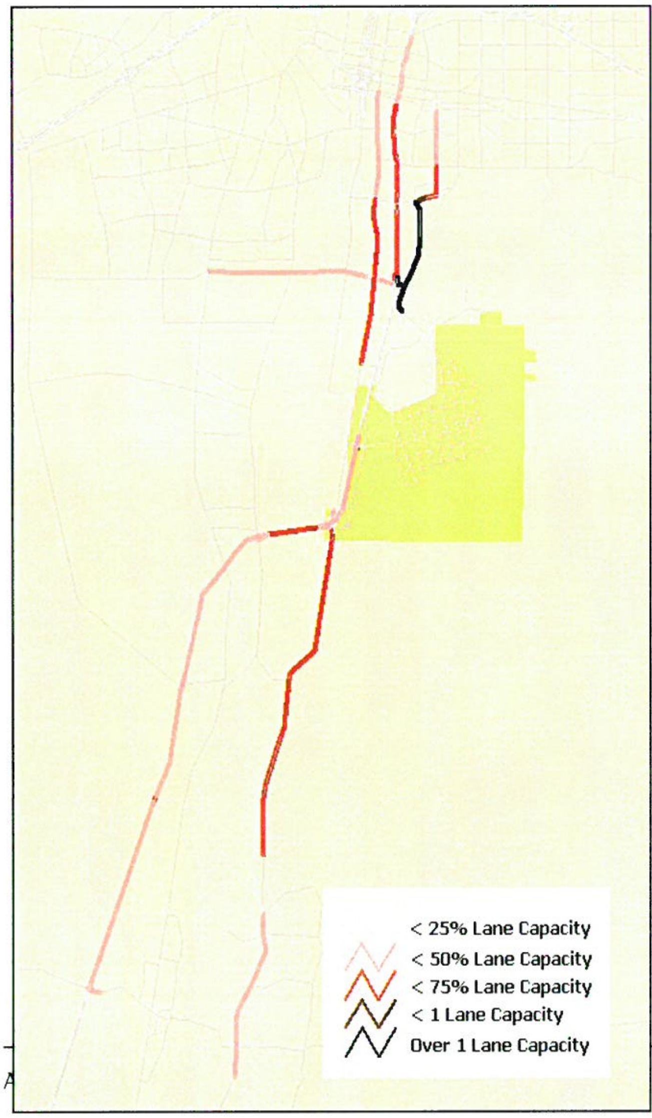
One of the objectives of the forecasts that were run was to identify the nature of traffic impacts that are associated with the Mesa del Sol development off-site.

To begin addressing that question, we performed a "select link" analysis to determine the volume of traffic on highways throughout the region that were specifically related to Mesa del Sol (that is, had one trip end within the development). In a "select link" analysis, the model can trace trips on highways that use certain facilities. For our purposes here, we traced traffic on any highway crossing the Mesa del Sol cordon (boundary) – namely, University Blvd., Bobby Foster Road, Mesa del Sol Blvd., and Broadway.

One way to characterize the amount of traffic on area highways from Mesa del Sol is in relation to the number of lanes on those highways – this is to say, in terms of the percentage of lane capacity that is occupied by traffic tied to Mesa del Sol. This is shown in Figure F-25.

For several sections of University Blvd, for example, MDS traffic occupies more than one full lane of capacity. Further away, Mesa del Sol traffic occupies less than half of a lane of capacity.

Figure F-25: Percent of Lane Capacity Occupied by MDS Traffic 2025 "Build" Scenario: AM Peak Period



From this point of view, the impact area of Mesa del Sol, or its "reach", is confined to areas south of the Albuquerque downtown, and south of Central. Beyond that point, the amount of traffic related to Mesa del Sol diminishes to less than a quarter of one lane of capacity is consumed. Mesa del Sol traffic is then highly dispersed into the network so that the impact on any one street is minimal and inconsequential.

Also note that the reach of Mesa del Sol traffic reaches south into Valencia County as well as far south as Los Lunas.

Table F-11: Residence Location of MDS Workers

Origins of HBW Attractions	Trips	Percent
Bernalillo County	3,338	19.0%
Valencia County	7,644	43.5%
Mesa del Sol	5,849	33.3%
Elsewhere	751	4.3%
Total	**17,582**	

Commuting patterns generated by the MRCOG model simulation suggest that Valencia County will be a major source of workers for employers in Mesa del Sol, much more so than Bernalillo County itself. Mesa del Sol presents the first significant source of job opportunities for Valencia County; traditionally a bedroom community where residents would otherwise have to travel much farther into Albuquerque before finding comparable job opportunities. Table F-11 offers a statistical breakdown of this situation.

Vehicle-Miles-of-Travel (VMT)

The "balanced community" nature of Mesa del Sol should have positive effects with respect to VMT. Also, if the simulation suggests that one impact related to Mesa del Sol will be to intercept commuting trips originating from Valencia County before they would otherwise pursue job opportunities deeper in Albuquerque, then there should be some VMT savings associated with this as well.

Table F-12 summarizes total VMT associated with the 2025 forecast for the "Build" and "No Build" scenarios. As indicated in the table, overall VMT increases with the "Build" alternative but of course overall population and employment associated with this scenario is higher as well, with the net addition of a significant level of development in Mesa del Sol. When we look at it from a per capita point of view, we see that VMT across the region drops, by about 2% overall. *Mesa del Sol increases population in the region by almost 9%, but achieves a 2% decrease in per capita VMT.*

Table F-12: 2025 VMT

	No-Build	Build	Difference	Percent
VMT	26,627,300	28,344,000	1,717,000	6.45%
Population	1,008,017	1,097,661	89,644	8.90%
Per Capita VMT	26.4155	25.8221	-0.5934	-2.25%

This VMT reduction is achieved through a more efficient urban form, the positioning of Mesa del Sol between the burgeoning bedroom community in Valencia County and the urban core. Other aspects of Mesa del Sol that may lead to additional reductions in VMT, such as through traffic reductions related to various new urbanism concepts, are not reflected in these statistics, as they were not tested in the MRCOG model.

Off-Site Impacts

The MRCOG model can be used to determine level of service conditions off-site. Figures F-26 and F-27 depict these conditions, highlighting locations where levels of service "E" or "F" are forecast. The resulting number of Level of Service E and F locations is not surprising since many of these roadways are predicted to be over capacity anyway, *even if there is no development in Mesa del Sol at all.*

Figure F-26: AM Peak Period Level of Service

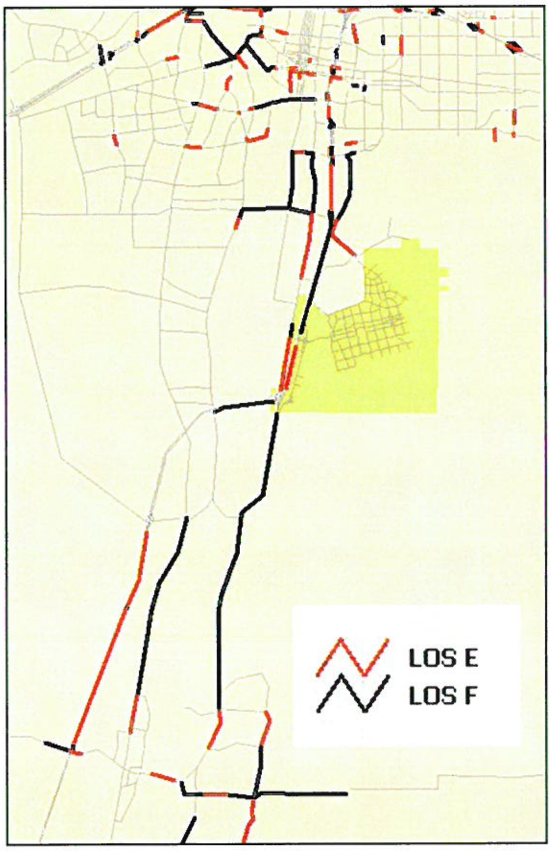
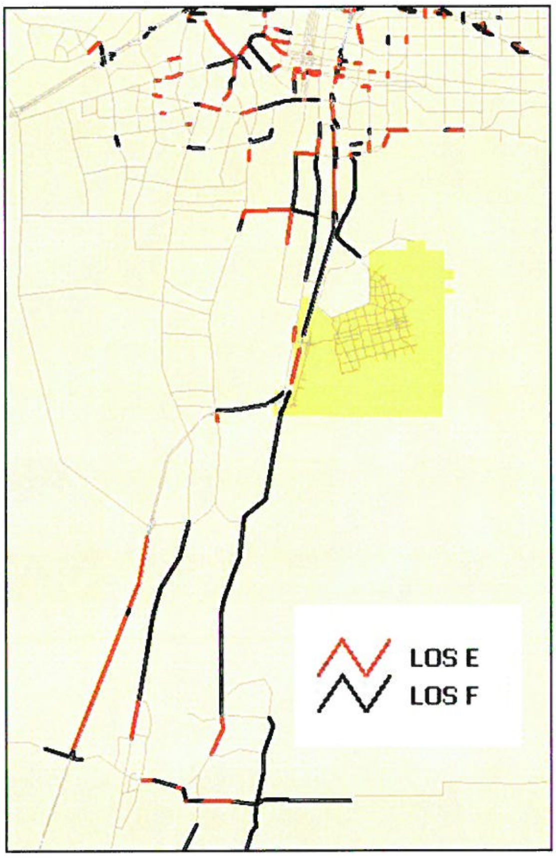


Figure F-27: PM Peak Level of Service



Note: Level of Service conditions on-site will be covered later, and is not shown in these graphics.

Many of the level of service issues indicated in the preceding figures are irrelevant to development in Mesa del Sol, and were predicted to occur even in the "No Build" scenario. A means to hone in on highway segments that are impacted by Mesa del Sol is through the "select link analysis" that was discussed earlier with respect to the "impact area" associated with the proposed development. Of the "problem" highway segments, those operating over capacity (at Level of Service "D"), we isolated those where there was a "significant amount of traffic" associated with Mesa del Sol. For this purpose we defined a "significant amount of traffic" in terms of more than 25% of a lane capacity.

This results in the locations shown in Figure F-28 (for the AM peak) and Figure F-29 (for the PM peak).

Figure F-28: Capacity Problems: AM Peak

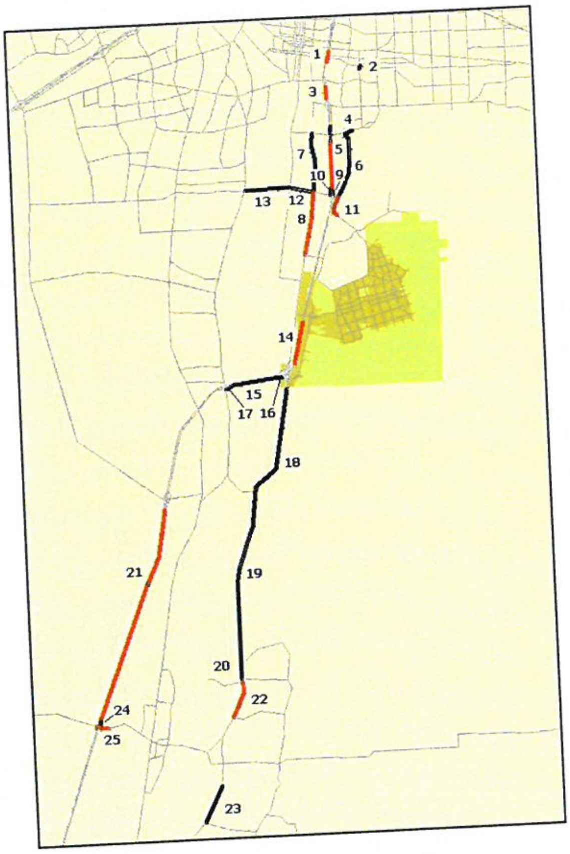
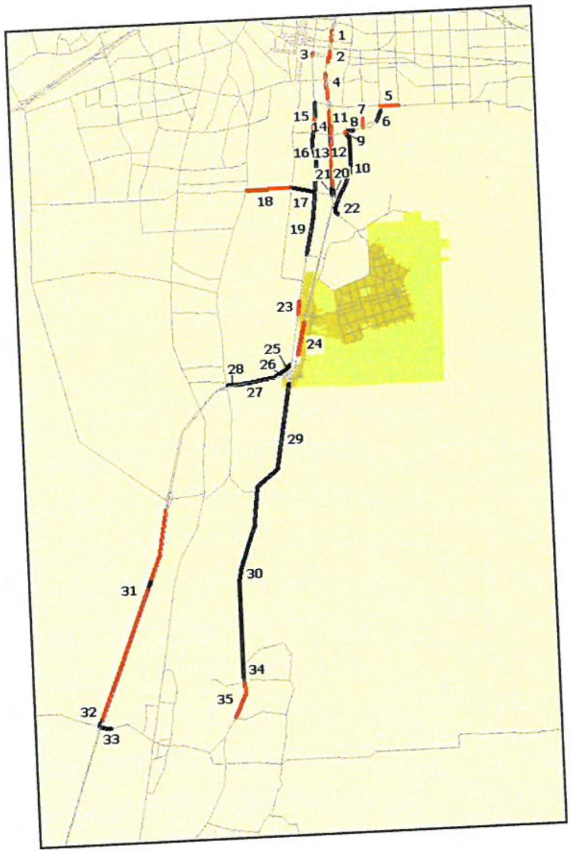


Figure F-29: Capacity Problems: PM Peak



Capacity data related to these locations is shown in Table F-13 and Table F-14. Highlights of the capacity comparison between the "build" and "no-build" scenarios are as follows:

- In the AM Peak period, there is only one location where Mesa del Sol traffic causes a highway segment to exceed capacity where it formerly operated at acceptable levels of service. All of the other locations will have capacity issues even if Mesa del Sol is not built
- In the PM Peak period, there are five locations on individual roadway segments where the addition of Mesa del Sol traffic creates capacity problems where otherwise acceptable levels of service drop to unacceptable levels.
- There are also offsetting gains where levels of service will improve, due to the fact that the emergence of Mesa del Sol as a major development alters travel patterns from Valencia County.

… Peak Period (continued)

Map Location	Name	Direction	Location	Lanes	Capacity	Volume	V/C	LOS	No-Build V/C	No-Build LOS
19	Broadway	SB	*S of Rio Bravo*	2	1,500	1,670	1.11	**F**	1.17	**F**
20	I-25 Off-Ramp	SB	*To Rio Bravo*	1	700	1,726	2.46	**F**	1.92	**F**
21	I-25 On-Ramp	NB	*From Rio Bravo*	1	700	1,008	1.44	**F**	1.28	**F**
22	University Extension	SB	*S of Rio Bravo*	3	2,250	2,360	1.04	**F**	--	--
23	Broadway	SB	*N of Mesa del Sol Blvd*	2	1,500	1,448	0.96	**E**	1.16	**F**
24	I-25	SB	*S of Mesa del Sol Blvd*	2	3,800	3,763	0.99	**E**	1.06	**F**
25	Broadway	SB	*Thru I-25 Interchange*	2	1,500	1,573	1.04	**F**	1.18	**F**
26	I-25 On-Ramp	SB	*From Broadway*	1	700	828	1.18	**F**	1.05	**F**
27	I-25	SB	*S of Broadway*	2	3,800	4,223	1.11	**F**	1.02	**F**
28	I-25 Off-Ramp	SB	*To Isleta*	1	700	1,141	1.63	**F**	1.37	**F**
29	NM 47	SB	*S of I-25*	2	1,700	2,768	1.62	**F**	1.41	**F**
30	NM 47	SB	*S of NM 147*	2	1,700	2,773	1.63	**F**	1.55	**F**
31	I-25	SB	*S of NM 317*	2	3,800	3,678	0.96	**E**	0.95	**E**
32	I-25 Off-Ramp	SB	*To NM 6*	1	900	1,676	1.86	**F**	1.81	**F**
33	NM-6	EB	*E of I-25*	2	1,700	2,294	1.34	**F**	1.33	**F**
34	NM 47	SB	*S of Peralta Blvd*	2	1,700	1,790	1.05	**F**	1.03	**F**
35	NM 47	SB	*N of Valencia Rd*	2	1,700	1,674	0.98	**E**	0.94	**E**

Appendix F 45 Transportation

On-Site Capacity Needs

- The previous section discussed traffic impacts related to the development of Mesa del Sol, ***off-site***. In addition to this, the MRCOG forecasts provide us with an ability to review the capacity needs of the circulation system ***on-site***. The area shown in the following figure in dark yellow, the "takedown" area, indicates the area where phased development is planned in the 2025 scenario. The circulation system for this scenario is also not fully built out, roadways outside of the takedown area are not required and only one new interchange with I-25 and Mesa del Sol Blvd. is proposed.
- ***AM Peak Period:*** The forecast indicates that levels of service "D" or better will be met virtually everywhere on the phased circulation system. There is only one location where Level of Service D conditions are not met—on University Blvd. leaving the Mesa del Sol site. (See Figure F-30.)
- University Blvd. exiting the site to the north is depicted as a 6 lane arterial (3 lanes in each direction). The forecast indicated that this facility will exceed capacity by 2025 in the AM peak period. However, as stated previously, no allowance for traffic reductions for transit were made in the travel demand forecast. Future transit provisions will help to ameliorate this situation.
- ***PM Peak Period:*** The forecast for the PM peak period reflects similar conditions as reported above in the AM period. Levels of service "D" conditions, or better, will be met virtually everywhere except for the aforementioned University Blvd. This is illustrated in Figure F-31, with capacity data at problem locations reported in Table F-16.

-18:
ut Scenario: PM Capacity Deficiencies

Map Location	Name	Direction	Proposed Lanes	Proposed Capacity	Volume	V/C	LOS
1	University Extension	SB	3	2,250	2,696	1.19	F
1	University Extension	NB	3	2,250	2,358	1.04	F
2	University Extension	SB	3	2,400	2,577	1.07	F
2	University Extension	NB	3	2,400	2,328	0.97	E
3	Bobby Foster	WB	3	2,250	2,085	0.92	E
4	Bobby Foster	SB	2	1,500	1,422	0.94	E
5	Unnamed	SB	1	675	677	1.00	F
6	Unnamed	SB	2	1,600	1,702	1.06	F
7	Unnamed	SB	2	1,600	1,565	0.97	E
8	Bobby Foster	SB	3	2,250	2,147	0.95	E
9	Bobby Foster	WB	3	2,250	2,054	0.91	E
9	Bobby Foster	EB	3	2,250	2,255	1.00	F
10	Unnamed	SB	1	675	622	0.92	E
11	Unnamed	SB	3	2,250	2,251	1.00	F
12	Unnamed	SB	3	2,250	2,065	0.91	E

Traffic and System Summary

the location of Mesa del Sol, connections to the larger City ion network will be concentrated on the western and northern edges of ɔment. With La Semilla and Kirtland Air Force Base on the east and lo reservation on the south, there will be virtually no "through-traffic" he internal transportation network at Mesa del Sol. With a substantial t base at Mesa del Sol, traffic modeling shows that there is a good minimize the average number of household trips that would have an e greater Albuquerque transportation network. However, given the itions on the existing area transportation network (i.e. off-site), affic due to projected growth without Mesa del Sol will tend to nents of the network. Within Mesa del Sol, as demonstrated with nand model, the planned roadway network will accommodate traffic t as development takes place, and for 2025 with acceptable levels of one roadway that serves Mesa del Sol, University Blvd. Extension, a congested condition in 2025 due to the addition of Mesa del Sol t condition can be mitigated with use of high capacity transit.

I-25, Broadway / NM 47, University, and Rio Bravo Boulevards are the primary arterials that will serve to carry traffic into and out of Mesa del Sol and provide key connections to the rest of Albuquerque. I-25 north of Rio Bravo, Rio Bravo west of 2nd, and NM 47 just south of I-25 currently operate at LOS E or worse. In 2025, without any development at Mesa del Sol, I-25 from Isleta to Gibson, Broadway / NM 47 from Valencia County to Sunport, University from Rio Bravo to Sunport, and Rio Bravo from Broadway to Isleta are all predicted to operate at LOS E or F. (These are illustrated in Figure F-X).

Projected population and employment growth in the region, without Mesa del Sol, will generate accompanying growth in traffic and will require various improvements to the existing transportation system to accommodate the increased traffic volumes. These improvements may include the addition of travel lanes to existing arterial roadways, and to I-25, as well as the addition of an interchange or interchanges to I-25.

Requirements for Off-Site Improvements have been analyzed and developed based on projections of future traffic volumes for the design year 2025 with and without Mesa del Sol, as well as for the full "Build-Out" scenario at some point well into the future beyond 2025. Traffic modeling results and subsequent improvements discussed in this and previous sections are preliminary at this Level A stage, and may be modified in the future during more detailed traffic impact studies, such as will typically occur during Level B and Level C submittals.

Off-Site Impacts / Improvements Anticipated for 2025

The following are major roadways in the immediate vicinity of Mesa del Sol, that are discussed to call attention to the locations that exhibit problems in 2025 from a traffic operations perspective per model results. The question of responsibility for these roadways and funding of these improvements will be addressed through the normal regional transportation planning process as needs become obvious and priorities become clear.

I-25 / Mesa del Sol Blvd. Interchange

A full-movement interchange for Mesa del Sol Blvd. and I-25 will be required to provide direct access for Mesa del Sol traffic from and to I-25. Mesa del Sol Blvd. is projected to be the primary access into Mesa del Sol, and is planned to begin at Broadway west of Mesa del Sol, and extend over or under I-25 into the development. The new interchange is proposed to be located on I-25 approximately 1.8 miles south of the existing Bobby Foster Road overpass, and approximately 1.6 miles north of the existing Broadway / NM 47 interchange with I-25. The configuration and exact location of the interchange has not yet been determined; this will be accomplished during a Location Study process for the interchange that will be performed in accordance with NMDOT and Federal Highway Administration (FHWA) procedures. A traditional diamond interchange has been depicted on graphics and figures in this document for illustration purposes only.

I-25 / Rio Bravo Blvd. Interchange

The north side entrance and exit ramps to Rio Bravo from and to I-25 are projected to operate at a failing LOS F in 2025, without any added traffic from Mesa del Sol. Reconstruction of the I-25 / Rio Bravo Blvd. interchange will be necessary to accommodate 2025 traffic. Although Rio Bravo Blvd. would be expected to remain in the same approximate location crossing I-25, the configuration of the reconstructed interchange would be determined during an Evaluation of Alternatives study in accordance with NMDOT and FHWA procedures.

I-25 Widening

I-25 is projected to operate at a LOS F between the Isleta Interchange and the Rio Bravo Interchange in 2025, without Mesa del Sol. Widening of I-25 from four lanes to six lanes will be required to accommodate 2025 traffic, without Mesa del Sol. This widening will be necessary from at least the Broadway / NM 47 Interchange (if not to Isleta) to the Rio Bravo interchange, connecting with the planned widening as shown under the "Committed Improvements" discussed in a previous section of this document.

Bobby Foster Road and Overpass

Bobby Foster Road as presently exists is a three lane roadway, with one lane striped for eastbound (up Mesa) traffic, and the other two lanes striped for westbound (off Mesa) traffic, to accommodate the highest present traffic use, that of exiting traffic at the Journal Pavilion Amphitheater. The bridge over I-25 is a two-lane structure, in fair condition. Bobby Foster Road is projected to be a six-lane avenue in the 2025 traffic model. Bobby Foster Road is projected to be widened as part of this project, beginning at Broadway, over I-25 and into Mesa del Sol. With modeling of the six lane section, traffic is projected to operate at a LOS B. Since this is more than adequate, a four-lane section may be sufficient, and will be explored during subsequent Level B and C studies. Initial construction will likely address a phased approach, i.e. constructing the roadway as a four-lane section until such time as traffic warrants the six lanes.

Broadway / NM 47

By 2025, Broadway is also projected to operate at LOS E or F from Valencia County to Sunport Blvd., again, without Mesa del Sol. Based on modeling results, widening of Broadway from its present four lanes to six lanes will be required to accommodate 2025 traffic. Since Broadway is a parallel corridor to I-25, and effectively serves the same traffic in conjunction with I-25, improvements to one or the other will provide motorists with an alternative route, and planning for any improvements should be done in conjunction with each other. In addition, Commuter Rail will be in place by 2006, with the potential to greatly affect the predicted traffic volumes on Broadway and I-25. Therefore, widening of Broadway should be re-evaluated in the future after implementation of other area transportation improvements.

University Blvd. Extension

The University Blvd. Extension has been modeled as a six-lane facility in the traffic model for 2025. This roadway is predicted to carry a heavy volume of traffic, with the ADT in 2025 predicted to range from 38,000 to 40,000. Peak hour volumes are predicted to be 2,097 in the AM Peak Hour and 2,360 in the PM Peak Hour. With these volumes, and with the present assumptions in the traffic model (i.e. 750 vehicles per hour per MRCOG's minor arterial classification), the volume per lane will exceed capacity, thus driving the level of service to a failing condition (LOS F). However, with use of reclassification of University to a Principal Arterial status, thus accepting a higher volume per lane, and with the assumption of some diversion of traffic from vehicles to future transit (possibly up to 4% of the traffic) an acceptable level of service can be computed. Therefore, the six lane section may hold up as adequate, when reviewed again in future Level B and C documents, and when considering the impact of high capacity transit. Six lanes are therefore assumed to be adequate for 2025, pending future analysis and re-evaluation.

I. Financial Responsibilities for On-Site and Off-Site Improvements

One of the requirements identified in the aforementioned *Planned Communities Criteria: Policy Element*, is "private and public responsibilities for on-site and off-site improvements". This is a complicated and multi-faceted subject, when dealing with various roadways and highways that are under the jurisdiction of various agencies (city, county and state), and where many of these existing roadways are nearing the end of their useful design life and major improvements are needed anyway, regardless of whether Mesa del Sol is built. It is beyond the scope of this document to determine the reasonable and fair cost sharing allocations that will ultimately have to be addressed. These cost responsibility issues will be left to future discussions, negotiations and documentation in a development agreement between the major parties involved.

J. Proposed Roadway Classifications

1. Primary Roadway Types and Sections

The roadways serving through traffic within the Mesa del Sol development can be broken down into four major categories—Boulevards, Avenues, Connectors and Locals. The following section describes the basic components of each of these roadway types. Figures illustrating these roadways are included in Appendix F-1 of this document. There are many specific applications of each roadway section, with the figures in Appendix F-1 showing the variations of each type of roadway and its general application, as included in the figures' labeling. Figure F-3, included in an earlier section of this document, provides cross referencing for the Boulevards and Avenues, with references to the figures in Appendix F-1, for indication of which typical sections apply to which roadways. Refer to both of these sections for further detail on the roadway typical sections.

Transit Boulevard

The Transit Blvd. is a multi-functional and multi-modal arterial designed to match the mixed-use centers it supports. Like traditional boulevards, it has a central area for through traffic and transit, along with small-scale parallel access roads, similar to frontage roads, to support local activities and pedestrian environment at the edges. It is a place where cafes, small businesses, apartments, transit, parking, and through traffic all mingle in a simple and time-tested hierarchy.

This Transit Blvd. will be lined with higher density development and will run through the most intense mixed-use centers at Mesa del Sol - the Urban Center and Community Center, and continue on to on to serve the Employment Center via an intersection with the University Blvd. extension. The Transit Blvd. will connect, via the University Blvd. extension and interchanges with I-25, to the rest of Albuquerque. Within the Urban and Community Centers, the Boulevard will split into couplets, two one-way streets set a block apart, creating an urban grid of pedestrian scaled streets.

The Transit Blvd. will include two through lanes in each direction. Large medians will be provided, 44-48 ft. wide, to accommodate the future addition of 12 ft. transit lanes in both directions, and 10-12 ft. wide median stations, also in both directions. In the future, this additional width could also be assigned to additional through traffic lanes, as needed depending on the progress of development of regional high capacity transit facilities. Bicycle lanes will also be provided adjacent to the through traffic lanes. The local single lane access roads will be separated from the through lanes by a 12 ft. median. The access roads will be 11 ft. wide, with 7 ft. parking lanes provided adjacent to the access lanes. Landscaped walkways will also be included adjacent to the parking lanes. A wide right-of-way is necessary to accommodate this multi-modal roadway.

In keeping with the concept of a sustainable, safe, pedestrian friendly environment, no street at Mesa del Sol will contain more than three travel lanes in one direction, allowing pedestrian continuity without diverting auto capacity. In addition, the one-way system mentioned above for the urban and community centers eliminates left turn delays, actually decreasing travel time through the mixed-use centers.

The transit system running through the Boulevard(s) will be compatible with ABQ Ride's preferred type of transit, which could be light rail, streetcars, or Bus Rapid Transit (BRT).

Variations to the primary Transit Blvd. described above are shown in Appendix F-1.

Avenues

Avenues are the major routes in addition to the Boulevards that will connect Mesa del Sol's mixed-use centers to each other and will provide connections to the rest of the area and to off-site roadways. Avenues will typically have four lanes. Within Mesa del Sol's Urban Center, the planned north-south Avenue will break into an urban couplet similar to the Boulevards through the Community and Village Centers. Between centers, Avenues could have a parkway treatment lined by alley-loaded large lot homes -- as in the historic neighborhoods of many American cities.

Avenues are planned to have two or three through lanes in each direction, with lanes widths of 11-12 feet. Avenues will also have medians, generally 12 to 48 feet wide, with the wide medians used to accommodate future transit use. With the wide medians, 12 ft. transit lanes can be provided in each direction, along with 12 ft. median stations for transit use. Avenues will typically be located next to parks or linear open space, thus providing a separate zone, and trails, for use by bicyclists and pedestrians.

Various applications and variations of the Avenue described above are shown in Appendix F-1.

Connector Streets

Connector streets form a finer grid of approximately ¼ mile spacing within and between neighborhoods. These connections provide routes for direct access to neighborhood centers. Connector streets are more frequent and more continuous than standard collectors or local streets and therefore serve to disperse the traffic in such a way as to create livable environments along them. The connectedness of the Connector street system also serves to relieve the Avenues of local trips. Connector streets have two lanes and on-street parking. Depending on traffic volumes and type (i.e. residential), bicycle lanes may be provided and landscaped walkways will also be provided.

Connectors will have one lane in each direction, 11-12 ft. wide, depending on the presence and use of medians with curbed sections and use of gutter pans, and the type of land use served. 5 ft. wide bike lanes will typically be provided in both directions. Parking lanes will be provided alongside the bike and through lanes, with parking lanes of 8 ft. in commercial areas, and 7 ft. in residential areas.

Walkways will be provided on the Connectors, with minimum widths of 5 ft. (outside of landscaped buffers) in residential areas and 16 ft. in commercial areas.

Various applications and variations of the Connector described above are shown in Appendix F-1.

Local Streets

Local streets will serve local neighborhood traffic, with their primary function being to provide local access. The local streets will typically have sidewalks on both sides along with street trees. Several local street sections have been developed for Mesa del Sol and are illustrated in Appendix F-1. In order to keep traffic speeds low (and thus avoiding the need for future retrofitting for "traffic calming") while providing adequate emergency access, pavement widths for Local Streets are proposed to vary from 28 to 32 feet (curb-to-curb) for two-way traffic, with 19 to 26 ft. of pavement for one-way traffic. This is narrower than City of Albuquerque standards, which require a minimum of 36 to 40 feet of pavement for two-way streets, subject to utility spacing and offset requirements as well, with frequent on-street parking. However, these narrower sections have been applied successfully in many other jurisdictions, particularly within the context of New Urbanism developmens. The use of the various local street sections will depend on context and anticipated traffic volumes. (Refer to the supporting White Paper on Street Design in Appendix C for additional information, including case studies and contacts.)

Alleys

Alleys will be provided in certain neighborhoods for back access to garages, utilities and trash pickup. Alleys will be designed to provide for a single lane of traffic, 12 feet wide, behind the residences. Alleys will be located symmetrically within a 20 ft. right-of-way, with 4 ft. buffers on either side of the paved area. A typical section for Alleys is included in Appendix F-1.

2. Functional Classification and Application of Typical Sections

Table F-19 on the following page shows the functional classification and application by traffic volume of the Mesa del Sol typical sections. The higher classifications are designed for mobility and are spaced further apart than the lower classifications, which provide access to land uses and are spaced closer together. This table includes all of the typical sections as illustrated by the figures in Appendix F-1. The use and specific applications of the typical sections will be presented and discussed in more detail in future Level B reports.

The numbers provided as "Maximum Volumes" represent an estimate of the maximum total number of vehicles likely to be able to use the facility per day, i.e. the total average daily traffic (ADT). The actual maximum could vary by as much as 10% and will ultimately depend on auxiliary lanes, turning movements and intersection operations. A more detailed analysis of operations will be performed in subsequent Level B and C phases of planning.

Arterials are assumed to have a capacity of 10,000 vehicles per day per lane (vpdpl). A review of traffic volumes on arterial roadways in cities comparable to Albuquerque indicates a maximum of 12,000 vpdpl, but to be conservative, and taking the relatively low local tolerance to congestion into account, we have assumed 80% of this value. Values shown in the following table reflect a range that includes this assumption, plus 10% as discussed above, thus, 10,000 to 11,000 vpdpl. In addition, because of the impedance of maneuvers present with parking lanes, we have reduced the assumed capacity of lanes adjacent to parking to be 8,000 vpdpl.

Collectors are assumed to have a maximum volume of approximately 50% of the measured maximum of 12,000 vpdpl, which is consistent with their function (i.e. 50% mobility, 50% access). This volume (6,000 vpdpl) is consistent with findings from the similar Stapleton development in Denver, which also utilizes "new urbanism" concepts and has many similar characteristics to Mesa del Sol.

Local roads are assumed to have a maximum volume of 2,000 vpdpl, which reflects the use of local roads primarily for local access. On local roads with queueing (i.e. one lane of travel for two directions), it is estimated that capacity will be reduced approximately 25% such that the maximum volume is 1,500 vpd. Applying trip generation rules, it is unlikely that residential areas that use each local road will generate more traffic than this theoretical capacity, given the density of housing and the spacing of local roads.

Table F-19. Maximum Traffic Volumes of Mesa del Sol Cross Sections

Classification	Principal Function	Spacing	Maximum Volume (range)
Divided Arterials	Mobility	1–1 ½ miles	10,000 – 11,000 vpdpl**
1A-2 Transit Boulevard Configuration A			40,000 – 44,000 vpd***
1B-2 Transit Boulevard Configuration B			40,000 – 44,000 vpd
1B-3 Transit Boulevard Configuration B			60,000 – 66,000 vpd
1C-2 Parkside Boulevard			40,000 – 44,000 vpd
1C-3 Parkside Boulevard			60,000 – 66,000 vpd
1D-3 Parkside Boulevard w/out Transitway			60,000 – 66,000 vpd
Avenue A (Employment Center)			38,000 – 41,000 vpd
Avenue B (Employment Center)			36,000 – 38,000 vpd
1E-2 Avenue with Transitway			36,000 – 38,000 vpd
1E-3 Avenue with Transitway			56,000 – 60,000 vpd
1F-2 Avenue w/out Transitway			36,000 – 38,000 vpd
1F-3 Avenue w/out Transitway			56,000 – 60,000 vpd
1G-2 Avenue on Slope			40,000 – 44,000 vpd
1G-3 Avenue on Slope			60,000 – 66,000 vpd
1H-3 Avenue on Slope w/out Transitway			60,000 – 66,000 vpd
1I-2 Avenue Interstate Bridge			40,000 – 44,000 vpd
1I-3 Avenue Interstate Bridge			60,000 – 66,000 vpd
1J-2 Avenue Open Space Frontage			40,000 – 44,000 vpd
1J-3 Avenue Open Space Frontage			60,000 – 66,000 vpd
1K-2 Avenue Open Space w/out Transit			40,000 – 44,000 vpd
1K-3 Avenue Open Space w/out Transit			60,000 – 66,000 vpd
1L Avenue Couplet w/ Transitway			18,000 – 19,800 vpd
1L Avenue Couplet w/ Transitway at Station			18,000 – 19,800 vpd
1M Avenue Couplet w/out Transitway			16,000 – 17,600 vpd
1L Avenue Couplet w/ Transitway			16,000 – 17,600 vpd
Collectors	50% Mobility 50%Access	¼ mile	6,000 – 6,600 vpdpl
2A Connector Main Street (Commercial)			12,000 – 13,200 vpd
2B Connector Residential w/ Median			12,000 – 13,200 vpd
2C Connector Residential			12,000 – 13,200 vpd
2D Connector Industrial			12,000 – 13,200 vpd
Locals	Local Access	180 --700 feet	2,000 – 2,200 vpdpl
3A Local A			4,000 – 4,400 vpd
3B Local B Queueing			4,000 – 4,400 vpd
3C Local C Queueing			1,500 – 1,650 vpd
3D Local D One Way			2,000 – 2,200 vpd
3E Local E One Way by Open Space			2,000 – 2,200 vpd
3F Local F Queueing Restricted Parking			1,500 – 1,650 vpd
3G Local G Industrial R&D			4,000 – 4,400 vpd
3H Local H Alameda			4,000 – 4,400 vpd
Other	Access & Walking		
4A Alley			NA
4B Pedestrian Way			NA

Notes:
* = One Way Street
** vpdpl = vehicles per day per lane
*** vpd = vehicles per day

STREET SECTIONS

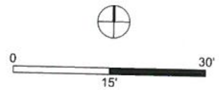
LEVEL A PLAN : JUNE 2005

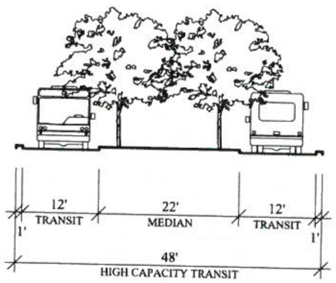
F-1

MESA DEL SOL

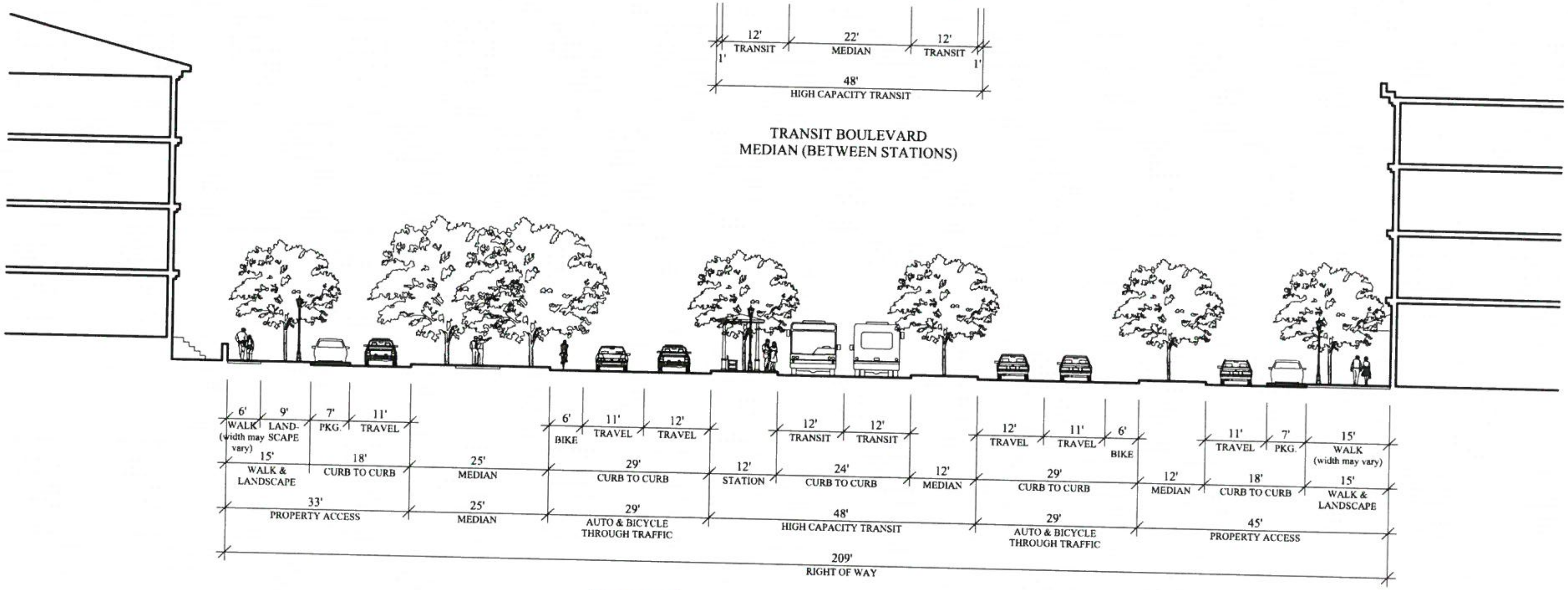
Boulevards 1

(Primary roadways with multi-roadway boulevard configurations)





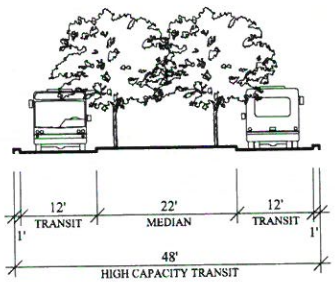
TRANSIT BOULEVARD
MEDIAN (BETWEEN STATIONS)



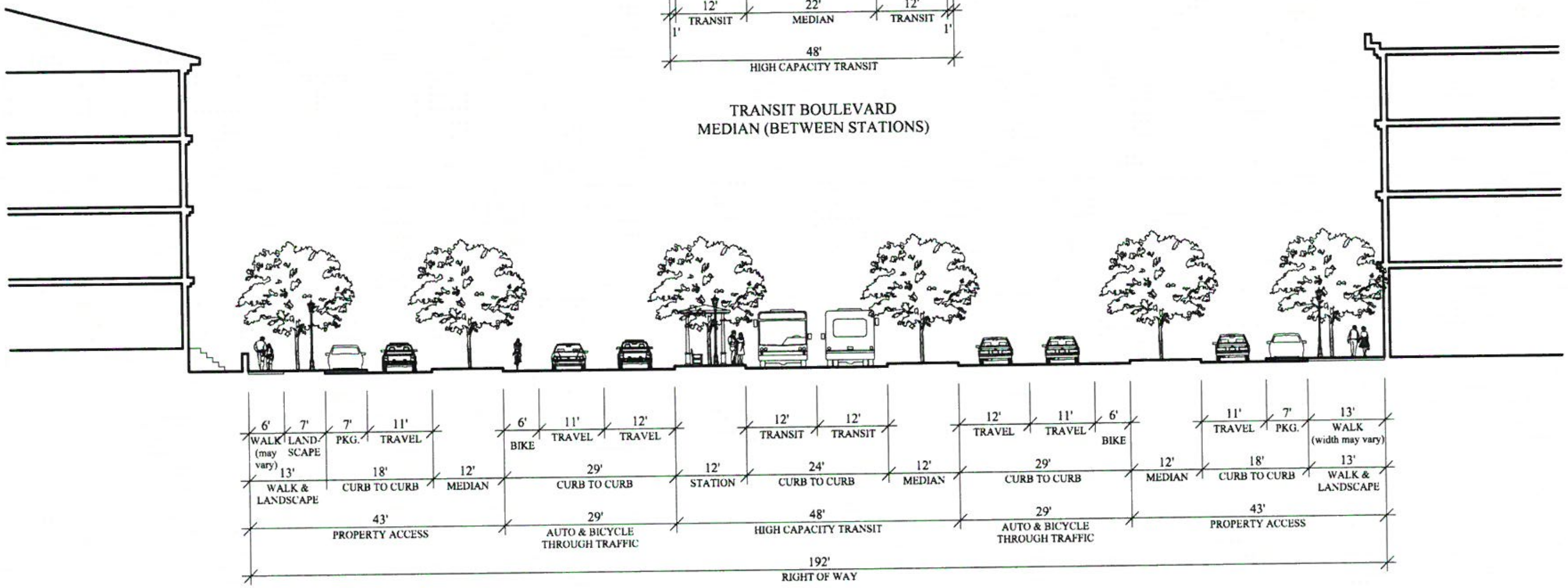
1A-2 TRANSIT BOULEVARD CONFIGURATION A
Two Through Lanes per Direction

Boulevards 1

(Primary roadways with multi-roadway boulevard configurations)



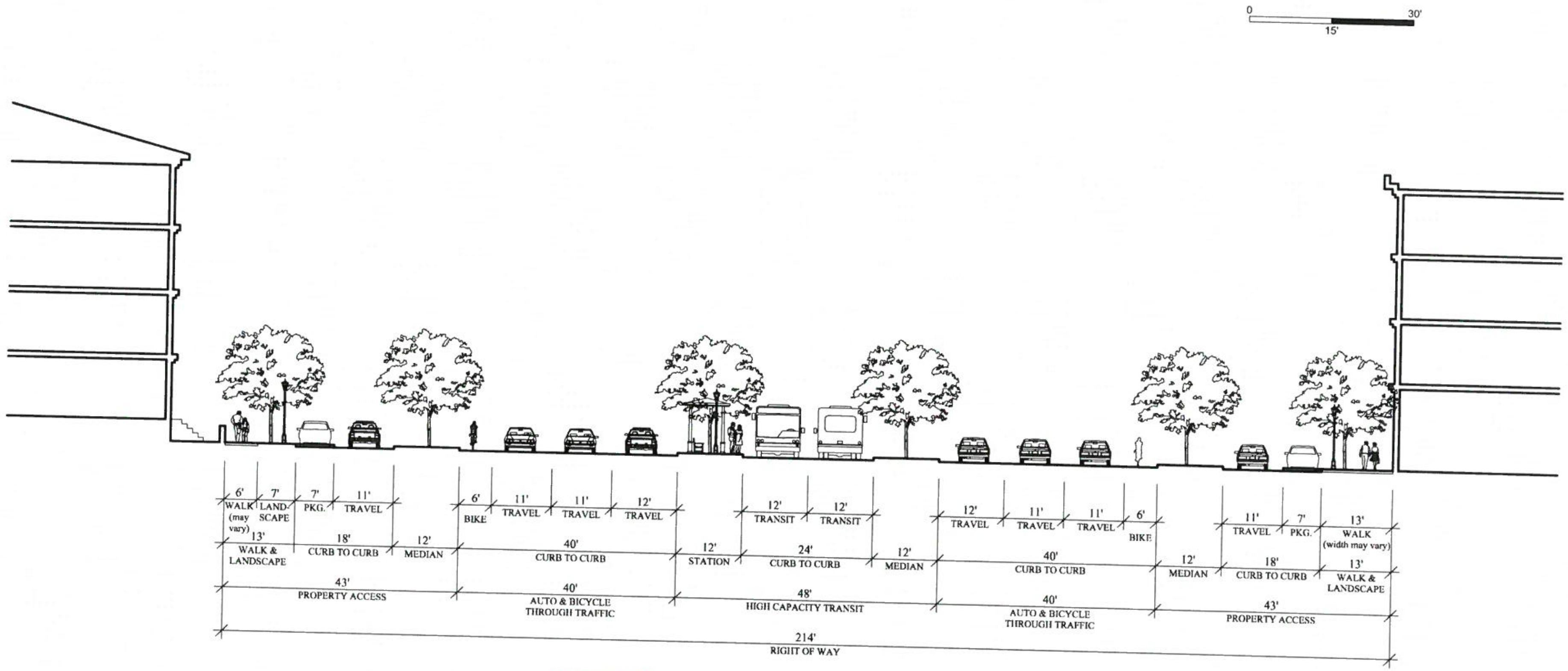
TRANSIT BOULEVARD
MEDIAN (BETWEEN STATIONS)



1B-2 TRANSIT BOULEVARD CONFIGURATION B
Two Through Lanes per Direction

Boulevards 1

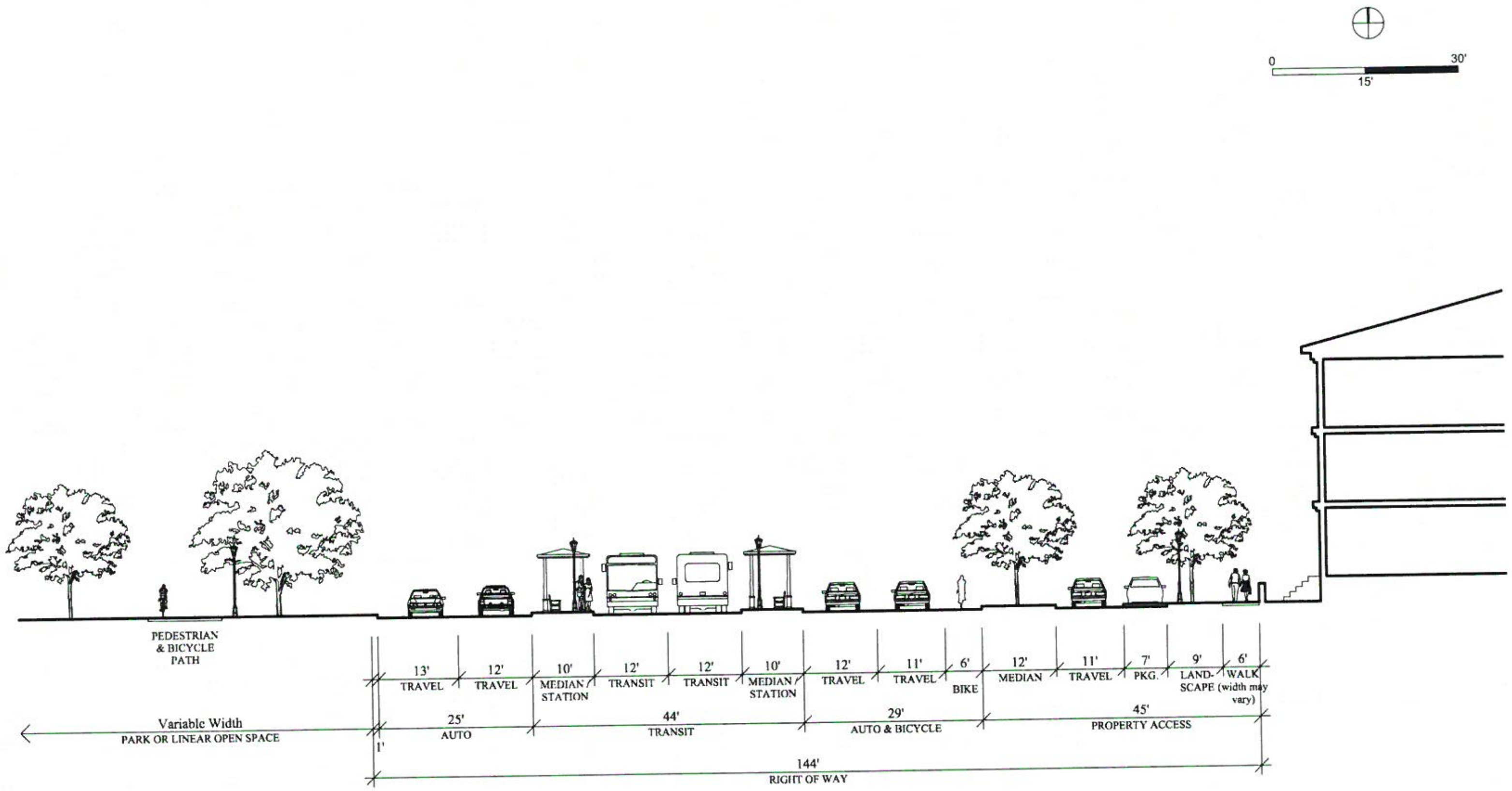
(Primary roadways with multi-roadway boulevard configurations)



1B-3 TRANSIT BOULEVARD CONFIGURATION B
Three Through Lanes per Direction

Boulevards 1

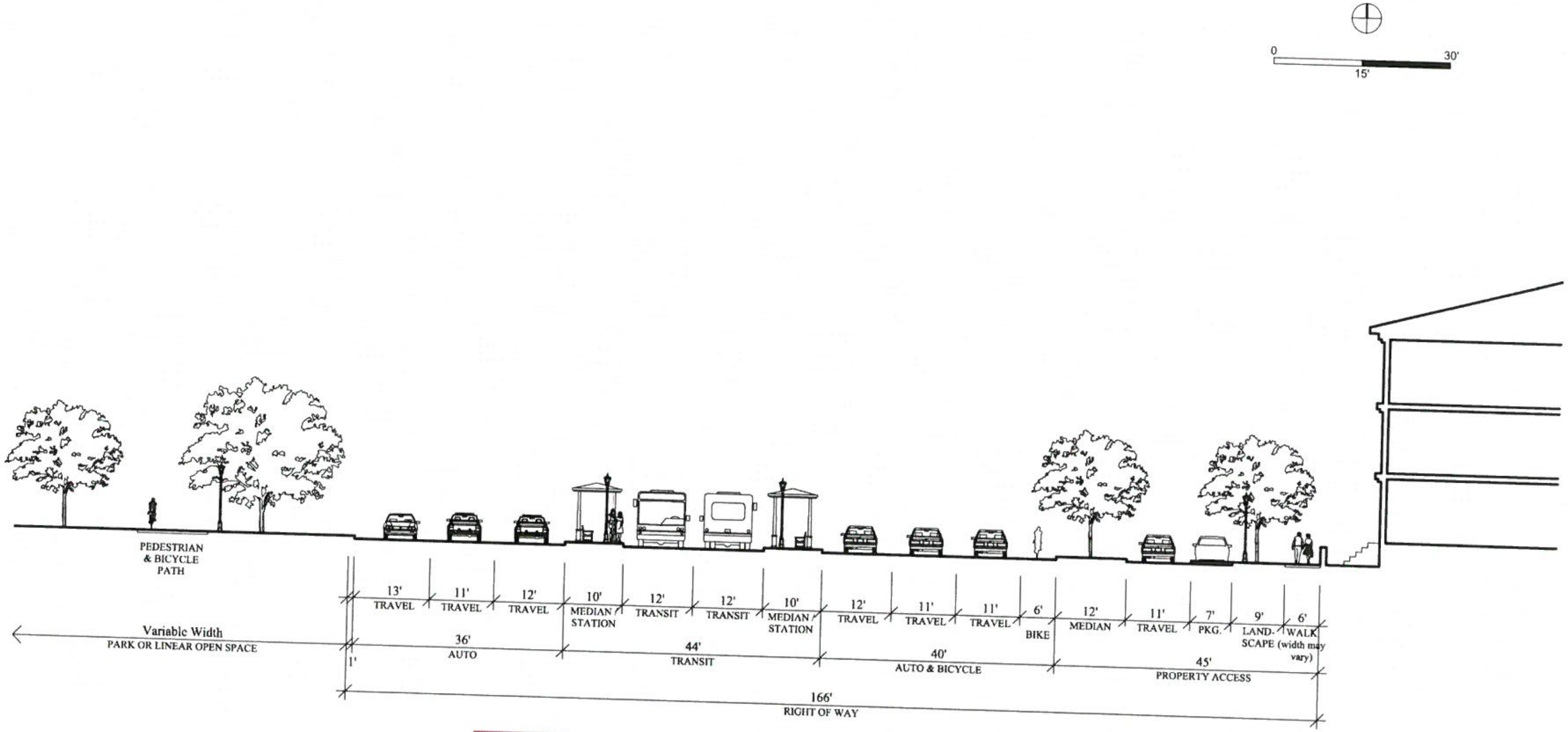
(Primary roadways with multi-roadway boulevard configurations)



1C-2 PARKSIDE BOULEVARD
Two Through Lanes per Direction

Boulevards 1

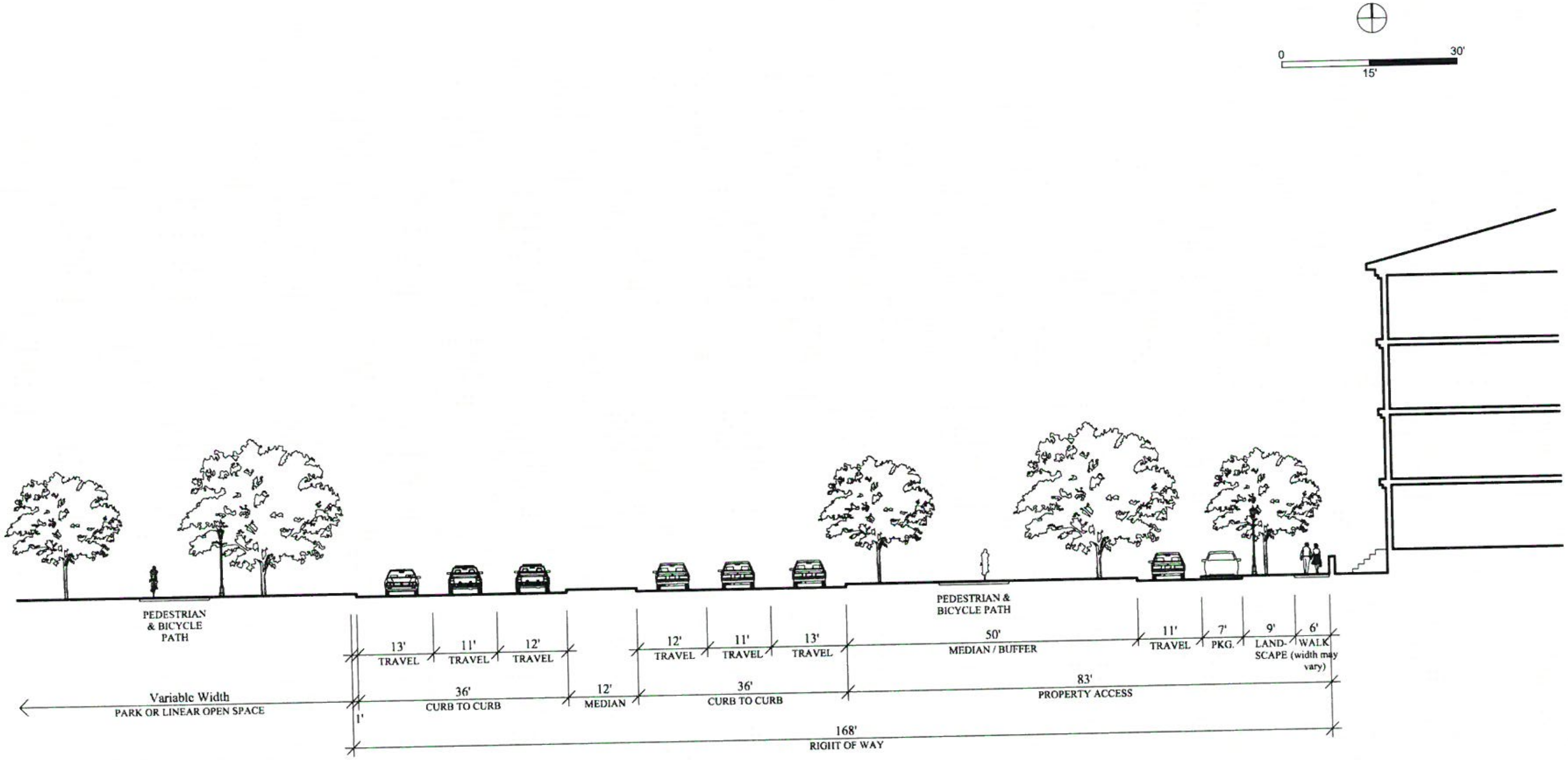
(Primary roadways with multi-roadway boulevard configurations)



1C-3 PARKSIDE BOULEVARD
Three Through Lanes per Direction

Boulevards 1

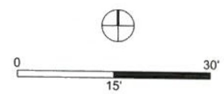
(Primary roadways with multi-roadway boulevard configurations)

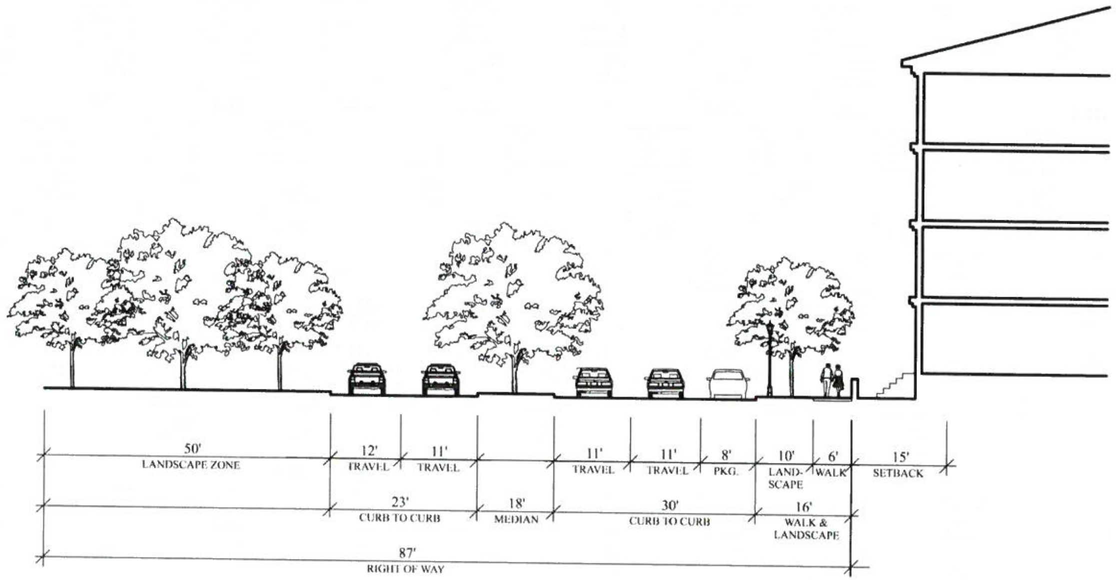


1D-3 PARKSIDE BOULEVARD WITHOUT TRANSITWAY
Three Through Lanes per Direction

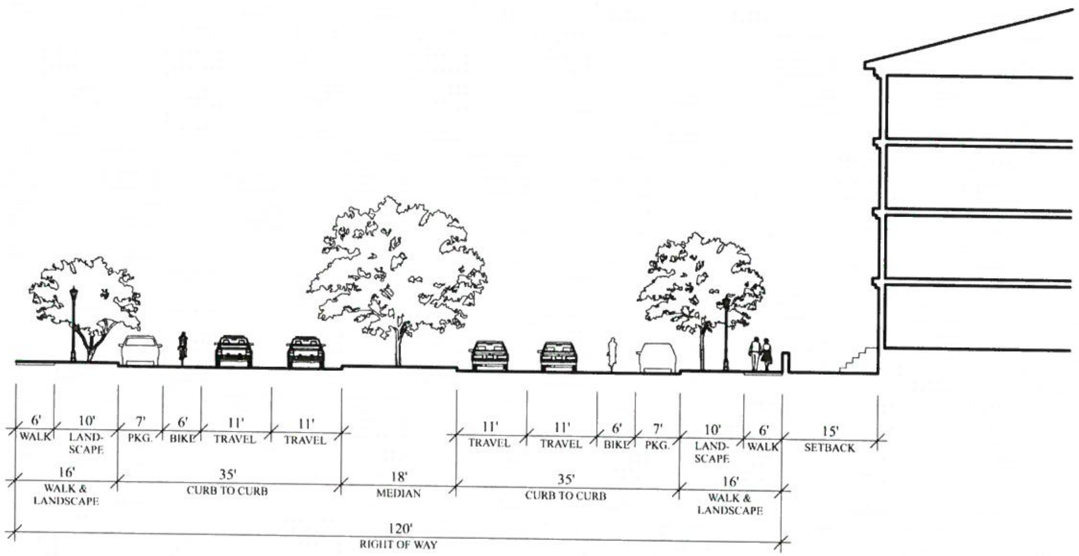
Avenues 1

(Primary roadways without multi-roadway boulevard configurations)





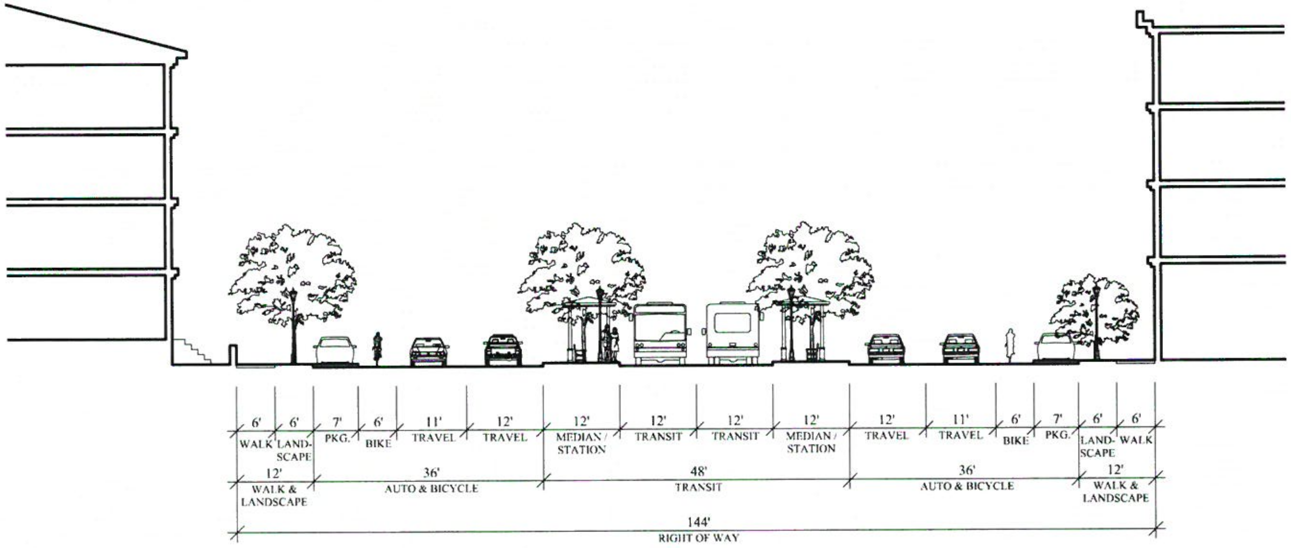
"AVENUE A" (EMPLOYMENT CENTER)
Two Through Lanes per Direction



"AVENUE B" (EMPLOYMENT CENTER)
Two Through Lanes per Direction

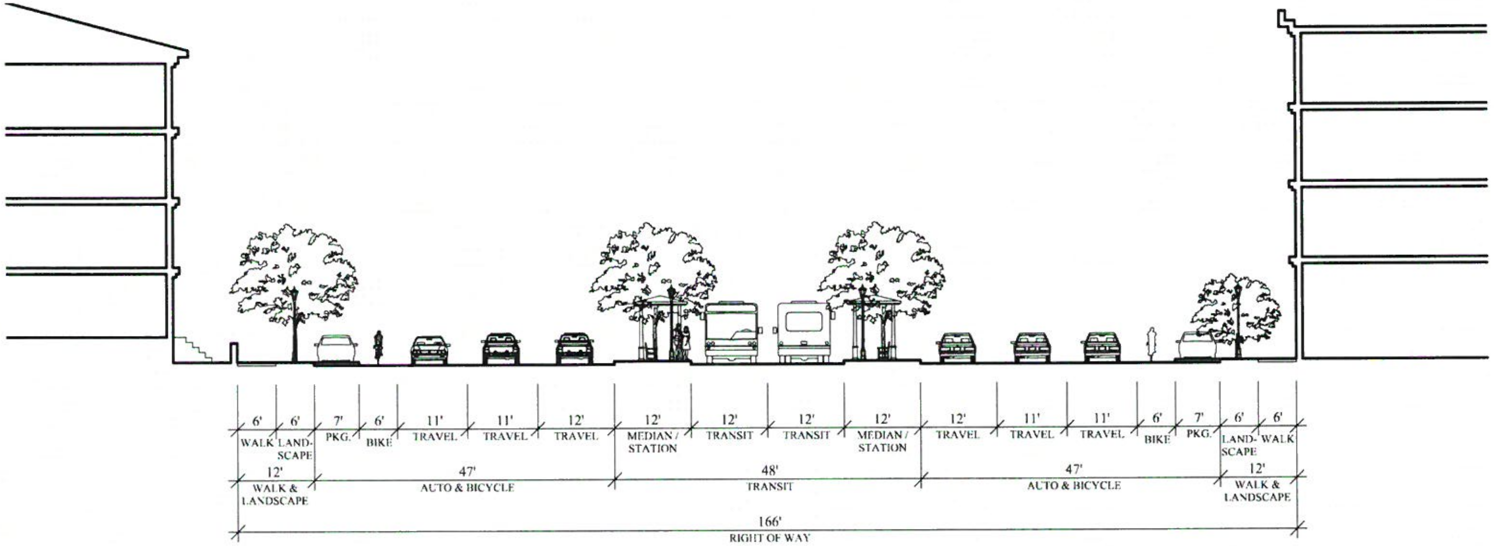
Avenues 1

(Primary roadways without multi-roadway boulevard configurations)



1E-2

AVENUE
WITH TRANSITWAY
Two Through Lanes per Direction

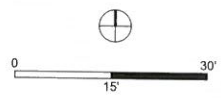


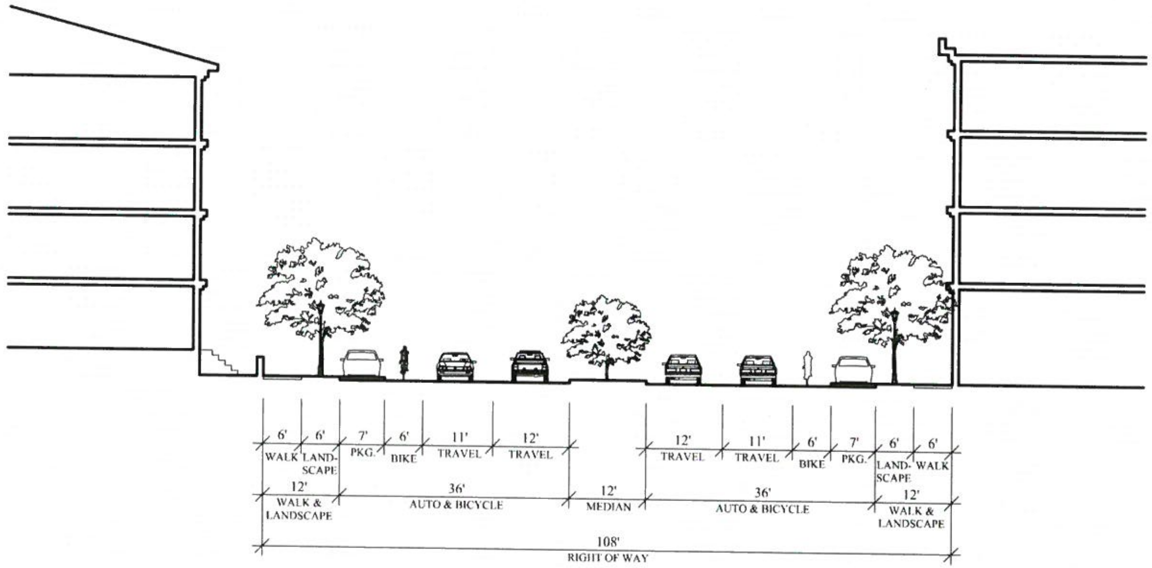
1E-3

AVENUE
WITH TRANSITWAY
Three Through Lanes per Direction

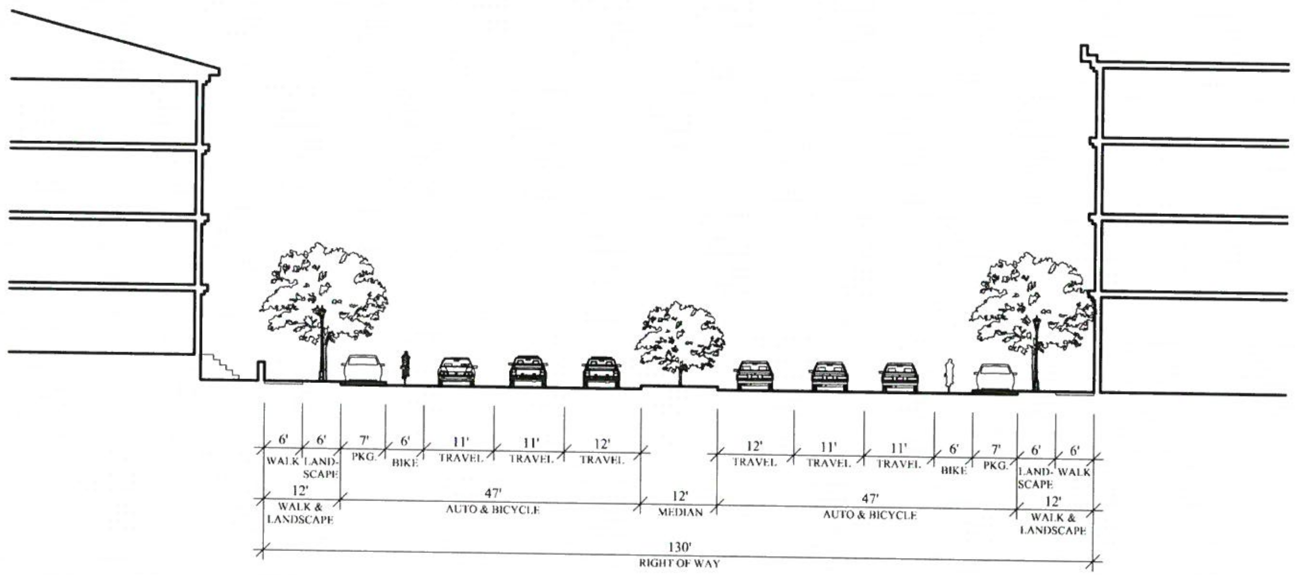
Avenues 1

(Primary roadways without multi-roadway boulevard configurations)





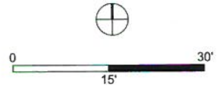
1F-2 AVENUE
WITHOUT TRANSITWAY
Two Through Lanes per Direction

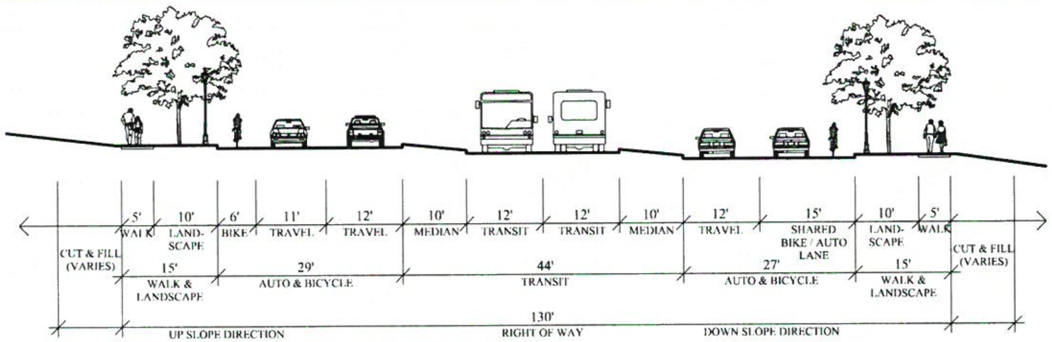


1F-3 AVENUE
WITHOUT TRANSITWAY
Three Through Lanes per Direction

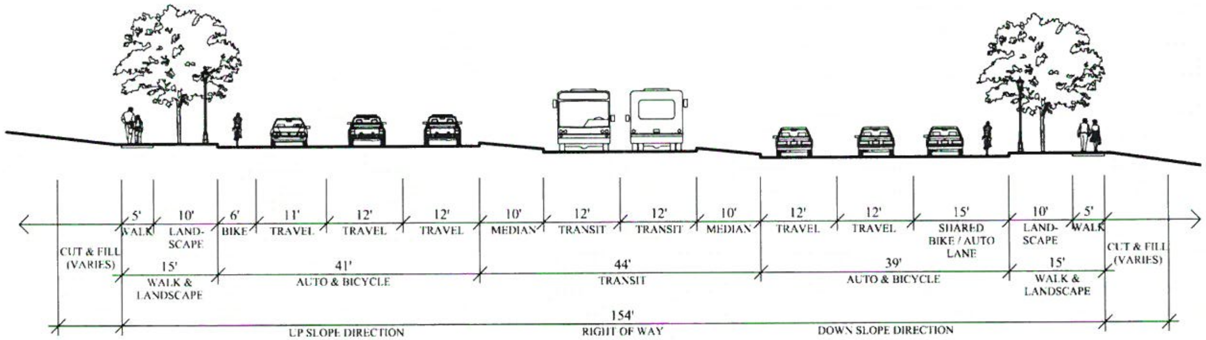
Avenues 1

(Primary roadways without multi-roadway boulevard configurations)

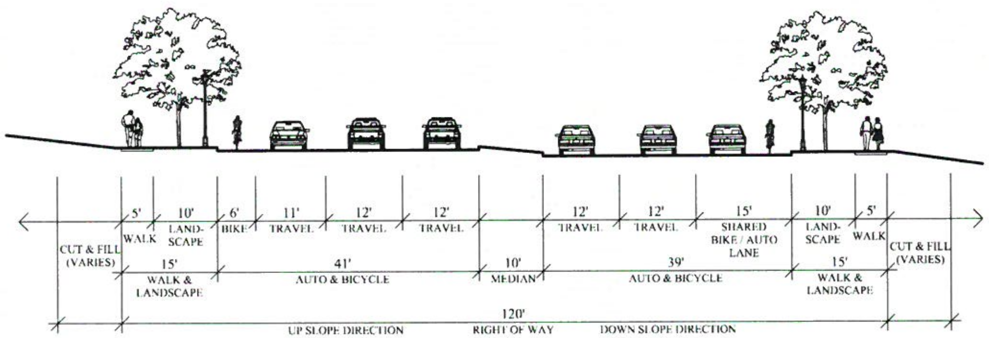




1G-2 AVENUE ON SLOPE
Two Through Lanes per Direction



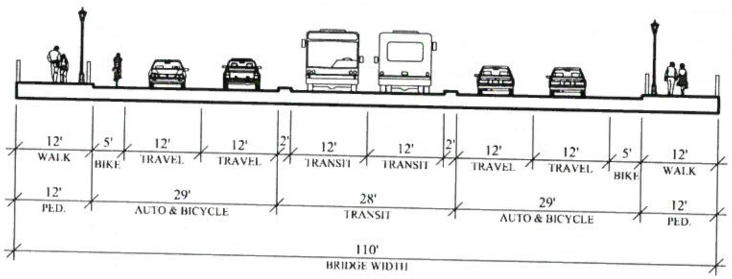
1G-3 AVENUE ON SLOPE
Three Through Lanes per Direction



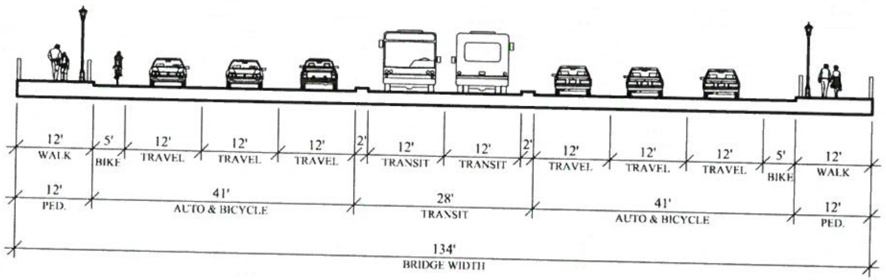
1H-3 AVENUE ON SLOPE WITHOUT TRANSITWAY
Three Through Lanes per Direction

Avenues 1

(Primary roadways without multi-roadway boulevard configurations)



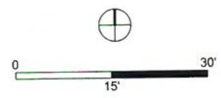
1I-2 AVENUE
INTERSTATE BRIDGE
Two Through Lanes per Direction

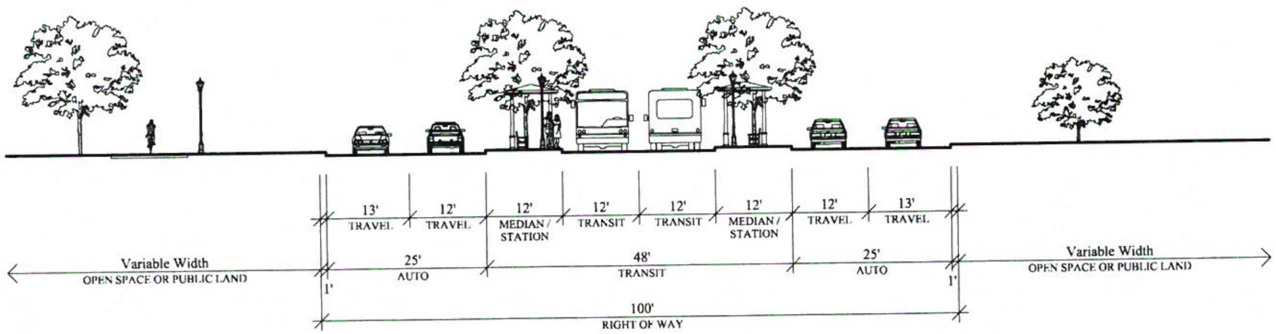


1I-3 AVENUE
INTERSTATE BRIDGE
Three Through Lanes per Direction

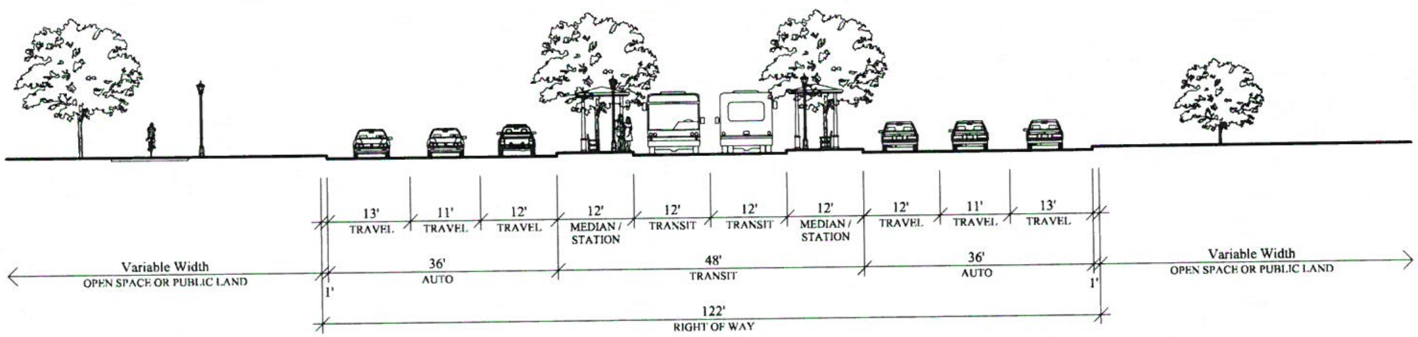
Avenues 1

(Primary roadways without multi-roadway boulevard configurations)





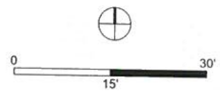
1J-2 AVENUE
OPEN SPACE OR PUBLIC LAND FRONTAGE
Two Through Lanes per Direction

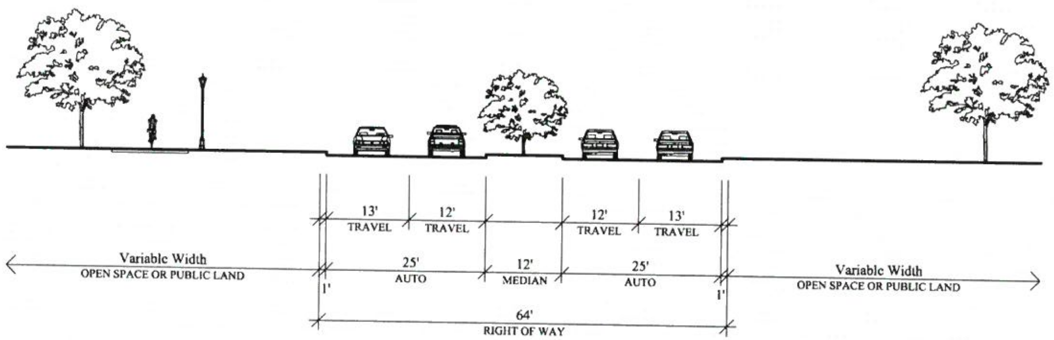


1J-3 AVENUE
OPEN SPACE OR PUBLIC LAND FRONTAGE
Three Through Lanes per Direction

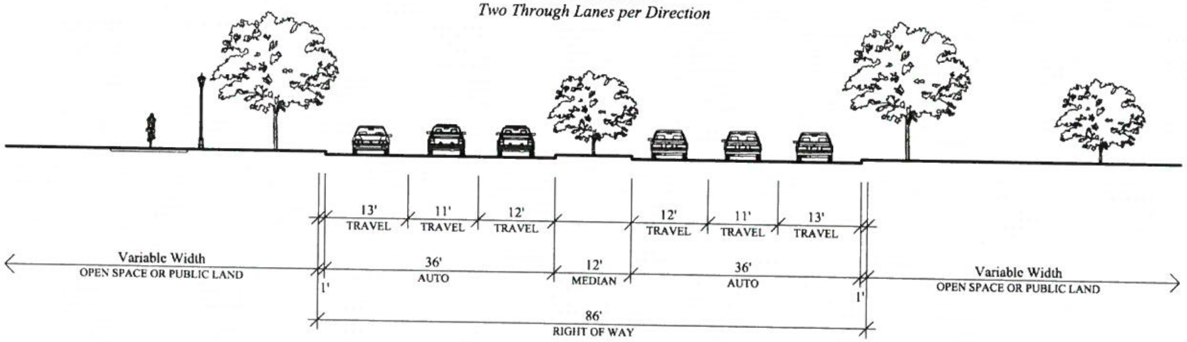
Avenues 1

(Primary roadways without multi-roadway boulevard configurations)





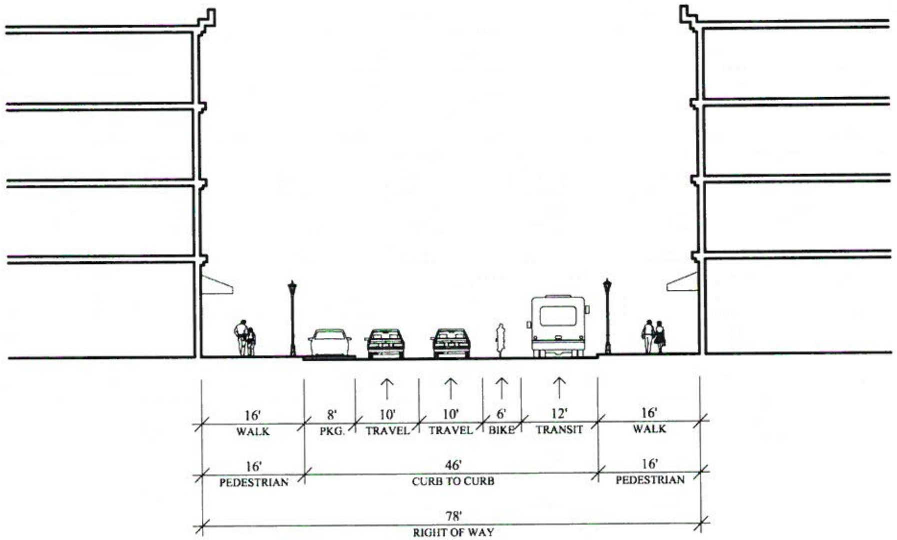
1K-2 AVENUE
OPEN SPACE OR PUBLIC LAND FRONTAGE
NO TRANSITWAY
Two Through Lanes per Direction



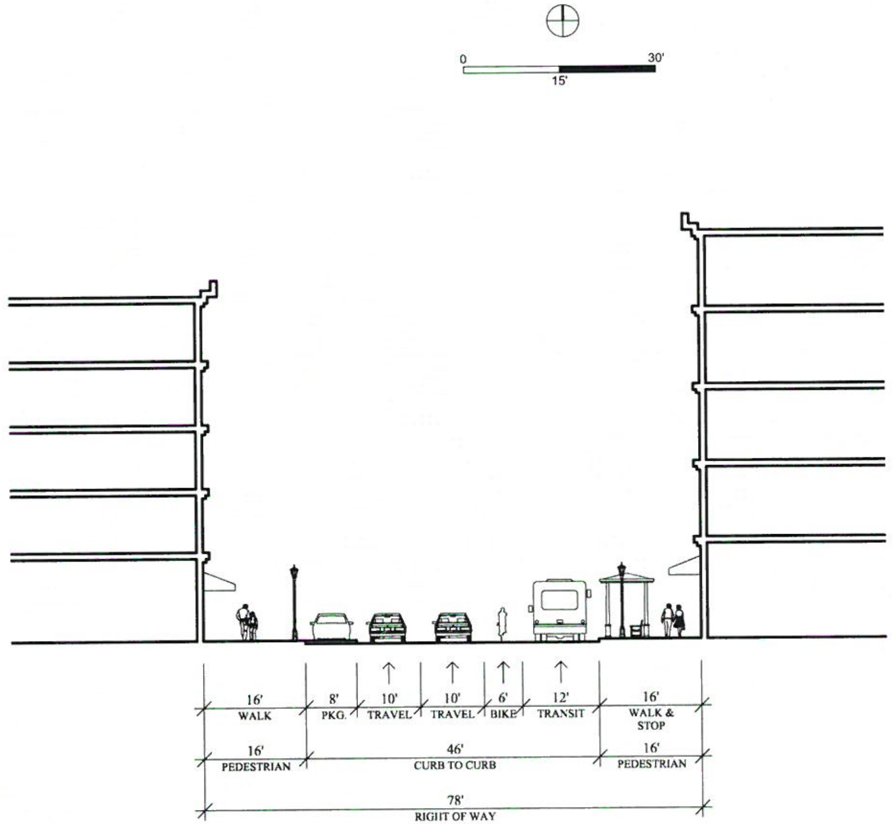
1K-3 AVENUE
OPEN SPACE OR PUBLIC LAND FRONTAGE
NO TRANSITWAY
Three Through Lanes per Direction

Avenues 1

(Primary roadways without multi-roadway boulevard configurations)



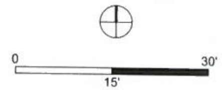
1L AVENUE COUPLET WITH TRANSITWAY

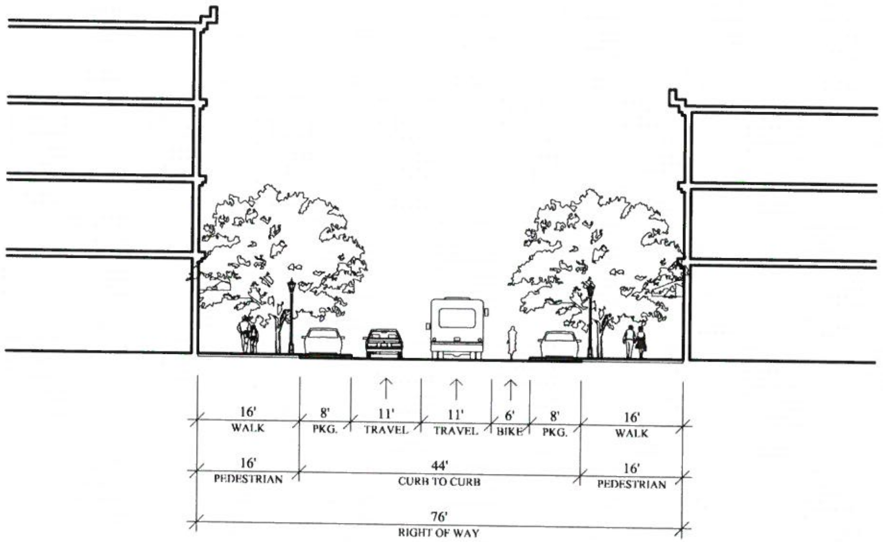


1L AVENUE COUPLET WITH TRANSITWAY AT STATION

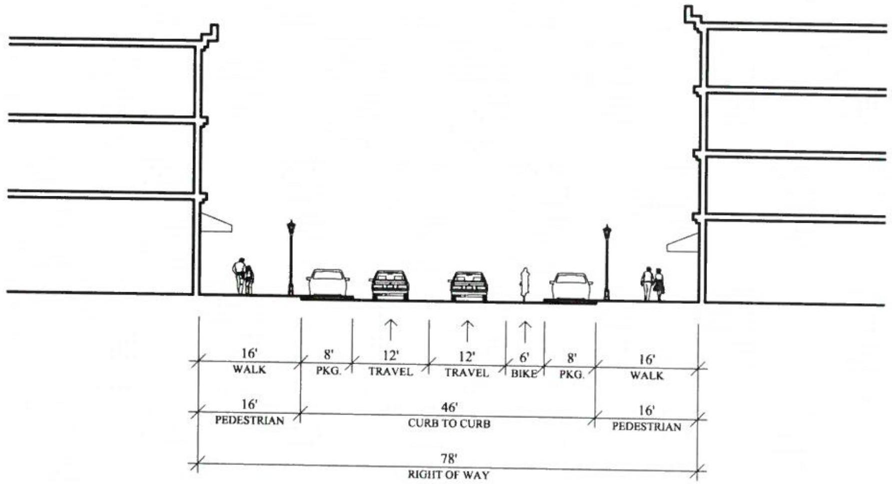
Avenues 1

(Primary roadways without multi-roadway boulevard configurations)



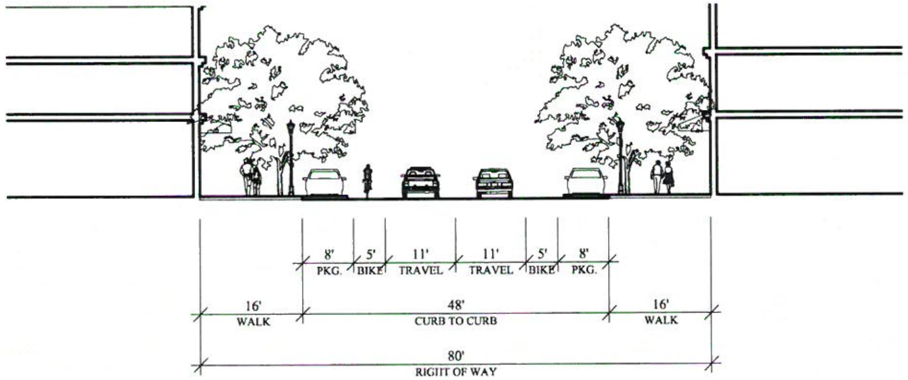


1M AVENUE COUPLET WITHOUT TRANSITWAY

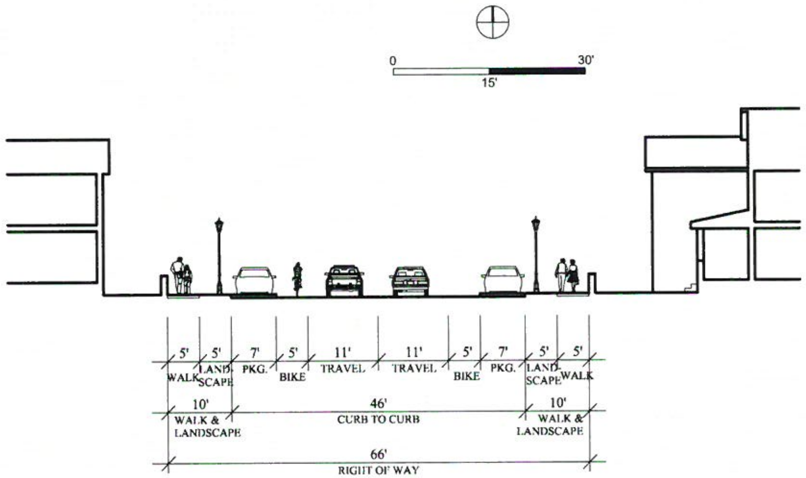


1L AVENUE COUPLET WITH TRANSITWAY *Interim Configuration*

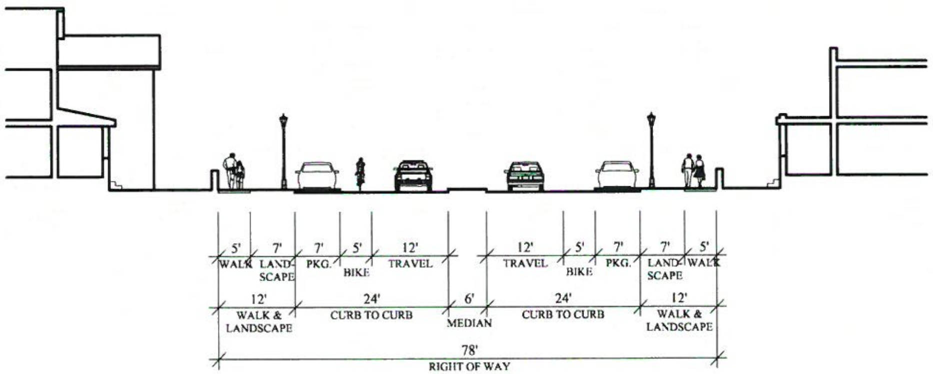
Connectors 2



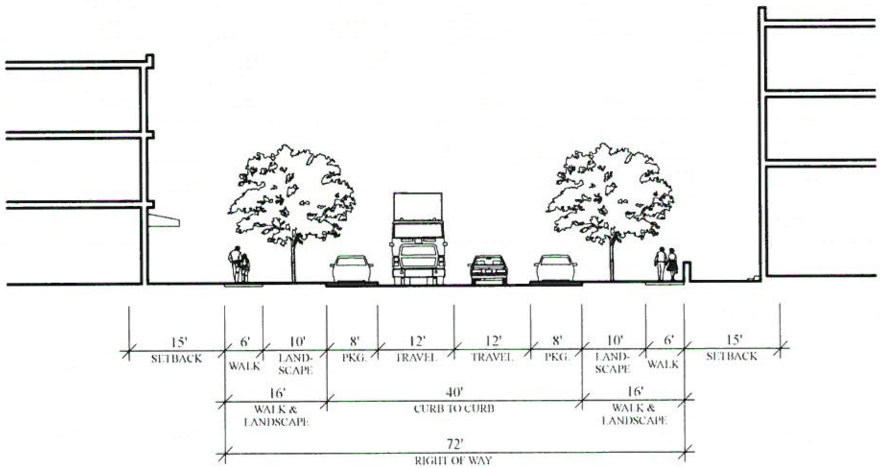
2A CONNECTOR MAIN STREET (COMMERCIAL)



2C CONNECTOR RESIDENTIAL

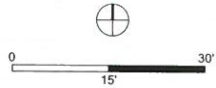


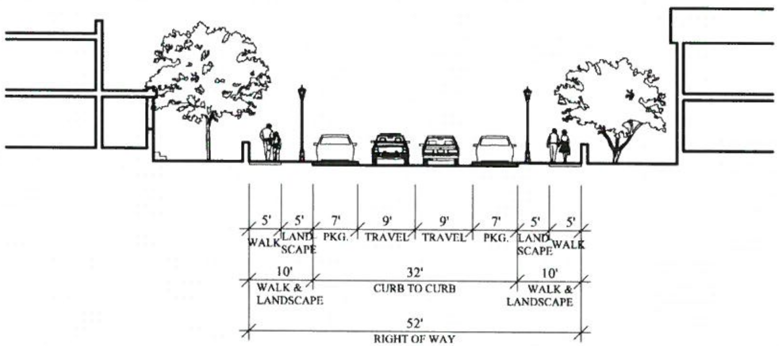
2B CONNECTOR RESIDENTIAL WITH MEDIAN



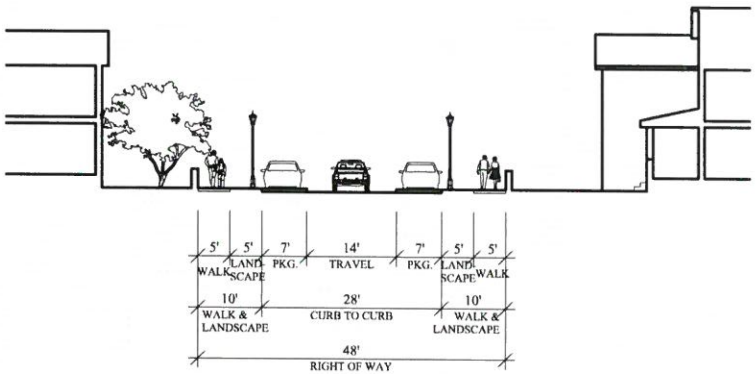
2D CONNECTOR INDUSTRIAL

Locals 3

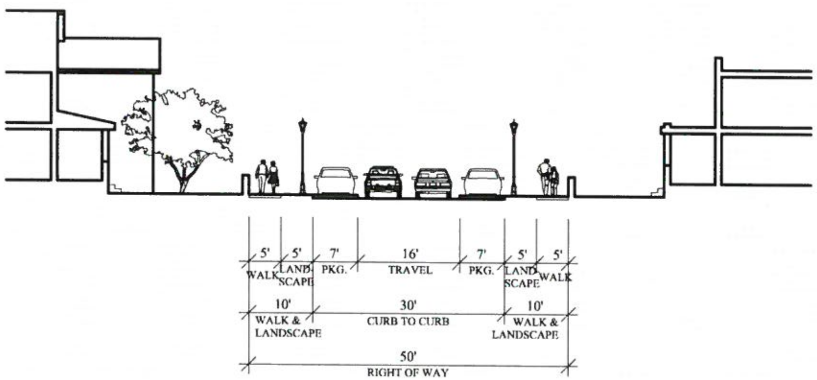




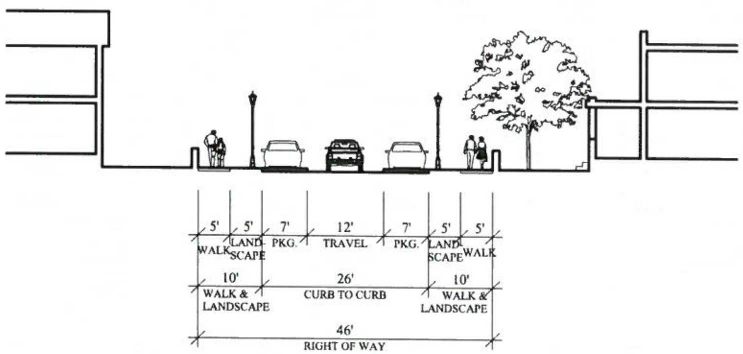
3A LOCAL A



3C LOCAL C Queueing

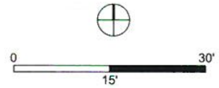


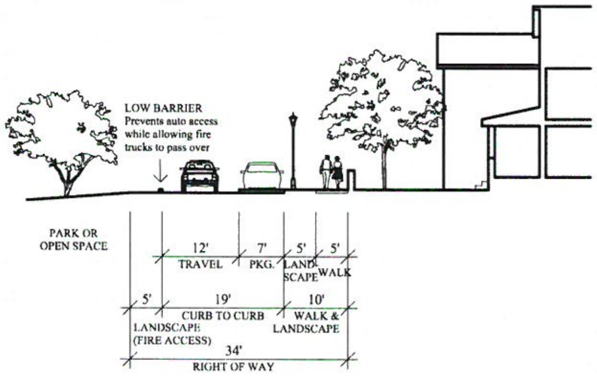
3B LOCAL B Queueing



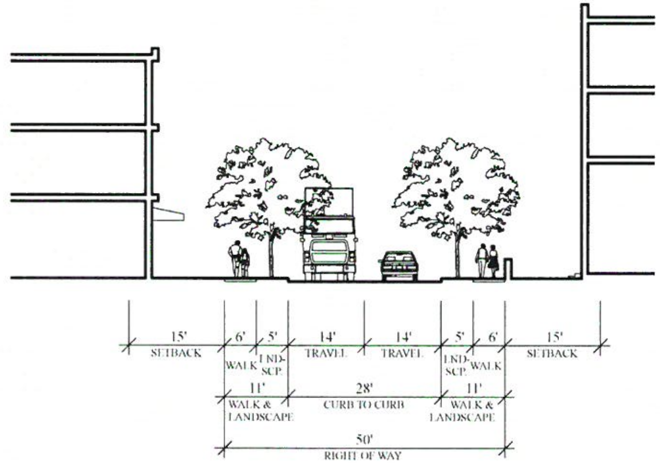
3D LOCAL D One Way

Locals 3

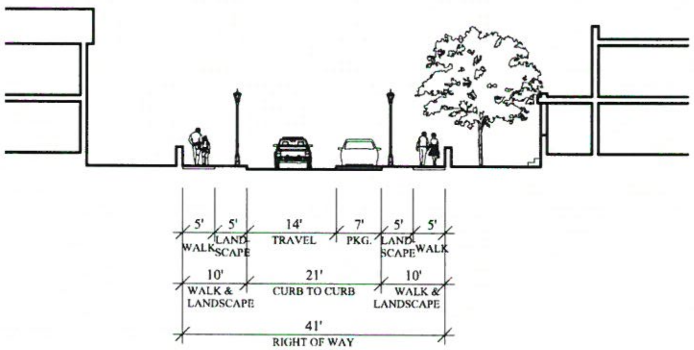




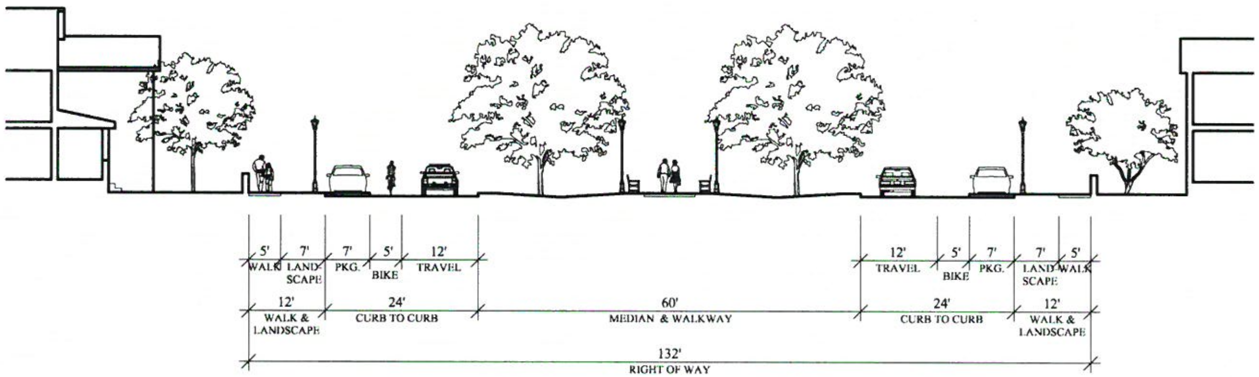
3E LOCAL E
One Way by Open Space or Park



3G LOCAL G - Industrial / R&D

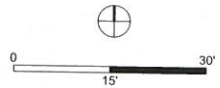


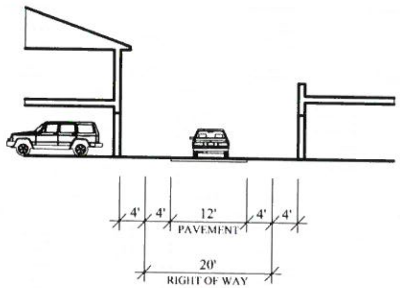
3F LOCAL F
Queueing, Restricted Parking



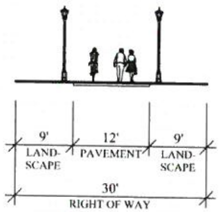
3H LOCAL H - Alameda
Median widens to 90' or narrows to 28' at Signalized Intersections for Staking & Clearing

Other 4





4A ALLEY



4B PEDESTRIAN WAY

2025 SCENARIO

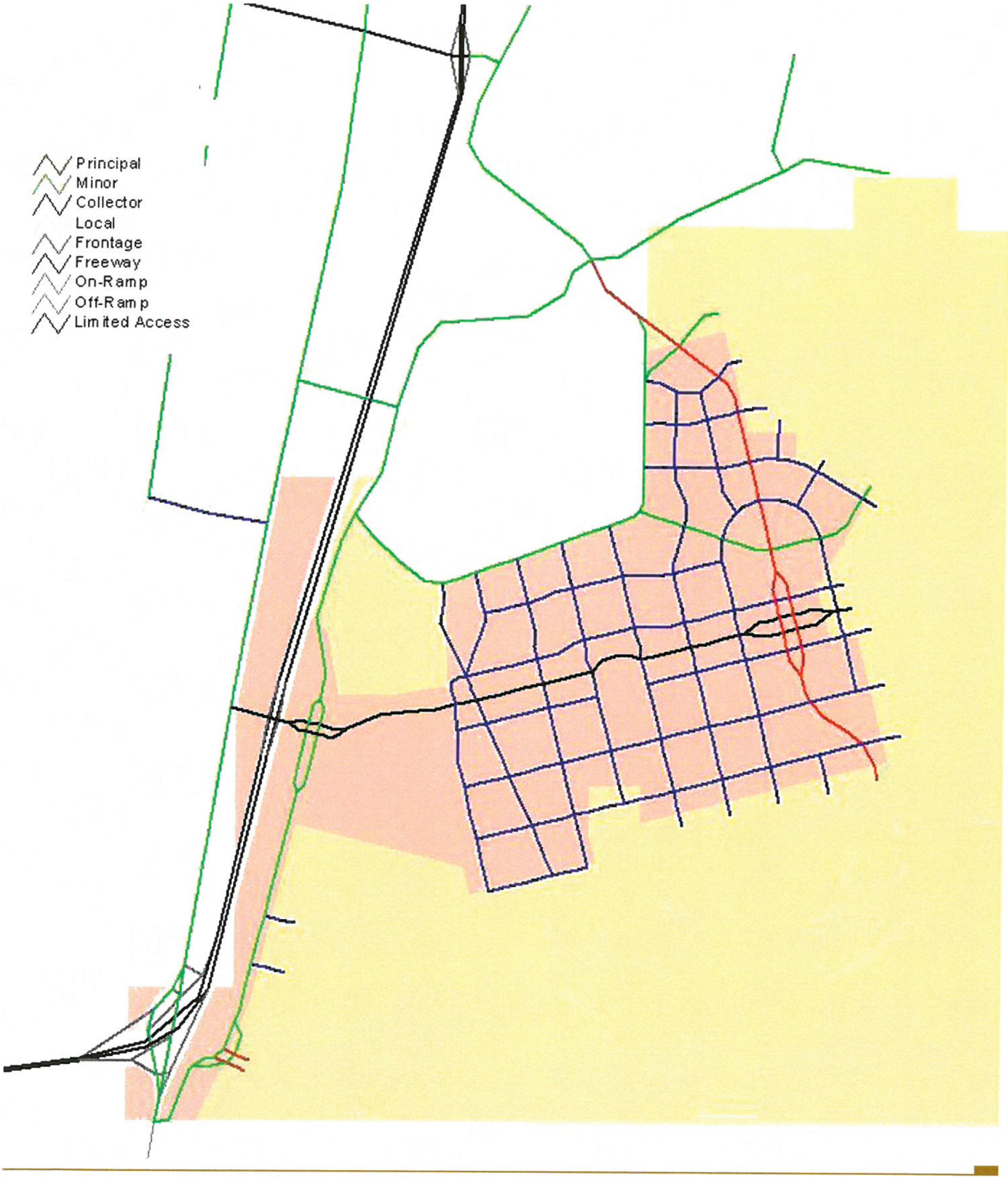
LEVEL A PLAN : JUNE 2005

F-2

MESA DEL SOL

2025 SCENARIO FUNCTIONAL CLASS

Figure F-2-1

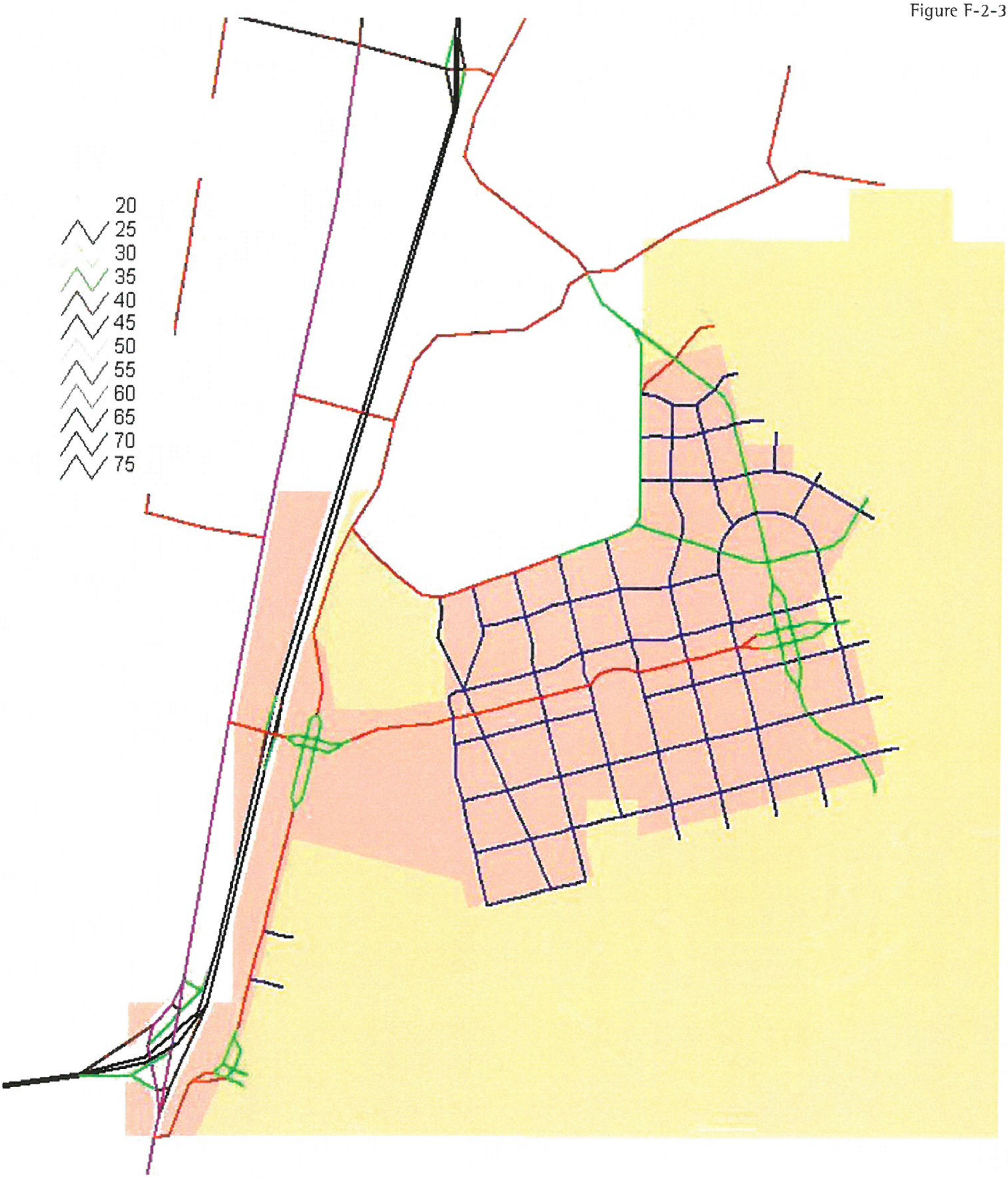


2025 SCENARIO
DIRECTIONAL LANES

Figure F-2-2

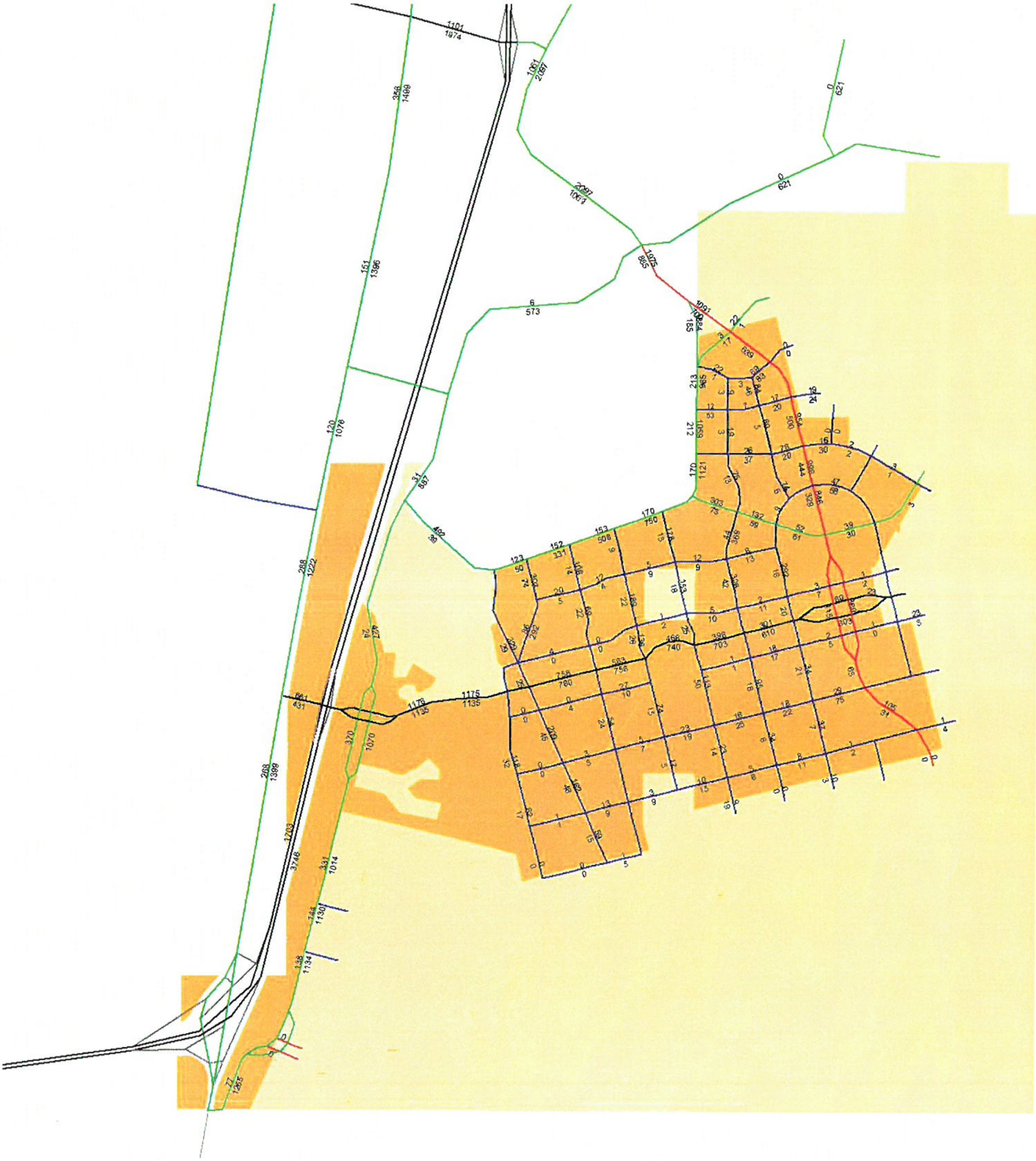
2025 SCENARIO SPEEDS

Figure F-2-3



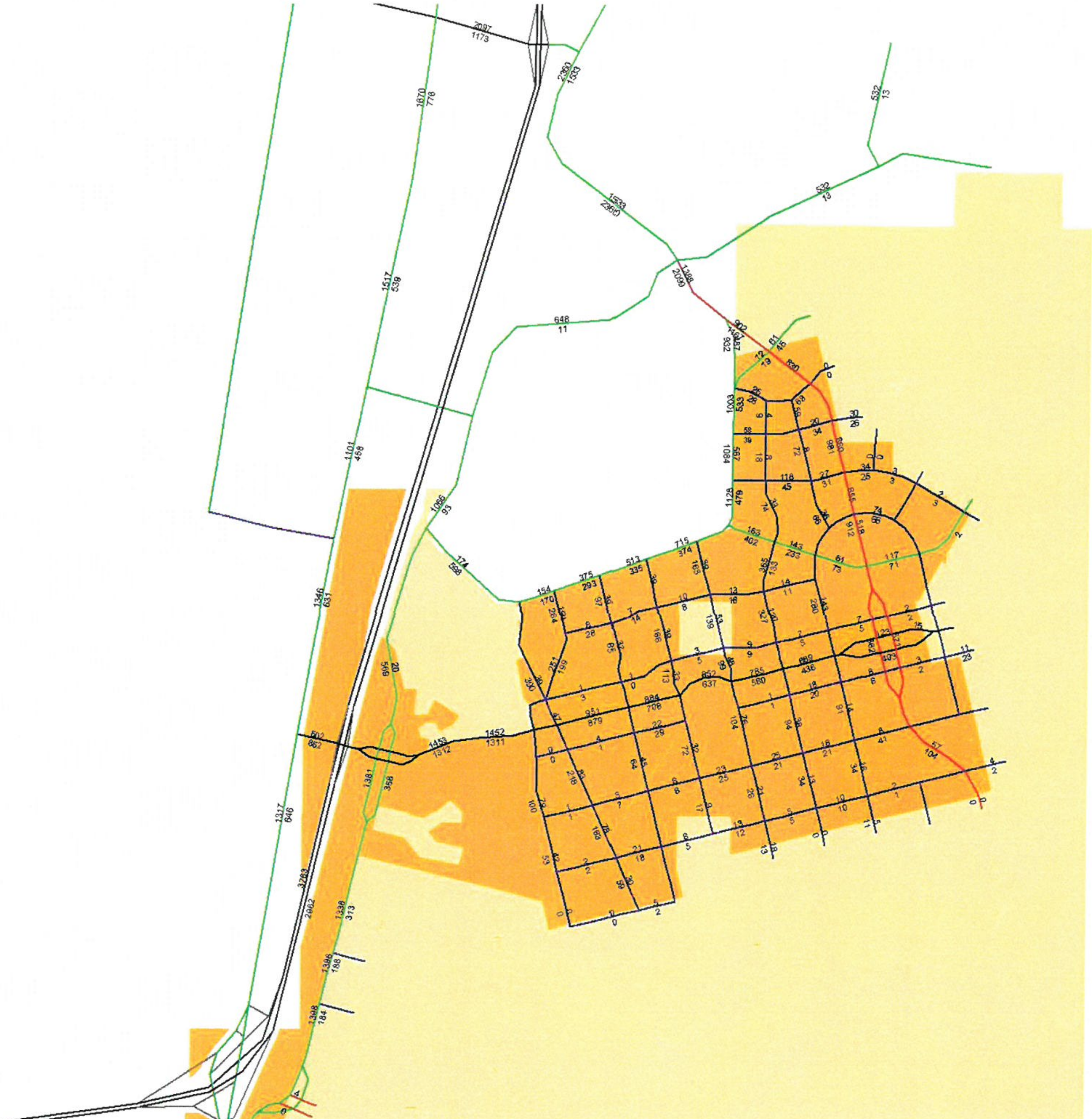
2025 SCENARIO
AM PEAK HOUR VOLUME

Figure F-2-4



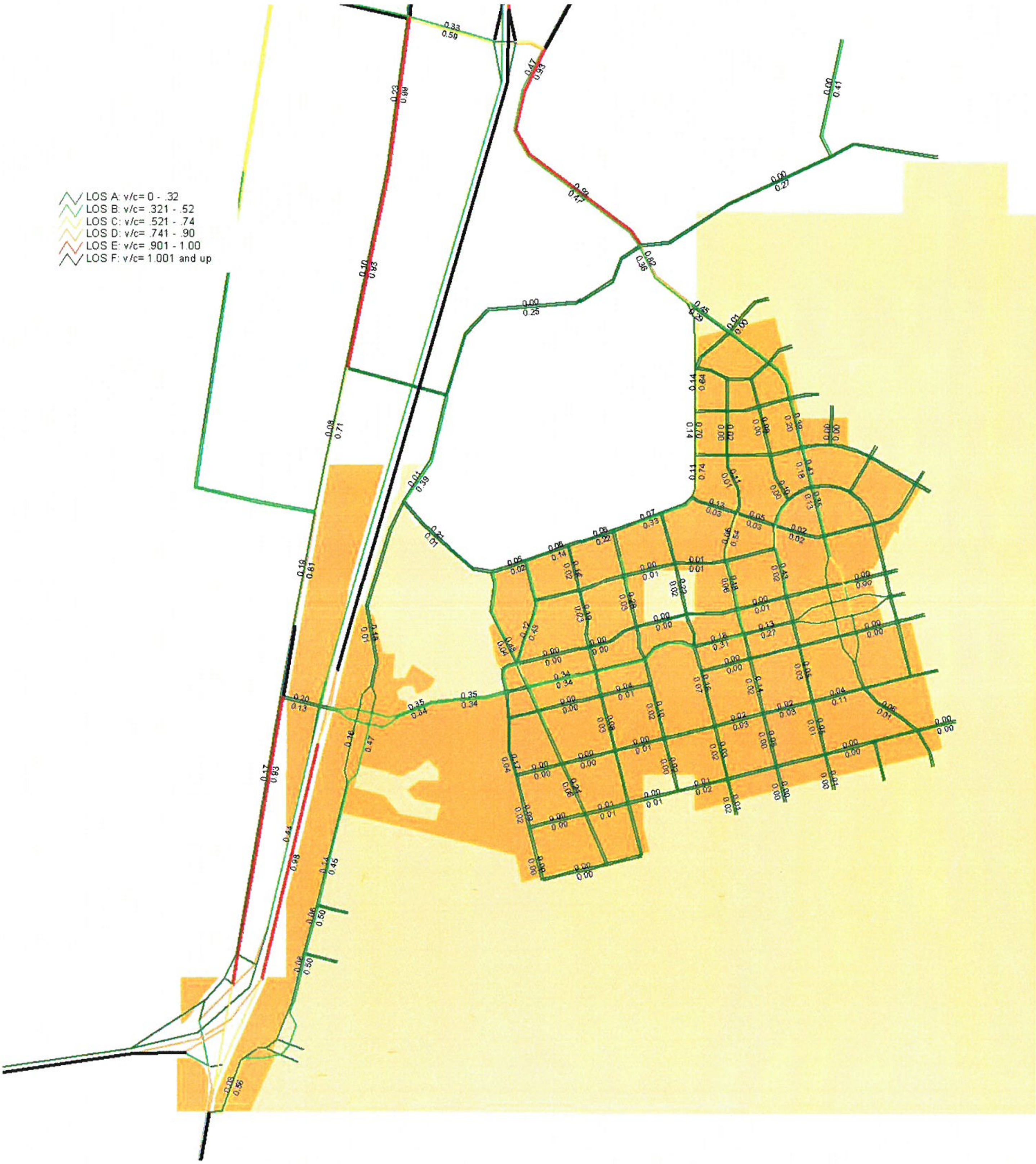
2025 SCENARIO
PM PEAK HOUR VOLUME

Figure F-2-5



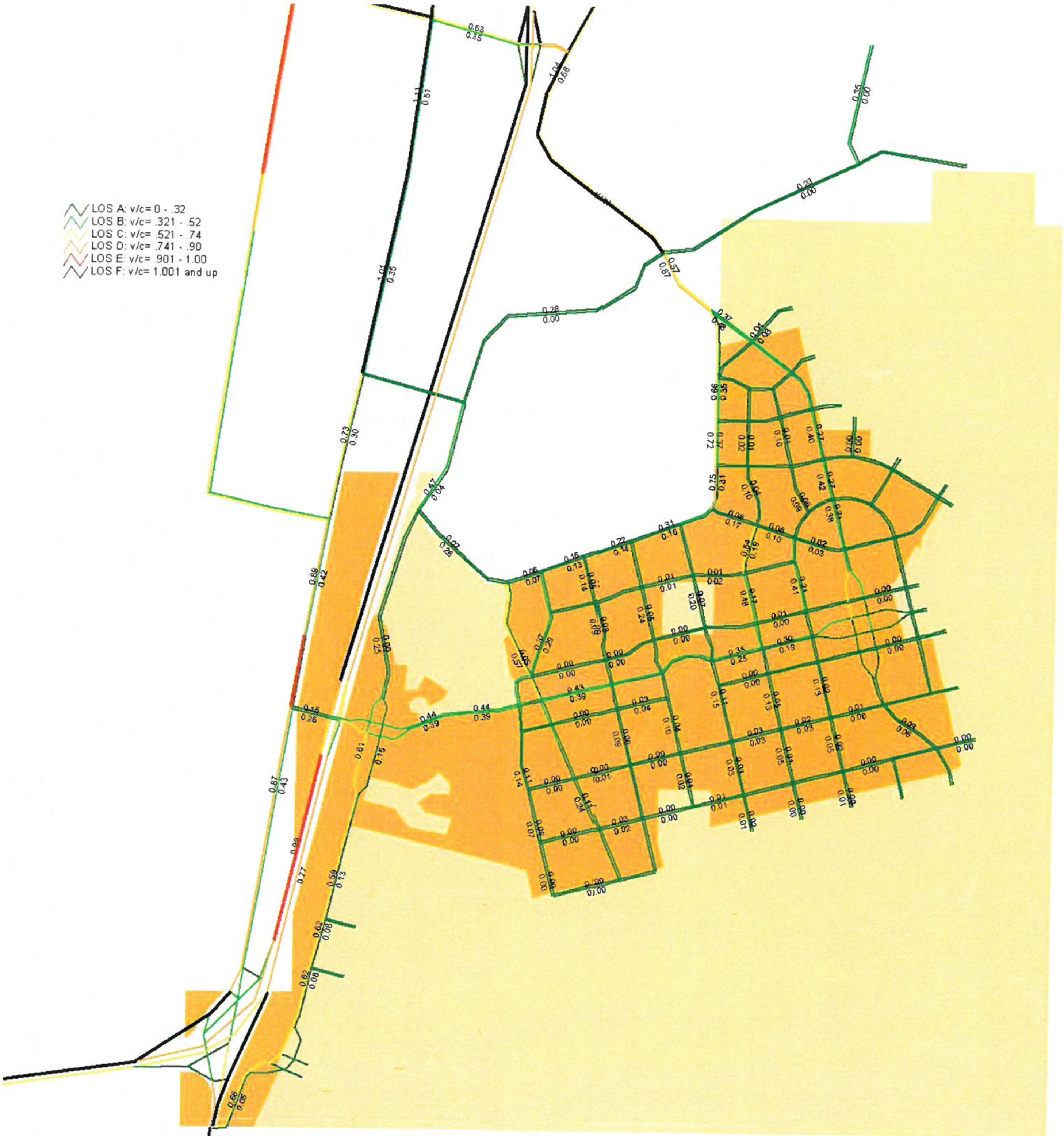
2025 SCENARIO
AM PEAK HOUR
LEVEL OF SERVICE

Figure F-2-6



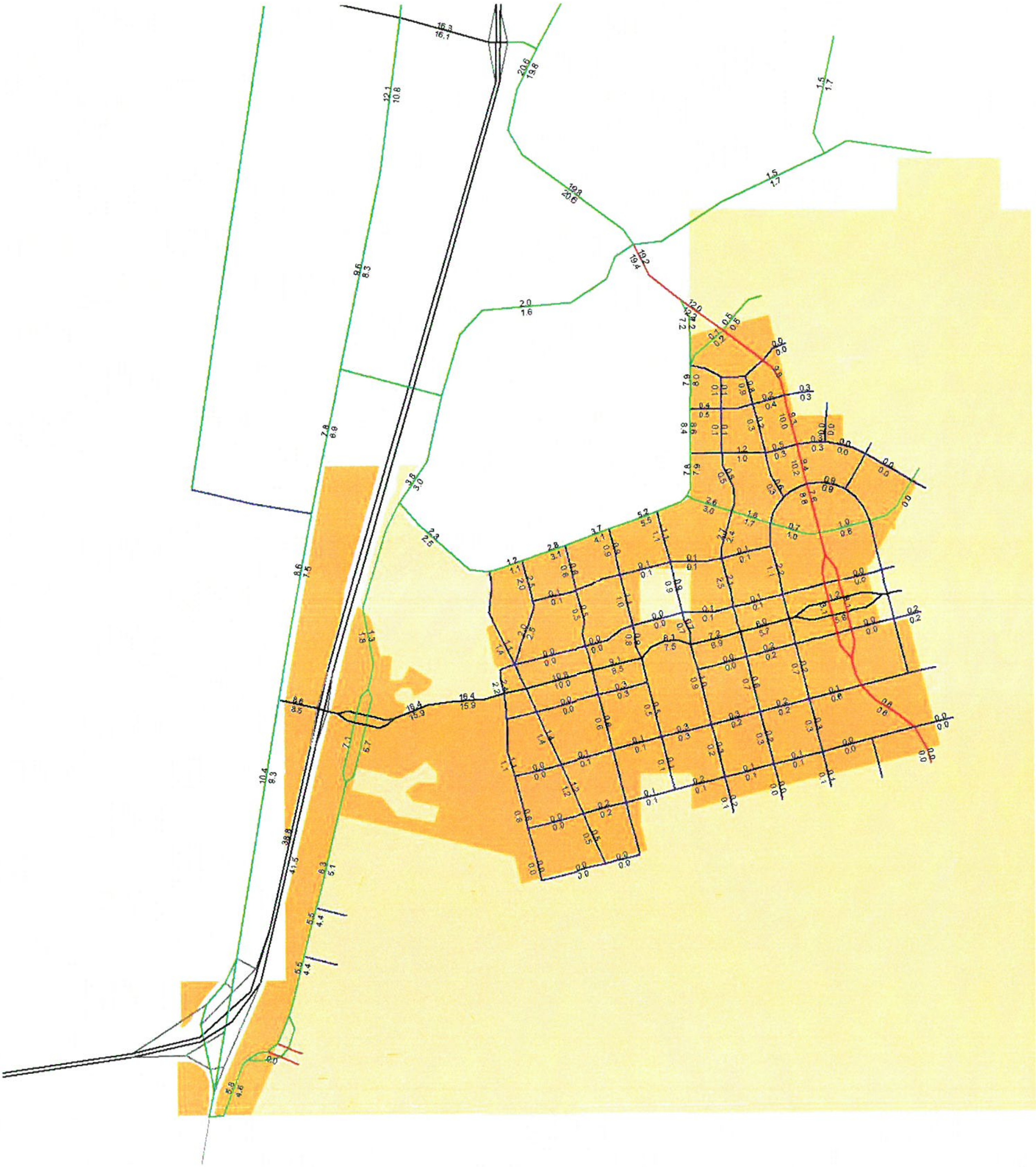
2025 SCENARIO PM PEAK HOUR LEVEL OF SERVICE

Figure F-2-7



2025 SCENARIO ADT

Figure F-2-8



BUILDOUT SCENARIO

LEVEL A PLAN : JUNE 2005

F-3

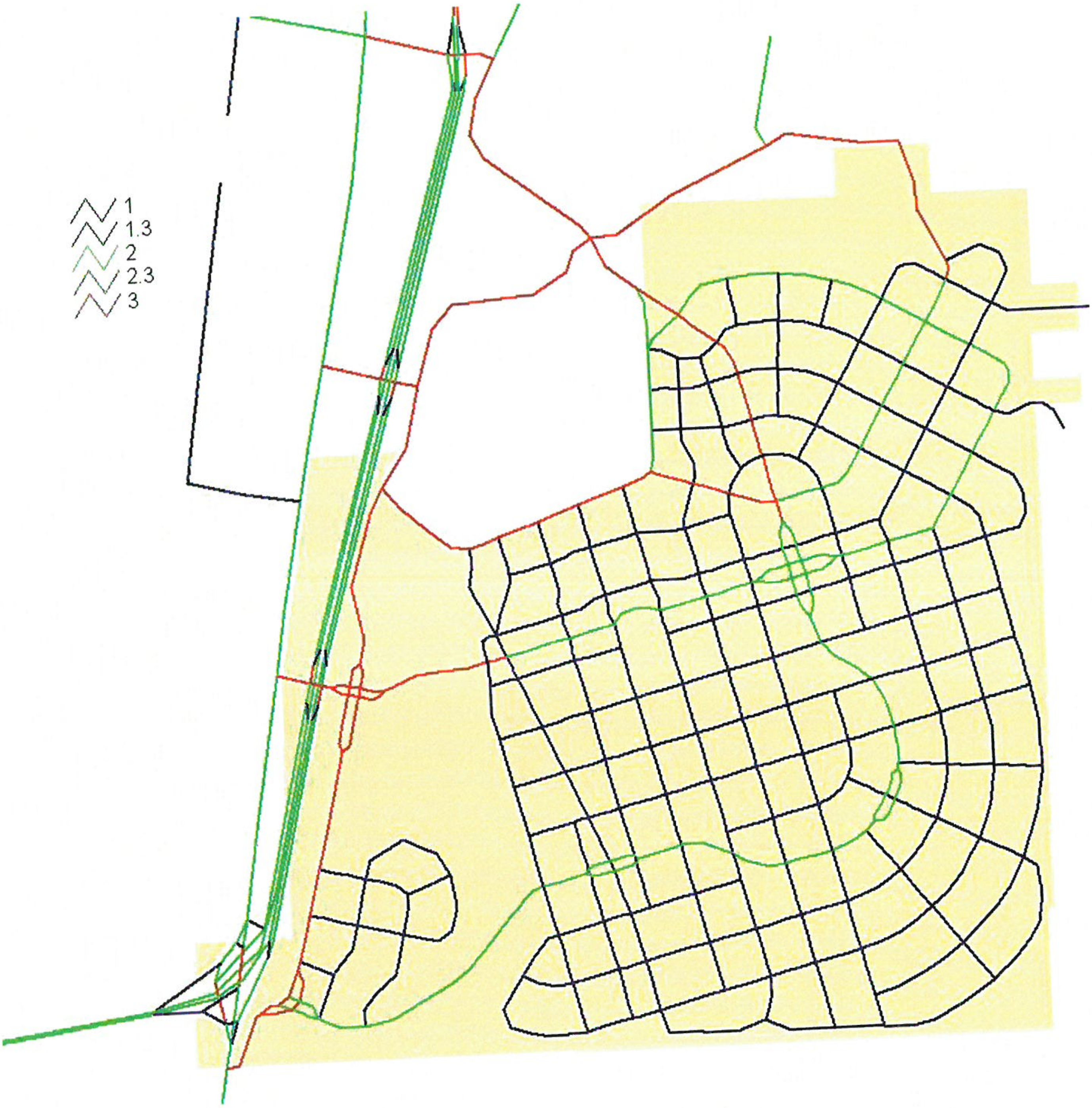
MESA DEL SOL

BUILDOUT SCENARIO FUNCTIONAL CLASS

Figure F-3-1

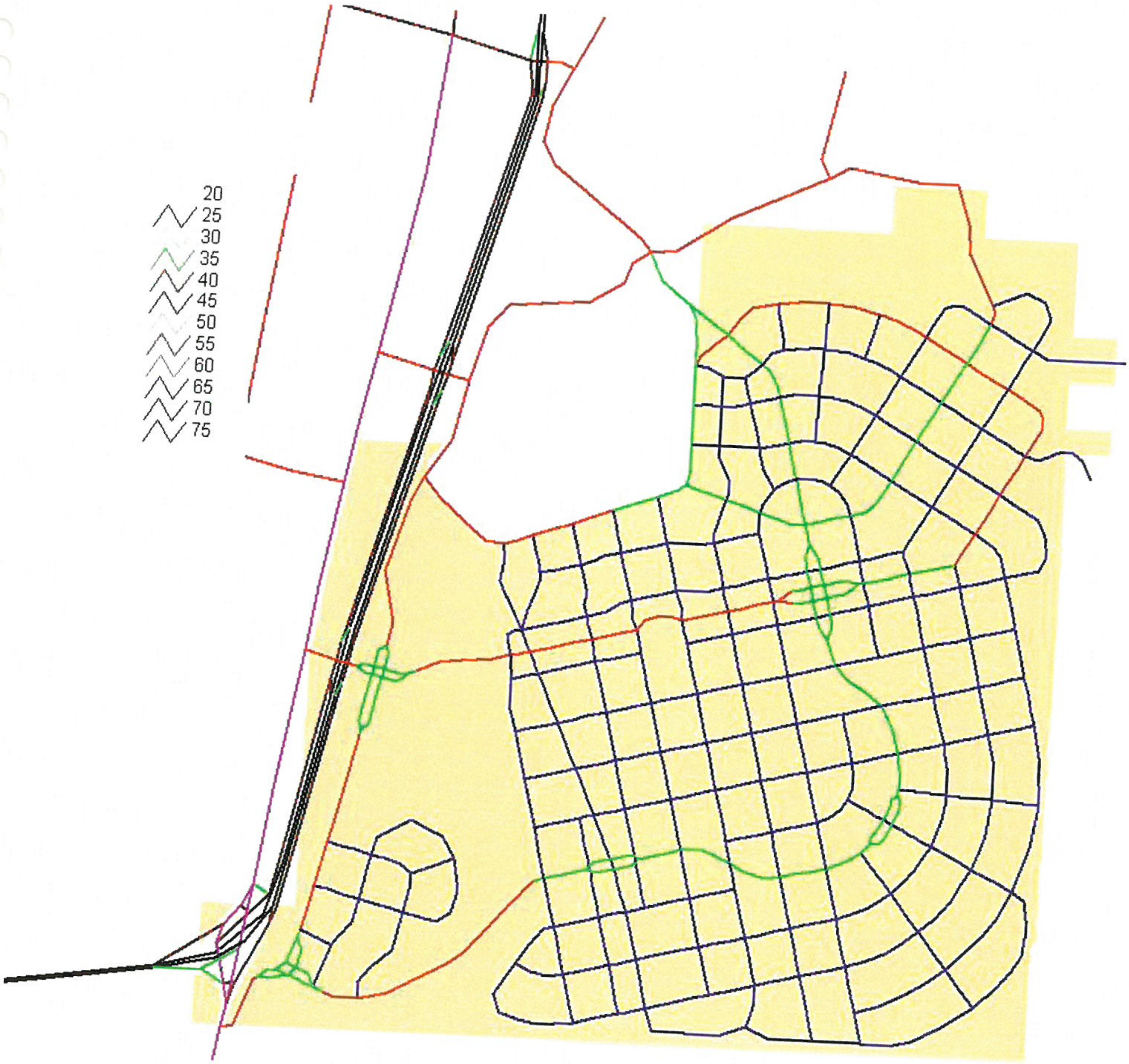
BUILDOUT SCENARIO DIRECTIONAL LANES

Figure F-3-2



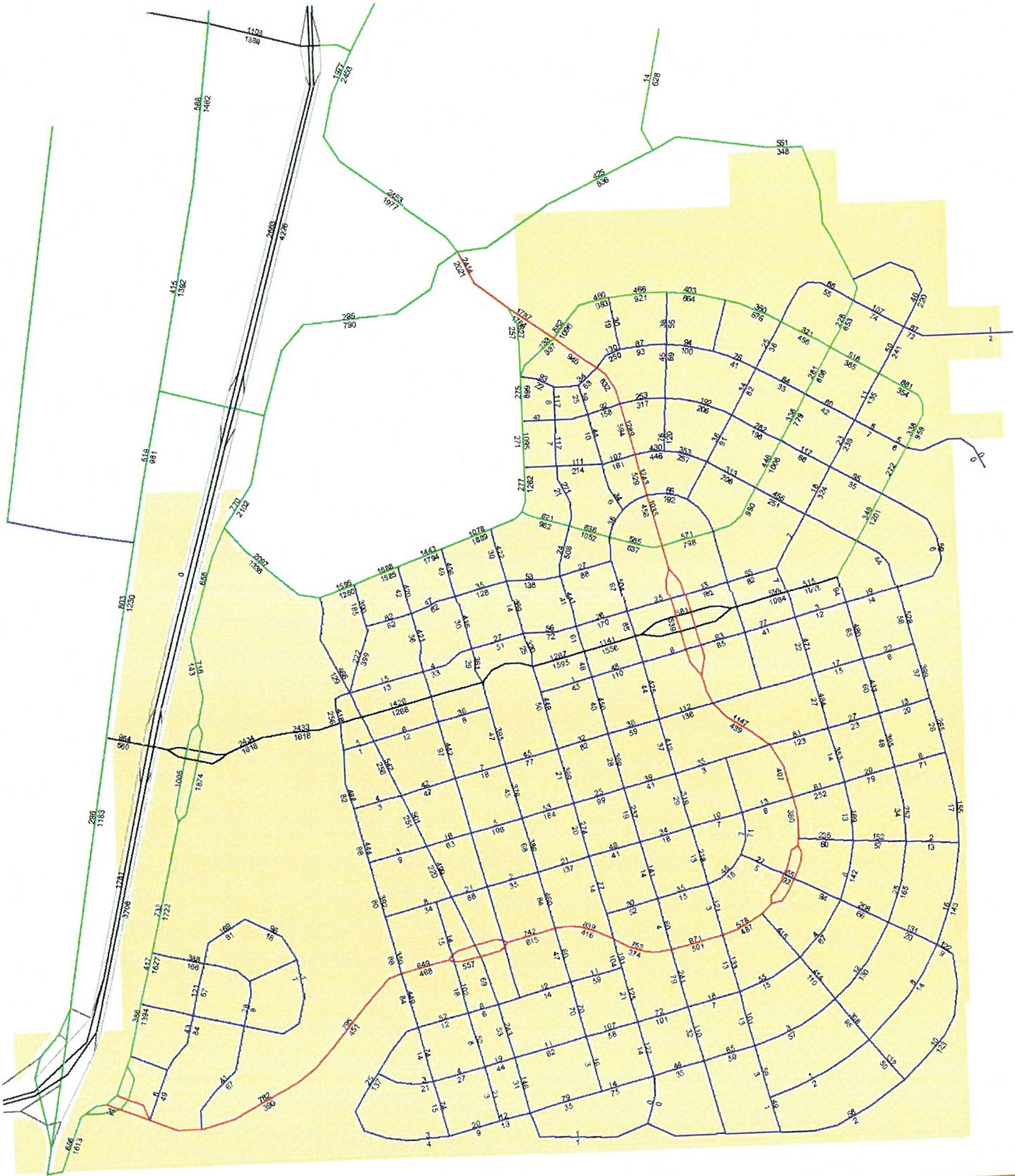
BUILDOUT SCENARIO SPEEDS

Figure F-3-3



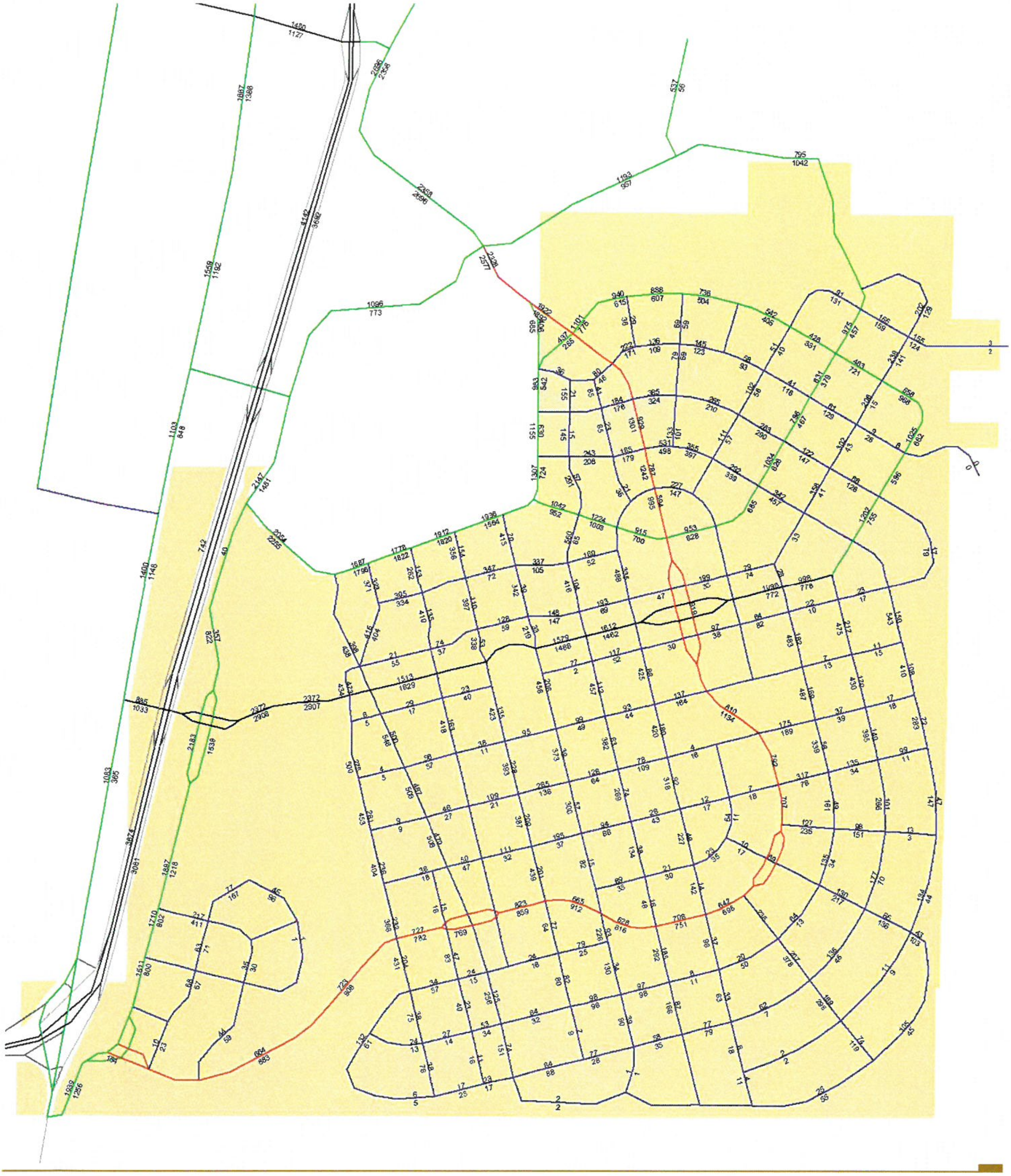
BUILDOUT SCENARIO
AM PEAK HOURLY VOLUMES

Figure F-3-4



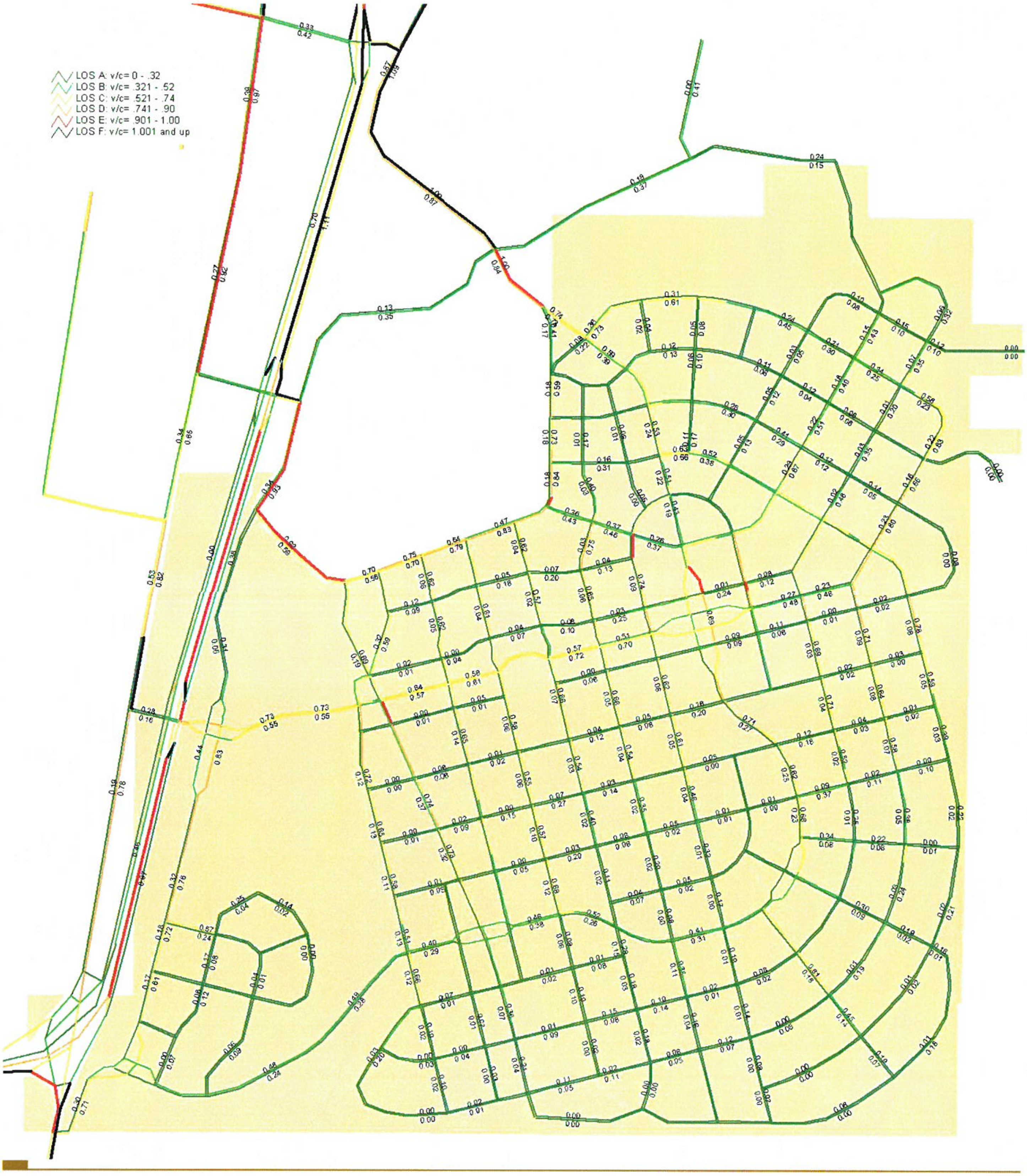
BUILDOUT SCENARIO
PM PEAK HOUR VOLUME

Figure F-3-5



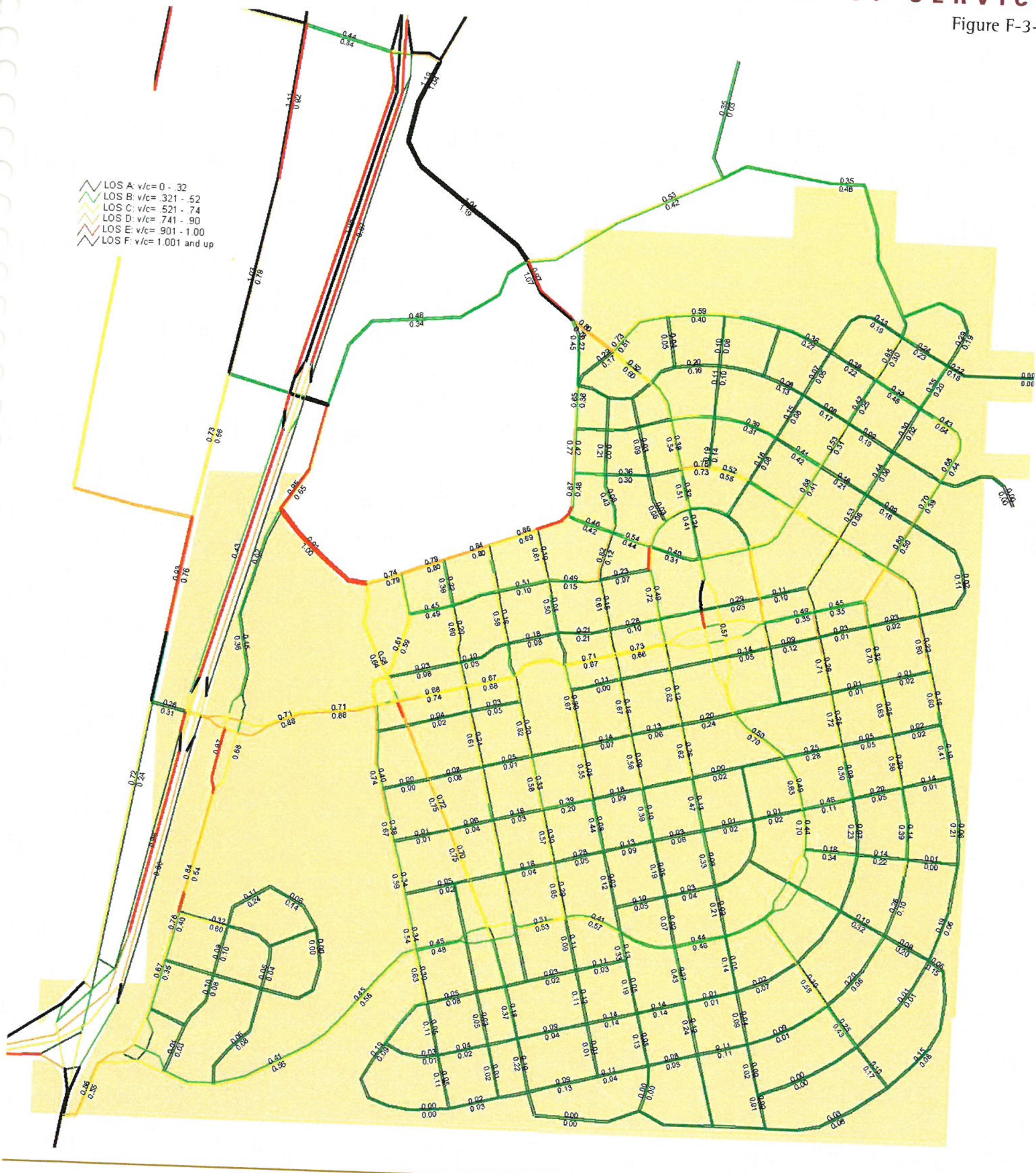
BUILDOUT SCENARIO AM PEAK HOUR LEVEL OF SERVICE

Figure F-3-6



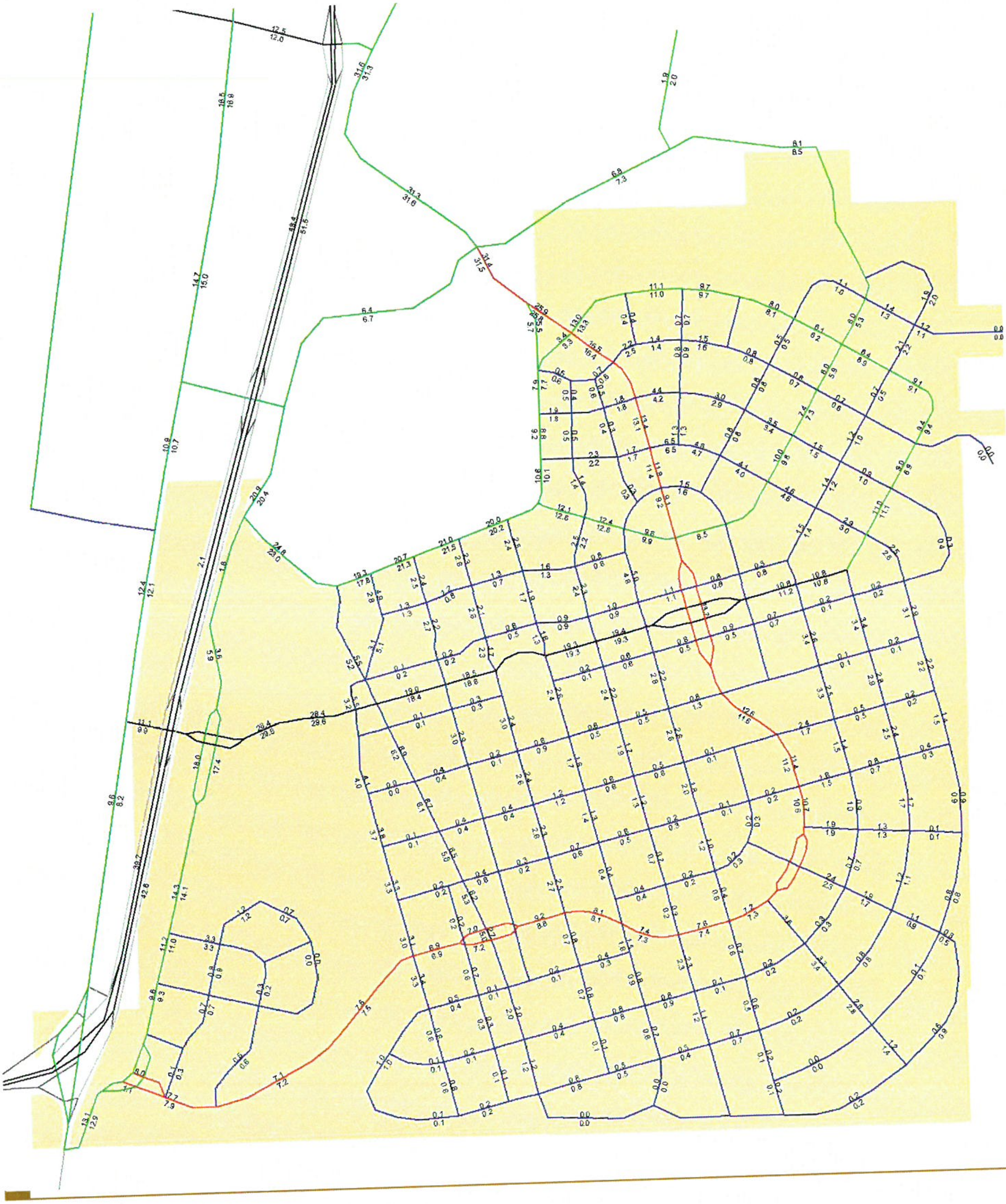
BUILDOUT SCENARIO
PM PEAK HOUR
LEVEL OF SERVICE

Figure F-3-7



BUILDOUT SCENARIO ADT

Figure F-3-8



SOCIO-ECONOMIC ATTRIBUTES

LEVEL A PLAN : JUNE 2005

F-4

MESA DEL SOL

APPENDIX F-4

A. Socio-Economic Attributes

The MRCOG model is not actually driven by the estimates of land use (dwelling units and commercial development square footage). Instead, inputs to the MRCOG EMME/2 travel model require estimates of a variety of socio-economic variables. These are all summarized briefly in the list below.

The estimates of these socio-economic variables have to be derived from the descriptions of land use for the two Mesa del Sol scenarios. We therefore refer to these as "derived" variables.

This section describes the methodology that was used for each item.

Area *X Coordinate* *Y Coordinate*	Area is expressed in acres. The coordinates of the TAZ centroid is expressed in feet, State Plane Coordinates, Central New Mexico Zone, NAD 83.These three attributes can be easily generated for TAZs using GIS
Population	Resident population
Dormitory Population	Group quarters population residing in dormitory and military housing barracks
Households	Resident households
SF Dwelling Units *MF Dwelling Units*	MRCOG assigns most "townhouse" dwelling units to the single-family category. This is based on the presumption that most "townhouses" are owner occupied.
"Basic" Employment *"Retail" Employment* *"Service" Employment*	MRCOG assigns employment to these three categories based on NAICS code. See the translation table 23 for the proportions by which this is done.
Income Group	TAZs are classified according to income five quintiles, ranging from low income (=1) to high income (=5). Note that it is the TAZ itself that is so classified. Since these are quintiles, the same number of TAZs (20%) are classified in each stratum.

Elementary-Middle School Campus Enrollments *High School Campus Enrollments* *UNM Campus Enrollments* *TVI Campus Enrollments*	Reflects the total number of students enrolled at campuses residing in each TAZ. Each TAZ with a school site (next set of fields) will have an enrollment associated with it here.
Elementary School Sites *Elementary School Districts* *Middle School Sites* *Middle School Districts* *High School Sites* *High School Districts*	TAZs that contain a school site are coded with the identifier of the school in question. Every TAZ belongs to a school district. The identifier for the school to which it belongs identifies districts. These data fields mean that hypothetical school district boundaries have to be established for each school.
UNM Campus Site	Boolean binary (=0/1) value indicating the presence of a UNM campus in the TAZ
TVI Campus Site	Boolean binary (=0/1) value indicating the presence of a TVI campus in the TAZ
Parking Cost	Costs of parking in the TAZ, typically $0 except for downtown and several other zones in region. No parking costs were assigned to Mesa del Sol zones.
Riverside Flag	Boolean binary (=0/1) value indicating whether the TAZ is located east of the Rio Grande. In the south valley, the boundary between "eastern" and "western" TAZ shifts to I-25.
District	MRCOG district number to which the TAZ belongs. Most Mesa del Sol TAZs reside in district 12. District 5 applies to TAZs west of I-25.

B. Demographics

Data for Bernalillo County from the US Census was used to convert dwelling units planned for the development into estimates of demographics. Prevailing occupancy rates and average household sizes reported by the census for both SF and MF dwelling units were used. Recall that "townhouses" are considered "single-family".

Table F-4.1: Census Demographic Statistics

Housing Type	Vacancy Rate	HH Size
SF	4.76%	2.65
MF	15.15%	1.91

So, households were computed from the dwelling unit counts for Mesa del Sol using the vacancy rates from the census shown in Table 20. Population was then computed from households based on average household sizes for Bernalillo County.

C. Employment

The MRCOG model requires projections of three types of employment: (1) "basic" employment, (2) "retail" employment, and (3) "service" employment. These were all derived from the amount of floor space proposed in the Mesa del Sol scenarios.

Table F-4.2: Average Square Foot per Employee (ASU)

Development	Low	High	Use
Retail	769	1,389	800
Office	319	325	323
R&D	319	325	323
Industrial	355	394	385

Note: "Use" column indicates the factors we used

To start, overall employment associated with the individual developments proposed in Mesa del Sol was estimated based on floor space. MRCOG does not track floor-space statistics for the region, and so we resorted to research that was done by Arizona State University for the Phoenix area in 2002. Table F-4.2 reports the statistics that ASU reported from their research for different types of development. Note that ASU did not define a "Research and Development" type, and so we are assuming that floor space requirements for it are similar to "Office." Also note that we looked quickly at the sensitivity of the employment projections with respect to using "low" or "high" floor space assumptions – overall, it doesn't make much difference.

Total employment, then, can be computed from floor space using these indices.

Once overall employment is projected, we needed to estimate what North American Industrial Classification System (NAICS) sectors these workers belong to. MRCOG has researched this item quite extensively (in connection with their land use forecasting model LAM), and has derived the breakdowns necessary. This was achieved by address matching all employers in the region and matching their locations with the types of development indicated in the regional land use cover. F-4.3 summarizes the percentage breakdown for each type of development. Note, once again, that MRCOG does not carry a "Research and Development" land use type, and therefore "Office" was used.

Note the mixes of sectors that typically occupy these different types of developments. Only 65% of the businesses attracted to a "retail" project, for example, are typically "retail" or "restaurant" businesses. The other tenants typically come from other NAICS industry sectors, more or less spread across the board.

Table F-4.3: NAICS Breakdowns of Employment by Development Type

	Development Type			
NAICS Sector	**Retail**	**Office**	**R&D**	**Industrial**
Agriculture, Forestry, Fishing	0.1081%	0.1161%	0.1161%	0.0653%
Mining	0.0000%	0.0299%	0.0299%	0.0433%
Utilities	0.0825%	0.6594%	0.6594%	0.9050%
Construction	3.2799%	1.5461%	1.5461%	15.4220%
Manufacturing	2.3850%	6.1714%	6.1714%	31.8288%
Wholesale Trade	1.2209%	1.0031%	1.0031%	10.3443%
Retail Trade	45.2601%	1.0166%	1.0166%	3.1709%
Transportation and Warehousing	0.9524%	0.7825%	0.7825%	8.0693%
Information	1.6562%	3.7139%	3.7139%	1.8569%
Finance & Insurance	1.8873%	11.3565%	11.3565%	0.6139%
Real Estate, Rental & Leasing	0.9013%	5.4236%	5.4236%	0.9125%
Professional, Scientific, Technical	4.0752%	9.1385%	9.1385%	4.5690%
Management of Companies	0.7384%	1.9083%	1.9083%	0.6805%
Admin, Support, Waste mgt, Remediation	4.9729%	11.1516%	11.1516%	5.5755%
Educational Services	3.4683%	7.7777%	7.7777%	3.8886%
Health Care & Social Assistance	4.2408%	9.5099%	9.5099%	4.7547%
Arts, Entertainment & Recreation	0.9223%	2.0683%	2.0683%	1.0341%
Accommodation & Food Services	0.4993%	1.1196%	1.1196%	0.5598%
Eating and Drinking	20.6957%	0.4555%	0.4555%	1.4208%
Other Services	2.3243%	5.2123%	5.2123%	2.6060%
Government	0.3292%	19.8390%	19.8390%	1.6790%
Total	**100.0000%**	**100.0000%**	**100.0000%**	**100.0000%**

With these statistics we could then estimate the number of workers in each development, by NAICS code. The next step then, is to assign these workers to the "basic", "retail", and "service" categories required by the EMME/2 model. This was done according to the same methodology that MRCOG uses for building model data sets that relates NAICS codes to these three employment sectors. Table F-4.4 gives the statistics by which this was done.

Table F-4.4: Conversion of NAICS Employment to EMME/2 Model Sectors

NAICS Sector	Employment Category			Total
	Basic	Retail	Service	
Agriculture, Forestry, Fishing	100%			**100%**
Mining	100%			**100%**
Utilities	100%			**100%**
Construction	99%		1%	**100%**
Manufacturing	98%	1%	1%	**100%**
Wholesale Trade	100%			**100%**
Retail Trade	4%	96%		**100%**
Transportation and Warehousing	96%		4%	**100%**
Information	78%		22%	**100%**
Finance & Insurance		1%	99%	**100%**
Real Estate, Rental & Leasing	3%		97%	**100%**
Professional, Scientific, Technical	3%		97%	**100%**
Management of Companies			100%	**100%**
Admin, Support, Waste mgt, Remediation	21%		79%	**100%**
Educational Services			100%	**100%**
Health Care & Social Assistance	1%		99%	**100%**
Arts, Entertainment & Recreation			100%	**100%**
Accommodation & Food Services		85%	15%	**100%**
Eating and Drinking		85%	15%	**100%**
Other Services	2%		98%	**100%**
Government			100%	**100%**

D. In summary:

- Overall employment estimates of jobs were generated for Mesa del Sol developments based on assumptions about average square foot per employee.

- Those jobs estimates were broken down by NAICS business sector based on MRCOG statistics about prevailing rates associated with different development types.

- Jobs by NAICS business sector were assigned to the three EMME/2 model categories, Basic, Retail, and Service, based on MRCOG's own methodology.

E. Household Income Groups

As indicated earlier in the table above, each residential zone must be assigned to an income class. These are defined to be strict quintiles, ranging from low-income households (=1) to high income households (=5). By definition in the MRCOG model, all residents in a single individual TAZ belong to the same class. We do not know what price classes housing in individual subdivisions in Mesa del Sol will be marketed for – none of that is determined yet. More importantly, we can not predict what income classes individual subdivisions in Mesa del Sol will be occupied by 20 years from now, or beyond. Therefore, we assigned income classes to residential TAZs in Mesa del Sol based on the following criteria:

- TAZs that were predominantly "multi-family" were assigned income classes 2, 3, and 4, ranging from the "low-medium" income class to the "medium-high" income class.
- TAZs that were predominantly "single family" were assigned income classes 3, 4, and 5, ranging from the "medium" income class to the "high" income class.

Note that the "low" income class (=1) was not used. TAZs falling into this income category are only found in the poorest areas of the region, occupied by very old, run down, housing.

The overlapping income categories (2, 3, and 4 for multi-family and 3, 4, and 5 for single-family) means that the strict definition of "quintiles" is violated somewhat (that is, the zone count in each category is not strictly 20%). This, in fact, is not particularly important, as these classifications are only used in the MRCOG model to select appropriate trip generation rates to apply to housing in these zones.

F. School Enrollments and Districts

Table F-4.5: Student Rates per Household

School Type	Number of Schools	Total Students	Per HH	Per School
Elementary	133	74,562	0.1782	561
Middle	42	36,165	0.0864	861
High School	25	34,496	0.0824	1,380

Note: Based on 418,448 households in the region, 2025

The MRCOG EMME/2 model also requires school sites, school districts, and enrollments associated with those districts, to be estimated. School sites are available directly from the Mesa del Sol Master Plan, which defines locations for the different types of schools. Enrollments were estimated based on resident households in Mesa del Sol TAZs, using the prevailing average rates gleaned from the basic 2025 MRCOG database for the region. The per capita rates from Table F-4.5 were used. From these rates, the number of students of each type, by place of residence, was estimated.

The next step was to define the school districts associated with each school site. For this, we used the MRCOG school district "editor", an interactive GIS based tool that facilitates the construction of school districts. As school districts were designed, an attempt was made to maintain the prevailing average enrollments for each school. Once school districts were defined, and then resident students that were members of each district were assigned as campus enrollments to the school site itself.

G. Employment Related to Schools

Employment related to schools was not covered by the methodology described above for "basic", "service", and "retail" workers. Estimates of school-related employment had to be added to the previous projections. For this, a MRCOG database describing average workers per student was used, with the resulting statistics appearing in Table F-4.6.

School-related employment was then estimated based on the enrollment statistics at each school site.

All school related employment is considered "Service".

Table F-4.6: Employment Related to School Enrollments

	Students	Jobs	Student Ratio
Elementary	55,881	7,167	7.80
Middle	27,321	3,350	8.16
High School	31,397	3,180	9.87

UNM Campus Sites and Enrollment: The UNM campus sites planned for Mesa del Sol have been incorporated into the model as Office Research & Development land use rather than as traditional college campuses, therefore, the traffic generated by them is accounted for elsewhere as described in Section 6 of Appendix F.