**Abstract:**

The purpose of the Regional Corridor Plan project was to undertake research and to develop information that can be used to modify the City of San Antonio's Major Thoroughfare Plan. Specific components of the Regional Corridor Plan included 1) development of the Regional Thoroughfare Plan (freeway and arterial) roadway alignments by examining future traffic capacity needs, roadway function, environmental issues, existing and planned neighborhoods, and anticipated land uses in the region, 2) testing different access management techniques via a detailed traffic analysis of a number of travel corridors in the San Antonio region and 3) making recommendations on corridor preservation. A series of stakeholder meetings were held to gather input on the Regional Corridor Plan components.

The Regional Corridor Plan was a collaborative effort of the staffs of the Alamo Area Council of Governments, Bexar County, City of San Antonio, San Antonio-Bexar County MPO, Texas Department of Transportation and VIA Metropolitan Transit.
The contents of this report reflect the views of the authors who are responsible for the opinions, findings and conclusions presented herein. The contents do not necessarily reflect the views or policies of the Federal Highway Administration, the Federal Transit Administration or the Texas Department of Transportation.
# Table of Contents

Introduction ........................................................................................................................................... 1
Goals ....................................................................................................................................................... 2
  Thoroughfare Spacing .......................................................................................................................... 4
  Roadway Gaps ...................................................................................................................................... 4
  Mobility .................................................................................................................................................. 4
Thoroughfare Classification System ...................................................................................................... 4
  Freeway ............................................................................................................................................... 6
  Super Arterial ...................................................................................................................................... 7
  Primary Arterial ................................................................................................................................. 7
  Secondary Arterial .............................................................................................................................. 7
  Arterials Over the Edwards Aquifer Recharge Zone ......................................................................... 8
  Primary and Secondary Arterials – Type B ....................................................................................... 8
  Collector .............................................................................................................................................. 8
  Local ................................................................................................................................................... 8
Regional Thoroughfare Plan Map .......................................................................................................... 9
  Land Use Trends ................................................................................................................................. 10
  Traffic Demand .................................................................................................................................. 11
  Environmental Issues ........................................................................................................................ 11
Right-of-Way Preservation ...................................................................................................................... 13
Potential Financing Methods ................................................................................................................ 14
Plan Implementation ............................................................................................................................... 14
Amendments to the Plan ........................................................................................................................ 15
Access Management ............................................................................................................................... 16
Stakeholder Involvement ......................................................................................................................... 25
Recommendations ................................................................................................................................... 26

Appendix A ...........................................................................................................................................  Regional Thoroughfare Plan Map
Appendix B ...........................................................................................................................................  Traffic Analysis
Appendix C ...........................................................................................................................................  Access Management Criteria
Appendix D ...........................................................................................................................................  Stakeholder Meetings
List of Figures

Figure 1. Reviewing Standards on Selected Arterials ................................................................. 1
Figure 2. Mobility/Access Relationship ..................................................................................... 5
Figure 3. Right-of-Way Preservation Examples ......................................................................... 13
Figure 4. Bitters Road Corridor Driveways ........................................................................... 17
Figure 5. Blanco Road Analysis Location .............................................................................. 20
Figure 6. Marbach Road Analysis Location ............................................................................ 21
Figure 7. Southwest Military Drive Analysis Location .......................................................... 22

List of Tables

Table 1. Federal Highway Administration Functional Classification System Description ...... 5
Table 2. Desirable Design Criteria ........................................................................................... 6
Table 3. Blanco Road Performance ......................................................................................... 20
Table 4. Marbach Road Performance ...................................................................................... 21
Table 5. Southwest Military Drive Performance ..................................................................... 22
Table 6. Summary of Access Category Standards .................................................................. 24
Introduction

The purpose of the Regional Corridor Plan project is to undertake research and to develop information that can be used to modify the City of San Antonio’s Major Thoroughfare Plan and to complete a detailed analysis of a number of specific travel corridors in the San Antonio region. The San Antonio region continues to grow and its urban area continues to expand. As land development occurs, a balance between access to individual properties and the functionality of arterial streets needs to be preserved. The Regional Corridor Plan project consists of several components. **Figure 1** shows this overall project methodology.

![Figure 1]

**Figure 1**
Regional Corridor Plan

Goals

The Regional Thoroughfare Plan (Plan) assists in the coordination of local plans by representing a single source of information that identifies the thoroughfare planning efforts of the region. Intended as more than just a composite of local roadway plans, the Regional Thoroughfare Plan shows the primary traffic arteries when land uses reach capacity under a “build-out” scenario with no commitment to a time frame. This plan identifies the ultimate system of arterials when the area is completely developed. City of San Antonio, suburban city and county plans were incorporated where appropriate to indicate the future proposed thoroughfares that will carry traffic across multiple jurisdictions.

The Regional Thoroughfare Plan provides a foundation upon which local governments, VIA Metropolitan Transit, any future mobility related agencies, and the public can work together to resolve regional transportation planning issues across jurisdictional boundaries. This Plan does not constrain individual city, county, or mobility related agency goals in any way. It also does not imply or grant approval of an implementation strategy. It should however be a guide for modification to existing plans and policies for local governmental agencies. Local governments are encouraged to monitor and implement their various individual components that define the Plan.

The San Antonio area is blessed with a comprehensive freeway network and a well spaced and comprehensive arterial street system in the central city (within IH 410), but the arterial network or thoroughfare system in the suburban areas has taken on a more disorganized pattern. This is partially due to greater environmental and topographical constraints in many areas. For a multitude of reasons, the system has been left with many gaps, discontinuous routes, and inadequate spacing that can hinder mobility, cause traffic congestion, and create safety concerns.

The Regional Corridor Plan and the development of its accompanying access management standards were a collaborative effort of the City of San Antonio, Bexar County, VIA Metropolitan Transit, the Alamo Area Council of Governments (AACOG), and the Texas Department of Transportation. The Plan utilized earlier work from the San Antonio-Bexar County Metropolitan Planning Organization. This work included population and employment projections, travel demand model forecasts, and concepts introduced in “Making Connections,” a transportation and land use project. The project also utilized information from the City of San Antonio Geographic Information System.
database and traffic data from the City of San Antonio Public Works Department. These plans, studies, and policies provided input into the Plan of both elements that should be included in the Plan and those that would create barriers for effective transportation in the region.

For the purpose of this report an arterial street is considered to be any major road that carries, or by virtue of location or continuity, has the potential to carry through traffic as well as to provide access to adjacent development. Characteristics of these types of roads include traffic volume of at least 7500 existing or projected vehicles per day, frequently has four travel lanes or two travel lanes with left turn provisions, adjacent land use usually contains considerable commercial development, and many intersections are signalized. (provide names of examples in SA-from different sectors of the city)

Problem Statement

The street and highway system has two major functions:

- movement of traffic between dispersed points
- provision of access to individual properties

Ideally the primary function of an arterial street is to provide relatively uninterrupted, long distance travel service throughout an urbanized area. While traffic movement is still important, land access functions are better provided by local and collector streets. However, increasingly, the movement function of arterial and collector streets in the urban environment has been compromised by access to adjacent land development.

An inefficient traffic circulation system can occur if a functional system is not established in the first place, or if the functional system is allowed to degrade. Without regulations or guidelines, new or continued commercial, industrial and residential development that locates on major arterials can result in a breakdown in the arterial function. When that occurs, the carrying capacity and safety of the arterial suffers from the effects of high traffic volumes coupled with unlimited access.

These actions that impede the proper operation of arterial streets occur gradually, and are caused by a large number of separate decisions in the private and public sectors often made with little comprehensive guidance.
Thoroughfare Spacing

Desirable thoroughfare spacing is a function of the capacity of the system and the effect on the freeway system. Spacing shown on the existing Thoroughfare Plan was reviewed to ensure logical roadway layout consistent with standard transportation planning practices. This was done within constraints and opportunities presented by existing development, environmental and topographical conditions. The goal was to create an efficient network of regional thoroughfares spaced from one to two miles apart.

Roadway Gaps

Identifying gaps in otherwise continuous roadway segments assists in determining potential restrictions to traffic flow that create an operational strain on surrounding arterials and reduce area mobility. The completion of a small roadway segment between two existing facilities can significantly reduce circuitousness and relieve congestion on parallel facilities. The Regional Thoroughfare Plan provides the medium to see how individual roadways or roadway segments affect mobility in the entire San Antonio/Bexar County area.

Mobility

Providing for long trips over continuous routes that link multiple city or county population and employment centers is important for mobility and orderly development. Identifying the corridors where anticipated traffic demand exceeds the operational capacity of the freeway and transit networks is essential for financially responsible planning and programming of transportation improvement funds. Primary arterials will play an increasingly important part serving as alternate routes to relieve congested freeway corridors.

Thoroughfare Classification System

A functional classification system is a hierarchy of streets that describe the operational characteristics and role of streets in a circulation system. The Federal Highway Administration (FHWA) Functional Classification System focuses upon the assignment of traffic on the primary and secondary system: arterials and collectors. The classifications shown on the Regional Thoroughfare Plan Map are an attempt to make the classifications more consistent between the City of San Antonio and TxDOT terminology.
Figure 2 – Mobility / Access Relationship

Freeways
Principal Arterials
Secondary Arterials
Collector Streets
Local Streets

Figure 2 above and Table 1 below describe the mobility and access characteristics of the different roadway functional classifications.

Table 1. Federal Highway Administration Functional Classification System

<table>
<thead>
<tr>
<th>Functional Class</th>
<th>Level of Mobility</th>
<th>System Access</th>
<th>Level of Accessibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeway</td>
<td>Connects all urban sub regions together, connects urban and rural service areas with metro major activity centers; connection to outside cities.</td>
<td>To other freeways, principal arterial, and selected arterial; no direct land access.</td>
<td>Long trips at high speed within and through the metro area; express transit trips. Typical speed ranges between 55 and 70 m.p.h.</td>
</tr>
<tr>
<td>Primary Arterial</td>
<td>Connects two or more sub regions; provides secondary connections outside cities; complements freeway in high volume corridors.</td>
<td>To freeways, other principal arterial, and high volume collectors; no direct land access except major traffic generators.</td>
<td>Medium distance to long trips at high to moderate speeds within the urban area; express transit trips. Posted speeds typically range from 35 to 45 m.p.h.</td>
</tr>
<tr>
<td>Secondary Arterial</td>
<td>Connects adjacent sub regions and activity centers within sub regions.</td>
<td>To freeways, principal arterial, other arterial, and collectors; restricted direct land access.</td>
<td>Medium to short trips at moderate to low speeds; local transit trips. Posted speeds typically range from 30 to 40 m.p.h.</td>
</tr>
<tr>
<td>Collector</td>
<td>Connects neighborhoods within and between sub regions.</td>
<td>To arterial, other collectors, and local Streets; direct land access.</td>
<td>Primarily serves collection and distribution function for the arterial system at low speeds; local transit trips. Posted speeds typically range from 25 to 35 m.p.h.</td>
</tr>
<tr>
<td>Local</td>
<td>Connects blocks within neighborhoods and specific activities within homogeneous land use areas.</td>
<td>To collectors and other local Streets; direct land access.</td>
<td>Almost exclusively collection and distribution; short trips at low speeds.</td>
</tr>
</tbody>
</table>
These classifications correspond to the manner in which a roadway functions, or should function. Within each of these functional classifications, design criteria are necessary to maintain that function. In the descriptions below the function of each type of roadway is described, as well as recommended design criteria to assist in maintaining the function. The desirable design criteria are summarized in Table 2.

**Table 2. Desirable Design Criteria**

<table>
<thead>
<tr>
<th>Street Type</th>
<th>Freeway</th>
<th>Super-Arterial</th>
<th>Primary Arterial Type A</th>
<th>Primary Arterial Type B</th>
<th>Secondary Arterial Type A</th>
<th>Secondary Arterial Type B</th>
<th>Collector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desirable ROW width</td>
<td>500’</td>
<td>250’</td>
<td>144’</td>
<td>144’</td>
<td>120’</td>
<td>100’</td>
<td>80’</td>
</tr>
<tr>
<td>Lanes</td>
<td>4-10</td>
<td>4-6</td>
<td>4-6</td>
<td>4-6</td>
<td>4</td>
<td>4</td>
<td>2-4</td>
</tr>
<tr>
<td>Curb</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Median</td>
<td>Yes</td>
<td>Yes</td>
<td>18’</td>
<td>18’</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Sidewalk Width</td>
<td>NR</td>
<td>6’</td>
<td>6’</td>
<td>6’</td>
<td>6’</td>
<td>6’</td>
<td>5’</td>
</tr>
<tr>
<td>Bike Facilities</td>
<td>No</td>
<td>Yes</td>
<td>5’</td>
<td>5’</td>
<td>5’</td>
<td>5’</td>
<td>5’</td>
</tr>
<tr>
<td>Vegetation/Utility Corridor (both sides)</td>
<td>10’</td>
<td>10’</td>
<td>10’</td>
<td>10’</td>
<td>10’</td>
<td>5’</td>
<td></td>
</tr>
</tbody>
</table>

**Freeway**

The freeway system provides connections between all urban sub-regions and connects urban and rural service areas with major urban activity centers. It also provides connections to outside cities. Freeways provide access to other freeways, principal arterials, and some secondary arterials. No direct land access is provided. Travel on freeways usually consists of long trips at high speeds. The typical section for a freeway is at the discretion of Texas Department of Transportation (TxDOT) and will have a
right-of-way width of 250 to 500 feet. The design features of freeways will be at the discretion of TxDOT.

**Super Arterial**

A super arterial is a partially controlled access arterial serving multiple activity centers while facilitating regional travel. A super arterial is characterized by grade separations at major intersections, curb and median access controls, and traffic signal progression. Speeds on super arterials are typically 40 to 50 mph. There are two super arterials on the Regional Thoroughfare Plan, Wurzbach Parkway, from Lockhill-Selma to IH 35 and the proposed Kelly Parkway, both of which are the responsibility of TxDOT. The typical section for a super arterial is at the discretion of TxDOT and will have a right-of-way width of 120 to 250 feet.

**Primary Arterial**

The primary arterial system serves the major centers of activity of urbanized areas. It provides secondary connections outside of cities and complements freeways in high volume corridors. Principal arterials provide access to freeways, other principal arterials, and high volume collectors. No direct land access is provided except at major traffic generators. Travel on principal arterials consists of medium distance to long trips at high to moderate speeds within the urban area. Speeds on primary arterials are typically 35 to 45 mph. Average daily traffic typically ranges from 15,000 to 100,000 vehicles. The typical section of a primary arterial has a minimum right-of-way width of 144 feet and will contain four to six travel lanes. The right-of-way will also accommodate bike lanes, sidewalks, and a median divider to improve traffic safety and mobility.

**Secondary Arterial**

The secondary arterial street system interconnects and supplements the primary arterial system. It accommodates trips of moderate length at a lower level of mobility than the principal arterial system. Secondary arterials place more emphasis on land access than principal arterials and offer lower traffic mobility. Speeds on secondary arterials are typically 30 to 40 mph. Average daily traffic typically ranges from 5,000 to 30,000 vehicles. The typical section of a secondary arterial has a desirable right-of-way width of 120 feet and will contain four travel lanes. The right-of-way will also accommodate bike lanes, sidewalks, and a median divider to improve traffic safety and mobility.
Arterials over the Edwards Aquifer Recharge Zone

There is a concerted effort in the San Antonio area to protect the water quality of the Edwards Aquifer. In response to that effort, it is the goal of the Plan to maintain area mobility, but not to promote development over the Edwards Aquifer Recharge Zone. The alignment of roadways over the Recharge Zone will need to respect any setbacks or other avoidance measures required by environmental regulations dealing with the aquifer, endangered species, vegetation, or other sensitive natural features. The roadways primary function should be to provide mobility across the region. Access to adjacent properties should be a secondary and highly limited function. The typical right-of-way width for the aquifer roadways should be a maximum of 144 feet while providing for four travel lanes, bike lanes, sidewalks, and a minimum of 50 feet of natural or vegetated area. The roadway should be constructed in a manner to facilitate the collection and filtration of stormwater run-off.

Primary and Secondary Arterials - Type B

The Type B arterials generally exist in the area inside of Loop 410. Their intent is to serve the same function as the primary and secondary arterials described above. However due to the relatively dense adjacent development found in most parts of the central city, and the preponderance of intersecting driveways along these roadways, it would be extremely difficult to retrofit these arterials to the standards of the Type A arterials. The Type B arterials do not have a center median and have a reduced border width (as narrow as 6’).

Collector

The collector street system provides both land access and traffic circulation within residential neighborhoods and commercial and industrial areas. Unlike the arterial system, the collector streets serve neighborhoods, distributing trips from the arterials through the area to their ultimate destinations. Collector streets also collect traffic from local streets in residential neighborhoods and channel it into the arterial system. Speeds on collectors are typically 30 to 35 mph. Average daily traffic typically ranges from 1,000 to 15,000 vehicles. The desirable right-of-way width for a collector street is 80 feet and it typically contains two to four travel lanes and sidewalks.

Local

The local street system consists of all facilities not in one of the higher classifications. Local streets primarily permit direct access to residences, businesses, or other adjacent property. The traffic volume generated by the adjacent land uses are
primarily short trips or a relatively small part of longer trips where the local road connects to roadways of a higher classification. Local streets offer the lowest level of mobility. Speeds on local streets are typically 25 to 35 mph. Average daily traffic is typically less than 1,000 vehicles. The right-of-way for a local street has a minimum width of 50 feet and typically contains two travel lanes and sidewalks.

The Regional Thoroughfare Plan lays out a network of roadways classified as freeways and arterials. It does not attempt to determine where collector and local streets should be built. The placement of collector and local streets should be primarily at the discretion of the developer within the context and recommendations of the land development regulations of the local entity. In addition to local regulations, there are sound guidelines for collector street placement that should be followed.

Collectors are designed to provide a greater balance between mobility and land access within residential, commercial, and industrial areas. The design of a collector facility is largely dependent upon the density, size, and type of adjacent development.

Emphasizing balance between mobility and access, a collector facility is designed to better accommodate bicycle and pedestrian activity while still serving the needs of the traveling public. A collector street should have the following characteristics: part of a grid of streets generally spaced at ½ mile intervals; serve as locally significant streets between neighborhoods; provide connectivity between arterials or between other collectors; accommodate existing or future traffic volumes of less than 15,000 vehicles per day; accommodate the local transit system; accommodates speeds of 25 mph or greater; provide limited restrictions on driveways and other access points to adjacent land uses; provide traffic signals at major intersections; function as a local emergency route; provide no more than two to four travel lanes; and serve all levels of adjacent land use density.

Regional Thoroughfare Plan Map

The roadways shown on the Regional Thoroughfare Plan Map (Map) represent the culmination of analysis of future traffic capacity needs, environmental issues, existing and planned neighborhoods, existing roadways, construction feasibility, and anticipated land uses in San Antonio and the surrounding area. The development of the Map was built on the City of San Antonio’s Major Thoroughfare Plan and the thoroughfare plans of surrounding cities.
A concerted effort was made to create a roadway network that met the goals of adequate spacing between arterials, filling in the gaps in the existing road system, and developing continuous regional routes. Several unique features exist in the San Antonio area and its development that are not conducive to a traditional grid-like pattern for a thoroughfare network.

The existing arterial network follows more of a spoke and wheel configuration. A transition to a more grid-like pattern in the undeveloped and currently developing areas will provide greater mobility and better suit today’s travel needs. Additionally, the topography of the northwest portion of the San Antonio area creates constraints to an efficient thoroughfare network. Finally, large features such as Braunig and Calaveras Lakes, Government Canyon State Park, and Camp Bullis provide some obstacles to the connectivity for the entire system. However, these features also will not generate a significant amount of traffic compared to their relative size, thus providing some measure of relief to the remainder of the thoroughfare system.

Land Use Trends

While not as rapid as many Sunbelt cities, growth in the San Antonio area has been steady for more than a decade. This steady growth has not been evenly distributed across all portions of the region. The majority of new residential and commercial development has occurred north of a line created by IH 10 East and US 90 West. There has also been an increased emphasis infill on development and redevelopment within IH 410. While some progress has been made toward this goal, most land use changes and intensification is occurring outside of IH 410 in western San Antonio and beyond Loop 1604 in the north. Growth in these areas is expected to continue for the foreseeable future.

Late in the development of this study, automaker Toyota announced that it would be constructing a manufacturing facility in south Bexar County, east of Applewhite Road, approximately midway between IH 410 and Loop 1604. It is anticipated that this facility and its support businesses will create significant land uses changes in the southern part of the San Antonio area. In addition to the conversion from agricultural to industrial use of the over 2,000 acres Toyota site, much of the surrounding land will be converted to new land uses. Residential development is also expected to increase in southern Bexar County. The new growth in southern Bexar County will likely not be at the expense of
growth in other geographic areas, but will result in more balance growth pattern than San Antonio has traditionally experienced.

Additionally, the same geographic area has been the subject of study under the City’s Southside Initiative. The Southside Initiative was created to bring a better quality of life to the area south of Loop 410 through more traditional neighborhood development, abundant parkland, improved schools, and a better balance between housing and jobs.

Traffic Demand

The existing travel demand model for the San Antonio area reflects population and employment projections developed in the late 1990s. For the most part, these projections assume that the growth patterns at that time would likely continue into the future. Likewise, most of the forecast travel demand in the area was focused north of IH 10 East and US 90 West. Consequently, when roadway capacity deficiencies were analyzed, most occurred in the same area. The impact of the southside developments have not been addressed at this time.

Environmental Issues

The identification of roadways in the Plan took into consideration the features of the natural environment. These included floodplains, severe slopes, the Edwards Aquifer recharge zone, and parklands. Specific features which present considerable constraint are the Government Canyon State Park site between FM 471 (Culebra Road) and SH 16 (Bandera Road) in western Bexar County, the multiple sites which have been purchased through the City’s Proposition 3 initiative for aquifer protection in northwest and north central Bexar County, the hilly terrain in the northwest portion of the county, and the Mitchell Lake area in the south central part of the county. Creeks and their associated floodplains dissect the entire area, which generally cross the county in a northwest to southeast direction. While not “off limits” from an environmental perspective, road development in, or across a floodplain can significantly add to the cost of the development of that facility.

Once the framework was established with the issues described above, a three-step process was followed to determine roadway alignments for the Plan. First, any roadways that were shown on the previous plan that did not correspond to what had actually been constructed were corrected to reflect what exists today. Second, an attempt was made to connect any gaps that exist, where feasible. The third step utilized the 2025 travel forecasts to determine what portions of the existing network would exceed capacity in the
future. Once these areas were determined, parallel or other relief corridors were identified. The Regional Corridor Plan Map is presented in Appendix A of this document.

Differences from previous versions of the Major Thoroughfare Plan map include new roadway corridors, reclassification of functions of some roadways, and rectification of roadway alignments. Specific changes to highlight include the addition of a primary arterial extending north from the intersection of SH 16 and SH 211 to IH 10 near the Bexar/Kendall County Line; the re-designation of Blanco Road as a primary arterial from Loop 410 north to the Bexar/Comal County Line; clarification of the alignment of Wilderness Oak; the inclusion of arterials in the northeast Bexar County suburbs; the addition of an arterial parallel to and south of I-10, east of Loop 410; the creation of arterial grids in south central and southwestern Bexar County; the inclusion of Kelly Parkway; and revisions in the SH 211/Talley Road area.

The announcement of the location of the new Toyota manufacturing plant east of Applewhite Road occurred late in the development of the Regional Corridor Plan. The data used in the analysis to develop the Regional Thoroughfare Plan map was produced in 1998 and did not take into consideration the proposed Toyota manufacturing plant. It is anticipated that the plant and support businesses will have a significant affect on the population and employment of the area south of IH 410. This anticipated increase in population and employment was not reflected in the demographic data used to develop the 2025 travel forecasts. Therefore, the City of San Antonio, Bexar County, and TxDOT have been working together to develop a roadway network in the area bounded by IH 410, Loop 1604, IH 35, and IH 37 to address the anticipated mobility needs. The network in this area is still under review by the City of San Antonio. It is recommended that this area, shaded on the accompanying map, be reviewed following the development of the San Antonio-Bexar County Metropolitan Planning Organization’s (MPO’s) next Metropolitan Transportation Plan (area’s long range transportation plan with a horizon year of 2030) scheduled for adoption in December 2004. That plan will incorporate updated demographics for the entire MPO Study Area into its development.

It is inevitable that revisions will be made to the roadway alignments shown on the Map due to new developments and new information. Revisions should be approved only if an alternative solution is proposed to maintain or improve area mobility or if it can be demonstrated that the removal of the facility will not negatively impact area mobility. The execution of a model run in the MPO’s regional travel demand model is being
recommended to be required to demonstrate the impacts of proposed modifications to the Plan.

Right-of-Way Preservation

TxDOT and other agencies have limited resources for the acquisition of right-of-way for future transportation projects. In the future, local governments will be expected to bear a greater share of the cost burden of right-of-way acquisition costs. Purchasing additional right-of-way can place a huge burden on the municipalities and greatly delay needed construction projects. To assist the local entities in the right-of-way acquisition process, it is recommended that those entities with the power to require land dedications for transportation purposes consider the following process for future improvements on the freeway system. For new corridors, where no road currently exists, require dedication of 144 feet (the amount required for a primary arterial) and the preservation of an additional 128 feet on both sides. This would create an ultimate corridor of 400 feet. For existing corridors, assuming an existing right-of-way width of 200 feet, require the dedication of 72 feet (one-half of the primary arterial) and the preservation of 28 feet on each side (See Figure 3). The dedicated area would either be donated by the landowner or purchased by a governmental entity for transportation purposes. The preserved area would remain under the ownership of the adjacent landowner, but no structures would be built in the preserved area. The preserved area could be used for parking, landscaping, and other aesthetic improvements until the property is needed for transportation improvements.

![Figure 3](image-url)
Potential Financing Methods

The new roadway and roadway improvements in the Plan may be constructed by private developers, local governments, or TxDOT. The traditional financing method for City and County road improvements has been the issuance of voter approved general obligation bonds by a local governmental entity. The bond debt is retired over a period of years through funds generated from local property taxes. All taxpayers under the jurisdiction of the taxing entity bear the burden of additional taxes to retire the debt.

Two methods directly place the fiscal responsibility of the improvement on the developer. One is to require the developer to construct the portion of the roadway improvement that is within or adjacent to their project. This can lead to a piecemeal transportation network that provides limited mobility. Another method is to exact an impact fee from the development which would be placed into a fund for road improvements. This method is effective when there is a significant amount of development in a relatively small geographic area.

Special taxing districts, road improvement districts or tax increment financing districts place the financial burden on the property owners who will benefit by the proposed improvement. With road improvement districts, bonds are sold and repaid through tax revenue generated within a defined geographic area that is determined to benefit from the improvements, usually in areas of new development. Tax increment finance (TIF) districts are usually reserved for areas targeted for redevelopment but also dedicate a portion of the tax revenue generated from within a defined geographic district for improvements in that district. The general public often views these methods as more equitable since those who accrue the benefits are responsible for the majority of the debt repayment.

Other mechanisms such as toll revenue financing would only be viable for limited or controlled access facilities. Efficient methods of toll collection are dependent on a facility having limited access points, such as a freeway or possibly a super arterial.

Plan Implementation

The Regional Thoroughfare Plan is a long-range plan that represents the ultimate build-out of a regional thoroughfare system for the San Antonio area. No attempt is
made here to create a timeline for the implementation of specific projects. The Plan creates a guide for arterial development to respond to current and anticipated development trends, while respecting the natural and physical constraints and the local environment.

The Plan must remain flexible to respond to changing goals of individual jurisdictions. Revisions to the Plan should stem from a rational decision-making process from an individual city or county and should not impair the overall intent of maintaining mobility of the San Antonio area. The Plan should be reviewed regularly. Revisions should respect the needs and constraints in a localized area but they must consider the impact to mobility of the entire region.

Amendments to the Plan

The Regional Thoroughfare Plan is intended to accommodate the ultimate future development of the area’s thoroughfare system. Many of the alignments are conceptual, long-term, and general in nature. To maintain flexibility in the planning process, an amendment procedure is outlined below. Changes may be made to the Plan if a more equitable, efficient, aesthetic, and practical roadway alignment is presented by property owners, developers, or other planning interests. Any development that is not consistent with the Plan will require an amendment. Since the alignments in the Plan are conceptual, minor deviations will be allowed. If it is determined that a request for an official amendment is necessary, the following general procedures are recommended.

To respond to proposed amendments, it is recommended that a standing review committee be created, comprised of one representative from the City of San Antonio – Planning Department, one from the City of San Antonio Development Services Department, one from the City of San Antonio – Public Works Department, one from Bexar County Public Works Department, one from AACOG, one from VIA, one representing the suburban cities, and one from TxDOT-San Antonio District, Advanced Planning Section. Additionally, if a proposed amendment would affect a suburban city not represented, that city would be included in the review process. The applicant would present the proposed amendment to the committee via the subdivision review process through which the project is reviewed. The reviewing jurisdiction would be responsible for forwarding the request to the committee. It will be up to the discretion of the committee to recommend acceptance of the proposed revision, request the MPO to run the travel demand model with the proposed revision (in the case of a deletion or
significant alignment modification) to test the impact of the proposed revision on the roadway network and then recommend acceptance or rejection of the proposed revision, or recommend rejection of the revision.

Access Management

As the region grows and land use densities intensify along with the public sector’s increasing constraints to fund infrastructure improvements, more must be done with the existing thoroughfare network to increase the mobility and travel safety for the San Antonio area. One method to achieve this goal is access management. Access management consists of a series of techniques or design elements that can be implemented on an existing or future roadway to allow for more efficient travel, while respecting the access needs of adjacent land uses. These elements may include the inclusion of turn lanes, auxiliary lanes, and raised medians; the establishment of minimum spacing requirements for driveways, median openings, and traffic signals; and the consolidation of existing driveways to reduce potential conflict points, thus increasing travel safety.

An additional focus of the study was the development of comprehensive policies for controlling access particularly with respect to intersection spacing and the number and density of direct access driveways along major streets. The overall goals of access control policies include safety, preservation of long-term integrity of the traffic movement function, and the promotion of aesthetically pleasing arterial corridors. These policies must be implemented consistently and must have some flexibility to react to specific situations.

This study provides examples of a variety of techniques available to help achieve these access management goals such as driveway design and placement considerations, arterial street design, and land use policies. It should be noted that these examples depict a synthesis of design considerations that have been developed by a variety of transportation engineers and planners from throughout the country. They have been portrayed in this document to provide a conceptual understanding of access control problems and solutions. Examples depicted in this document should not be assumed to be acceptable design standards in every municipality and on all streets. Each municipality or agency which has jurisdiction over public travelways generally requires a review and permit process before allowing the establishment of a direct access driveway on a major street. Thus, in preparing a site plan, or reviewing a development proposal,
local policies and regulatory standards must be examined in conjunction with any design standards depicted in this document.

To quantify the benefits of access management a series of case study analyses were performed using traffic simulation software on four existing San Antonio area roadways, Bitters Road at US 281, Southwest Military Drive at IH 35, Blanco Road at West Avenue, and Marbach Road at IH 410. The complete results of the analyses are presented in Appendix B of this study. In all cases, the introduction of access management elements to the design of the existing roadways improved travel efficiency in the immediate area.

The Bitters Road case study analyzed three scenarios: (1) the existing conditions, (2) the City’s proposed improvements for Bitters Road from West Avenue to Heimer Road, and (3) more stringent access management control. As seen in the Figure 4, there are many closely spaced driveways in the Bitters Road corridor.

Figure 4
Bitters Road Corridor Driveways
The measures of effectiveness and analysis results in Table 2 (Appendix B) were used for comparing the three alternatives. These measures reflect the mobility function of Bitters Road as an arterial within the San Antonio roadway system. In order to provide mobility, higher travel speeds and higher traffic volumes along with lower travel time delays are considered desirable. Environmental components such as decreasing emissions, decreasing fuel consumption and improving fuel efficiency are benefits. These benefits will become more important as the City’s air quality restrictions increase.

The system-wide measures show that both access-controlled alternatives generally improve the operations within the modeled area. This is indicated by reduced delays and travel times coupled with increased traffic volumes and speeds through the system.

The improved access control alternative results show an increased level of service when compared with the base condition. Simulation results from Netsim (traffic simulation software) indicate an increase in traffic volume of 25 to 45 percent. This increase in volume due to the reduction in access points is approximately equal to adding an additional lane to Bitters Road. The additional volume indicates trips from parallel facilities may be rerouting to the lower travel time facility. This rerouting is a combination of trips that previously avoided Bitters Road due to the level of congestion and trips now using Bitters Road to avoid other congested facilities. Those trips avoiding other congested facilities increase the miles traveled through the San Antonio system while the trips routed back to Bitters decrease the system-wide miles traveled.

The Netsim results also show a decrease in the total delay per vehicle (65 to 170 seconds per vehicle) coupled with a more substantial reduction in stop delay per vehicle (100 to 200 seconds per vehicle). This indicates the reduction in stops through the Bitters Road corridor has allowed vehicles to experience shorter delays (deceleration at signals, speed reductions due to increased volumes, etc.) not currently seen in the existing scenario. Simulated speeds have also increased 20 to 33 percent while the total time traveled through the system has decreased only slightly due to the increase in the number of vehicles traveling through the system. The improved access controlled alternative shows virtually no impact to environmental measures.

The full access controlled alternative shows greatly improved operations within the Bitters Road corridor for both AM and PM peak hours using both Netsim and Simtraffic. Simulated traffic volumes increase by nearly 50 to over 100 percent compared with the existing condition, equivalent to one to two additional lanes of existing capacity. The total delay and stop delay per vehicle decreased by 83 to 91 percent.
percent when compared with the existing scenario. The increase in Bitters Road speeds as simulated in Netsim rose from less than 3 miles per hour (mph) in the base alternative to between 17 and 27 mph in the full access controlled alternative. This implies the improvements would greatly increase the mobility provided by Bitters Road within the study area. Despite the large increase in the number of vehicles, the increased fuel efficiency and travel speeds result in a 30 to 40 percent reduction in fuel consumption.

The traffic analysis case studies of the other three corridors also analyzed three scenarios, (1) a hypothetical no-build, or baseline scenario, where all the driveways were completely removed; (2) the hypothetical scenario termed controlled-access scenario, where driveways were consolidated according to the proposed access management plan, with all driveway-generated traffic entering and exiting on the arterial; and (3) the existing scenario, where the existing driveways were modeled as built whenever possible (driveways spaced 40ft or less had to be consolidated for the model to run). The scenarios were applied to Southwest Military Drive at IH 35, Blanco Road at West Avenue, and Marbach Road at IH 410.

The no-build, or baseline, scenario was signal-optimized for the arterial. Its results represent the maximum theoretical limit for traffic flow quality on the arterial segment under study, for the assumed traffic volumes, turning movements, and geometric conditions. The results of the existing and the controlled-access scenarios are compared to one another and to the baseline, in order to assess the proposed access management measures' ability to improve flows on arterials.

As shown in the following figures and tables, the application of access management tools on the existing roadways greatly improved the average speeds and decreased travel delay.
Figure 5 – Blanco Road Analysis Location

Table 3. Blanco Road Performance

<table>
<thead>
<tr>
<th>Arterial Measure of Efficiency</th>
<th>Baseline Scenario</th>
<th>Controlled Access</th>
<th>Existing</th>
<th>Improvement with Proposed Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Speed (mph)</td>
<td>12</td>
<td>8</td>
<td>6</td>
<td>Increase 1.3 times (33%)</td>
</tr>
<tr>
<td>Stopped Delay / vehicle (sec)</td>
<td>68</td>
<td>121</td>
<td>304</td>
<td>Decrease 2.5 times (151%)</td>
</tr>
<tr>
<td>Delay / vehicle (sec)</td>
<td>86</td>
<td>140</td>
<td>320</td>
<td>Decrease 2.3 times (128%)</td>
</tr>
</tbody>
</table>
Regional Corridor Plan

Figure 6 – Marbach Road Analysis Location

Table 4. Marbach Road Performance

<table>
<thead>
<tr>
<th>Arterial Measure of Efficiency</th>
<th>Baseline Scenario</th>
<th>Controlled Access</th>
<th>Existing Scenario</th>
<th>Improvement with Proposed Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Speed (mph)</td>
<td>15</td>
<td>14</td>
<td>6</td>
<td>Increase 2.3 times (133%)</td>
</tr>
<tr>
<td>Stopped Delay / vehicle (sec)</td>
<td>45</td>
<td>46</td>
<td>212</td>
<td>Decrease 4.6 times (360%)</td>
</tr>
<tr>
<td>Delay / vehicle (sec)</td>
<td>62</td>
<td>60</td>
<td>229</td>
<td>Decrease 3.8 times (281%)</td>
</tr>
</tbody>
</table>
A measure not analyzed in the traffic analysis, but perhaps the most important function of access management, is safety. Adequate driving spacing, median separated traffic, and concentrated left turn locations all reduce the number of points of potential conflict between moving traffic and traffic attempting to enter or exit the primary traffic stream. A reduction of conflict points translates into a reduction of accidents, providing a safer, more efficient roadway.
A set of desirable access management criteria was developed and is presented as Appendix C of this document. These criteria are more stringent than the criteria currently present in the City of San Antonio Unified Development Code and those that were presented in draft form by the Texas Department of Transportation in May 2002.

The following discussion presents a comparison of access management techniques found in the current City of San Antonio Unified Development Code, the proposed criteria of TxDOT, and the proposed desirable criteria. Access management in the City of San Antonio Unified Development Code (UDC) is addressed in Section 35-506 – Transportation and Street Design in subsections (n) Medians and (r) Access and Driveways. TxDOT released its Draft Access Management Manual in May 2002.

The UDC states that median openings shall be at least 400 feet apart. This is contrary to the proposed TxDOT Access Management criteria and the desirable criteria proposed in this study. Both TxDOT and the desirable criteria are based on the roadway’s functional classification and the density of existing surrounding development. Neither of these sets of criteria (TxDOT or desirable) allows for median openings at less than 660 feet (TxDOT) and only in fully developed areas where more stringent criteria can not be satisfied. In more sparsely developed areas, the distance between openings is a minimum of 1,320 feet.

Larger differences exist between the criteria for the location of access points or driveways. The UDC states that the number of access points will be based on the following criteria: (A) for lots less than two hundred (200) feet of frontage, one (1) access point may be permitted; (B) for lots with a frontage of two hundred (200) feet or more, one access point for every 200 feet of frontage will be permitted. The minimum proposed TxDOT criteria for access spacing allows a driveway every 330 feet, but only on fully developed roadways, with a traversable or no median, and speed limits less than 35 mph. The driveway criteria developed for the consultant team is less stringent, allowing for driveways every 155 feet on fully developed roadways, but only at speeds of 25 mph or less. In both the criteria developed by TxDOT and that developed by the consultant team the distance required between driveways increases significantly in more sparsely developed areas. In some cases with the TxDOT criteria this distance can be as great as one-half mile.

The UDC criteria are a great improvement over the traditional patterns of driveway access, signal spacing, and median breaks that have developed through the
Regional Corridor Plan

years in San Antonio. However, it is suggested that certain modifications be made to the UDC to provide better tools for preserving safety and mobility on area thoroughfares.

It is recommended that the City and surrounding jurisdictions adopt standards similar to those summarized below. Instead of a uniform criteria, as currently required in the UDC, the access management criteria is based on a roadway’s functional classification and the density of the surrounding development. Roadways with a lower functional classification and intense existing development would have criteria that would allow for more driveways, median openings, and more frequent traffic signals than a higher classified roadway.

Table 6. Summary of Access Category Standards

<table>
<thead>
<tr>
<th>Category</th>
<th>Development Type (ft)</th>
<th>Signal Spacing (ft)</th>
<th>Unsignalized Median Opening (ft)</th>
<th>Driveways (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Arterials</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sparse</td>
<td></td>
<td>2640</td>
<td>1320</td>
<td>1320 &gt; 55 mph 990 &gt; 50 mph</td>
</tr>
<tr>
<td>Partial</td>
<td></td>
<td>2640</td>
<td>1320**</td>
<td>1320 &gt; 55 mph 990 @ 45 or 50 mph 660 &lt; 40 mph</td>
</tr>
<tr>
<td>Full</td>
<td></td>
<td>1320* (no additional signals)</td>
<td>Median construction**</td>
<td>305 @ 40 mph 250 @ 35 mph 200 @ 30 mph 155 @ 25 mph</td>
</tr>
<tr>
<td><strong>Secondary Arterials</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sparse</td>
<td></td>
<td>2640</td>
<td>1320</td>
<td>1320 &gt; 55 mph 990 @ 45 or 50 mph 660 &lt; 40 mph</td>
</tr>
<tr>
<td>Partial</td>
<td></td>
<td>2640</td>
<td>1320**</td>
<td>1320 &gt; 55 mph 990 @ 45 or 50 mph 660 &lt; 40 mph</td>
</tr>
<tr>
<td>Full</td>
<td></td>
<td>1320* (no additional signals)</td>
<td>Median construction**</td>
<td>305 @ 40 mph 250 @ 35 mph 200 @ 30 mph 155 @ 25 mph</td>
</tr>
</tbody>
</table>

* Signal spacing should not be decreased from present conditions
** Median opening must meet geometric criteria

It should be noted that TxDOT has controls over large portions of many of San Antonio’s major roadways. Should any proposed Access Management Criteria of
Regional Corridor Plan

TxDOT by approved, new development along these roadways will be subject to these standards. Additionally, attempts would be made to retrofit the roadway should any major reconstruction be scheduled. TxDOT’s proposed criteria have met with strong opposition in many parts of the state and their future is uncertain. Some of the arterial roads in San Antonio that would be subject to these TxDOT standards include, but are not limited to, Blanco Road (north of Loop 410), NW Military Drive, Wurzbach Parkway, Fredericksburg Road, Bandera Road, Culebra (west of Loop 410), Potranco Road, Old Pearsall (SW Military to Loop 1604), Loop 13 (SW Military, SE Military, WW White), Austin Highway, Perrin Beitel/Nacogdoches, and the proposed Kelly Parkway.

The field of access management is continuing to evolve and it will continue to be studied. It is recommended that agencies review access management principles and tools as they are developed and implement those which are proven to be effective at improving mobility and safety.

Stakeholder Involvement

During the development of the Regional Thoroughfare Plan Update and the access management standards recommendations, several stakeholder meetings were held to discuss the progress and results of the study. Briefings on the project were given to the City of San Antonio’s Mayor’s Office, the City of San Antonio’s Assistant City Manager, the City of San Antonio’s Land Development Services Committee, the City of San Antonio’s Planning Commission, the Greater Bexar County Council of Cities, and the Bexar County Commissioner’s Court. Other groups who were provided project information, but did not feel the need for a meeting included, City of San Antonio Neighborhood Action Department, the Northwest Neighborhood Alliance, the Real Estate Council, and the San Antonio City Council’s Quality of Life Committee.

Each briefing consisted of a short presentation of the project background, the development of the Regional Thoroughfare Plan Map, and access management techniques. Comments specific to the proposed thoroughfare alignments on the map and particular access management techniques were limited. Several comments were received regarding the approval process of the Plan and procedures and reasons for amending the plan. Also, many stakeholders mentioned the need for the plan to go through formal adoption by the agencies, to enforce the approved plan, and require any parties proposing amendments to demonstrate an alternative that would work as well or better than the
original plan. The complete notes of the stakeholder meetings are included in Appendix D of this document.

Recommendations

The Regional Corridor Plan should help improve the quality of life for the citizens of San Antonio and Bexar County. The Regional Corridor Plan supports many of the goal, policies and actions of the City of San Antonio’s Master Plan policies including:

- Develop policies for various transportation modes that increase access to employment centers, community services, and cultural, recreational, educational and commercial facilities; and decrease the reliance on single occupancy vehicles.

- Consider impacts of transportation on the recharge zone when revising and implementing the Major Thoroughfare Plan.

- During the construction of all major thoroughfares and the reconstruction of existing major thoroughfares, install medians unless not feasible.

- Develop traffic control measures such as minimizing or sharing of driveways.

The Regional Corridor Plan also supports many of the MPO’s adopted Metropolitan Transportation Plan goals:

- Invest in the development of a regional transportation system that serves to increase the mobility and efficiency of the movement of people and goods.

- Encourage the cost effective expansion of the regional transportation system to meet the growing mobility needs while ensuring air quality; enhancing the safety of the traveling public; fostering appropriate land use patterns.

- Promote the development of a regional transportation system that recognizes the unique characteristics of the San Antonio-Bexar County area and ensures respect for neighborhoods, historic and archeological resources, the Edwards Aquifer and other social and environmental issues.
The Regional Corridor Plan is intended to provide the foundation on which local governments, with regulatory powers, can develop their own thoroughfare plans. It is recommended that the local governments incorporate the elements of the Regional Corridor Plan into their own plans in order to preserve the intent of improving area traffic mobility and safety. Specific elements in the Regional Corridor Plan should be highlighted, as they will by viewed as a departure from the current practices of roadway development in the San Antonio area. These include the recommendations for the preservation of corridors of adequate width to construct a roadway capable of providing safe, efficient travel; the incorporation of access management elements in roadway design; and the adherence to a regional vision of mobility, realizing that action undertaken in one jurisdiction will affect mobility in adjacent jurisdictions.

The Regional Corridor Plan seeks to promote safety and efficiency, better utilize current and expanded roadway capacity, and consider urban design as an integral part of the overall transportation system for the region.
Appendix A

Regional Thoroughfare Plan Map
Regional Thoroughfare Plan
Regional Thoroughfare Plan
Appendix B

Traffic Analysis
INTRODUCTION

Bitters Road serves as an arterial within the San Antonio, Texas roadway system. As an arterial, the primary goal of the roadway should be to provide mobility within the system rather than access to adjacent lands. The Bitters Road corridor of San Antonio currently has very poor access control in the vicinity of the U.S. 281 interchange. This analysis is intended to quantify the operational improvements that would be expected by implementing access management techniques along Bitters Road. The analysis was conducted on a 0.52 mile section of Bitters Road between West Avenue and Heimer Road including the interchange of Bitters Road with the U.S. 281 frontage roads (see Figure 1). Two traffic simulation programs were used in the analysis, Synchro/Simtraffic and Netsim. Netsim, which is the surface streets portion of Corsim, is generally considered to be a proven simulation package in the United States, but offers no traffic signal optimization features. Synchro specializes in the analysis and optimization of traffic networks and provides simulation through Simtraffic.

TRIP GENERATION AND TURNING MOVEMENTS

The first step in the analysis was to identify the land uses adjacent to Bitters Road. These land use types were combined with parcel and building size information gathered from the aerial photograph shown in Figure 1. The Institute of Transportation Engineers Trip Generation Manual, Version 6\(^1\) was used to estimate the number of trips into and out of each land use type. These trip generation estimates were assigned to driveways in order to approximate movements onto and off of the surface street system. Table 1 shows the number of trips into and out of each parcel for AM and PM peak hours. These trips were then combined with traffic counts collected at major intersections to produce turning movements at intersections and driveways along Bitters Road.

| Hour | Main Street Resident | 4th | 3rd | 2nd | 1st | Total
|------|----------------------|-----|-----|-----|-----|------
| 00   | 1000                | 00  | 00  | 00  | 00  | 00   |
| 01   | 2000                | 02  | 02  | 02  | 02  | 02   |
| 02   | 3000                | 04  | 04  | 04  | 04  | 04   |
| 03   | 4000                | 08  | 08  | 08  | 08  | 08   |
| 04   | 5000                | 16  | 16  | 16  | 16  | 16   |
| 05   | 6000                | 32  | 32  | 32  | 32  | 32   |
| 06   | 7000                | 64  | 64  | 64  | 64  | 64   |
| 07   | 8000                | 128 | 128 | 128 | 128 | 128  |
| 08   | 9000                | 256 | 256 | 256 | 256 | 256  |
| 09   | 10000               | 512 | 512 | 512 | 512 | 512  |
| 10   | 11000               | 1024| 1024| 1024| 1024| 1024 |
| 11   | 12000               | 2048| 2048| 2048| 2048| 2048 |
| 12   | 13000               | 4096| 4096| 4096| 4096| 4096 |
| 13   | 14000               | 8192| 8192| 8192| 8192| 8192 |
| 14   | 15000               | 16384|16384|16384|16384|16384|
EXISTING CONDITIONS

The three alternatives analyzed differ in the level of access management imposed on businesses adjacent to Bitters Road between West Avenue and Heimer Road. The first alternative analyzes traffic operations as they currently exist. This includes very close driveway spacing as a result of all businesses having unique and often multiple access points to Bitters Road. The cross-section of Bitters Road is five lanes with a center two-way left-turn lane (TWLTL). Simulation of a TWLTL is problematic using both Simtraffic and Netsim. This was overcome through the use of short left turn bays added to the four-lane cross-section at all driveways. Figure 2 shows the Simtraffic model for the existing alternative. Notice that 46 driveways exist within the study area, of which 23 access directly with Bitters Road between West Avenue and Heimer Road.

ACCESS MANAGEMENT

The high number of driveways that intersect with Bitters Road cause several undesirable operating conditions. According to the Highway Capacity Manual 2000\(^2\), the free flow speed of a multi-lane facility decreases 2.5 miles per hour (mph) for every 10 access points per mile on the right side of the road. Bitters Road contains 22 right-side access points eastbound between West Avenue and Heimer Road, a distance of 0.52 miles. This results in a density of over 40 access points per mile and a reduction in free-flow speed of approximately 10 mph. The westbound direction has 15 access points that contribute a 7 mph reduction in free-flow speed. The American Association of State Highway and Transportation Officials (AASHTO) \(^3\) states that accident rates increase on arterial streets as the number of adjacent businesses and at-grade intersections increase. The study area contains 15 businesses with direct access to Bitters Road with 5 at-grade intersections in the 0.52 mile stretch. The expected accident rate is 40 percent higher than the rate of a similar roadway with no business access and 4 at-grade intersections. The Access Management Handbook\(^4\) reports the findings of several case studies in which a congested urban arterial was reconstructed using access management techniques. The findings indicate that highway capacity is increased at locations where access management techniques were incorporated into the reconstruction projects. Additionally, accident rates tended to decrease while retail business along the corridor increased after the access management projects were completed.

\(^4\) Access Management Handbook, Center for Transportation Research and Education, Iowa State University, 2901 S. Loop Drive, Ames, Iowa, 2000.
The second alternative simulated the effects of improved access control, reducing the number of driveways along the entire project extent from West Avenue to Heimer Road as shown in Figure 3. This alternative represents a level of access management that could be achieved by ‘retro-fitting’ good traffic engineering and access management practices into the existing corridor. Ten driveways are eliminated between West Avenue and the U.S. 281 interchange and two driveways are eliminated between U.S. 281 and Heimer Road. This reduces the density from 40 to 25 access points per mile eastbound and from 30 to 17 access points per mile westbound. Additionally, a center median is added on Bitters Road from Embassy Oaks to the intersection of U.S. 281 Southbound Access Road. This results in right-in, right-out maneuvers only at those driveways between Embassy Oaks and the U.S. 281 interchange. A ‘backage’ road connecting Embassy Oaks with developments to the east provides access to those businesses for vehicles traveling west on Bitters Road.

The third alternative represents the hypothetical condition where recommended intersection and driveway spacing could be implemented. The full access control alternative installs a center median between West Avenue and Heimer Road and eliminates all driveway access to Bitters Road from all adjacent parcels (see Figure 4). Access density is reduced to 10 points per mile.
in both east and westbound directions. Access is provided through the use of backage roads that connect the land uses to streets intersecting with Bitters Road. These backage roads carry traffic through existing parking lots, allowing for full access to the surrounding land uses. The first backage road is located south of Bitters Road from West Avenue, across Embassy Oaks, to the Southbound U.S. 281 frontage road. This backage road would provide access to all parcels south of Bitters Road. The second backage road provides access to businesses north of Bitters Road and is located between the Southbound Access Road north of the Bitters/U.S. 281 interchange and the entrance to Hill Country Village located east of the existing Embassy Oaks intersection. The center median is continuous from West Avenue to the U.S. 281 interchange, providing right-in, right-out access at Embassy Oaks and the Hill Country Village intersections. The center median is also installed from the U.S. 281 interchange to Heimer Road. Access to adjacent parcels is provided only through the use of parking lot connections to Heimer Road.

SIMULATION MODELS

The simulation models were used to measure the benefits associated with improved corridor operations and travel times as well as possible disbenefits associated with longer trip lengths resulting from the access control measures. Once all traffic movements and infrastructure changes were estimated for the two analysis periods, a Synchro model was produced. Synchro requires both the hourly volume of traffic as well as the physical infrastructure (number of lanes, length of turn bays, traffic control, etc.). Traffic signal phasing was provided while cycle lengths and offsets were optimized using Synchro. Simtraffic was used to simulate the networks for both AM and PM proposed alternatives. For the existing alternative, the close spacing of driveways produced link lengths of less than 100 feet in many locations along the mainline of Bitters Road. These short links caused a breakdown of the car-following theories within Simtraffic, resulting in vehicles not progressing through the network but rather stalling at intersections for the remainder of the simulation. Therefore, Synchro/Simtraffic
Table 2

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Full Access Control</th>
<th>Improved Access Control</th>
<th>Existing Access Control</th>
<th>Synchro Access Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1.5</td>
<td>1.2</td>
<td>1.0</td>
<td>0.8</td>
</tr>
<tr>
<td>2.5</td>
<td>1.5</td>
<td>1.2</td>
<td>1.0</td>
<td>0.8</td>
</tr>
<tr>
<td>5</td>
<td>1.5</td>
<td>1.2</td>
<td>1.0</td>
<td>0.8</td>
</tr>
<tr>
<td>PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2.0</td>
<td>1.5</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>9</td>
<td>2.0</td>
<td>1.5</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>12</td>
<td>2.0</td>
<td>1.5</td>
<td>1.2</td>
<td>1.0</td>
</tr>
</tbody>
</table>

System Measures of Effectiveness

- Average Travel Time
- Volume
- Delay
- Speed
- Fuel Use
- Congestion

Simulation Results

- Alternative 1
- Alternative 2
- Simulation
- Validation
- Calibration
- Verification

Bidders Road

Bidders Road

Bidders Road

Bidders Road

Bidders Road

Bidders Road
results are not available for the existing AM and PM scenarios. The results of the remaining 4 scenarios are shown in Table 2. Netsim networks were then created using the data stored in Synchro for the 6 scenarios shown in Table 2. The Netsim simulation appears more reflective of existing and anticipated conditions than the Simtraffic results for this particular corridor since no instances of car-following theory breakdowns were observed in the Netsim simulation. The simulations for all scenarios were performed with three random numbers with results in Table 2 representing the average of the three simulations.

**ANALYSIS RESULTS**

The measures of effectiveness and analysis results in Table 2 were used for comparing the three alternatives. These measures reflect the mobility function of Bitters Road as an arterial within the San Antonio roadway system. In order to provide mobility, higher travel speeds and higher traffic volumes along with lower travel time delays are considered desirable. Improving environmental components such as emissions, fuel consumption and fuel efficiency are also considered benefits within the study.

The system-wide measures show that both access controlled alternatives generally improve the operations within the modeled area. This is indicated by reduced delays and travel times coupled with increased traffic volumes and speeds through the system.

The improved access control alternative results show an increased level of service when compared with the base condition. Simulation results from Netsim indicate an increase in traffic volume of 25 to 45 percent. This increase in volume due to the reduction in access points is approximately equal to adding an additional lane to Bitters Road. The additional volume indicates trips from parallel facilities may be rerouting to the lower travel time facility. This rerouting is a combination of trips that previously avoided Bitters Road due to the level of congestion and trips now using Bitters Road to avoid other congested facilities. Those trips avoiding other congested facilities increase the miles traveled through the San Antonio system while the trips routed back to Bitters decrease the system-wide miles traveled. The Netsim results also show a decrease in the total delay per vehicle (65 to 170 seconds per vehicles) coupled with a more substantial reduction in stop delay per vehicle (100 to 200 seconds per vehicle). This indicates the reduction in stops through the Bitters Road corridor has allowed vehicles to experience other delays (deceleration at signals, speed reductions due to increased volumes, etc.) not currently seen in the existing scenario. Simulated speeds have also increased 20 to 33 percent while the total time traveled through the system has
decreased only slightly due to the increase in the number of vehicles traveling through the system. The improved access controlled alternative shows virtually no impact to environmental measures.

The full access controlled alternative shows greatly improved operations within the Bitters Road corridor for both AM and PM peak hours using both Netsim and Simtraffic. Simulated traffic volumes increase by nearly 50 to over 100 percent compared with the existing condition, equivalent to one to two additional lanes of existing capacity. The total delay and stop delay per vehicle decrease by 83 to 91 percent when compared with the existing scenario. The increase in Bitters Road speeds as simulated in Netsim from less than 3 miles per hour (mph) in the base alternative to between 17 and 27 mph in the full access controlled alternative implies the improvements would greatly increase the mobility provided by Bitters Road within the study area. Despite the large increase in the number of vehicles, the increased fuel efficiency and travel speeds result in a 30 to 40 percent reduction in fuel consumption.

CONCLUSIONS
The measures of effectiveness indicate that the full access controlled alternative helps Bitters Road achieve the functional goals of an arterial, resulting in a more desirable level of service for traffic. The number of vehicles moving through the system could increase 50 to 100 percent with substantially higher speeds while significantly reducing delay and fuel consumption with minimal changes to the Bitters Road mainline. Access is still provided into surrounding developments with travel times to these destinations likely to decrease despite the lack of direct access. However, the full access controlled alternative requires more capital investment than the improved access controlled alternative. This alternative should be considered the recommended approach for new construction only.

The improved access controlled alternative also provides benefits, but at a smaller scale than the full access controlled alternative. The access management techniques achieve higher travel speeds and capacities while delays decrease through the system. The capital improvements required for this alternative are considerably less than those required for the full access controlled alternative. Although the full access controlled alternative would result in more favorable traffic operations, the increased capital cost may offset the benefits. Therefore, it is recommended that the improved access controlled alternative be considered the preferred strategy for the Bitters Road corridor.
Analysis of Driveway Spacing On San Antonio Arterials

Prepared by
TransAnalysis

Prepared for
HNTB Corporation
As part of the study the
San Antonio Regional Corridor Plan
for the
San Antonio-Bexar County Metropolitan Planning Organization
Analysis of Driveway Spacing On San Antonio Arterials

Study Scope and Objectives

This report documents the modeling approach, data collection, and results of a study of three arterials in San Antonio, Texas: Blanco Road, Marbach Road and Southwest Military Drive. The study objectives are to determine the influence of driveway spacing in the arterial performance, and to test the proposed driveway spacing standards. The study results will be used to develop an access management plan for the San Antonio Metropolitan area.

Arterials Characteristics

Figures 1, 2 and 3 shows the results of a survey of arterial intersections, driveway spacing, and types of business served by the driveways. Driveways can be as close as 30 feet, and are almost never more than 150 feet apart.

Study Approach

Study Scenarios

For each arterial, three scenarios were developed: (1) a hypothetical no-build, or baseline scenario, where all the driveways were completely removed; (2) another hypothetical scenario, termed controlled-access scenario, where driveways were consolidated according to the proposed access management plan, with all driveway-generated traffic entering and exiting on the arterial; and (3) the existing scenario, where the existing driveways were modeled as built whenever possible (driveways spaced 40ft or less had to be consolidated for the model to run).

The no-build, or baseline, scenario was signal-optimized for the arterial. Its results represent the maximum theoretical limit for traffic flow quality on the arterial segment under study, for the assumed traffic volumes, turning movements, and geometric conditions. The results of the existing and the controlled-access scenarios are compared to one another and to the baseline, in order to assess the proposed access management measures' ability to improve flows on arterials.

Modeling Approach

The state of the art in traffic software still precludes combining the simulation of small driveway spacing, two-way left turn lanes, and coordinated signals in the same program. Most traffic softwares in the market were developed to help solve specific conditions, and none of them has logic to handle conflicting traffic in the same lane. Typically, most traffic studies represent a two-way left turn lane as two back-to-back left turn bays. As for driveways, their presence is accounted for by adjusting the saturated flow rates as a function of parking and/or traffic from mid-block on each network link. This approach can be quite accurate for most studies; for the case at hand, however, the actual geometry of driveways is being examined. The two-way left turn lane cannot be substituted for
a series of short back-to-back left turn bays between every two driveways, without seriously compromising compatibility among the three scenarios.

In order to represent the driveways and the left turn movements in the same model, it is necessary to model the two-way left turn lane as one left turn lane for each direction. This more than doubles the capacity for left turn movements; however, since this capacity increase is consistent among all scenarios, the study objectives are met, because they depend solely on comparison among scenarios.

**Comparative Analysis and Measures of Effectiveness**

The scenario conditions were interpreted and discussed by comparing the following measures of effectiveness (MOE) for the arterial:

- Average Speed (mph)
- Stopped Delay / vehicle (sec)
- Delay / vehicle (sec)
- Queuing Penalty

The first three MOEs are self-explanatory. The queuing penalty is the number of vehicles affected by queues, multiplied by the percent of time blocked. It combines the two undesirable queuing characteristics in one number: (1) time wasted in queues, and (2) number of vehicles affected by queues. The larger the number of vehicles affected by queues, the larger (worse) this MOE; also, the largest the time spent queued, the worse this MOE.

**Study Limitations**

Specific results and measures of effectiveness for each individual scenario are valid exclusively in the context of comparative scenario performance, and in no circumstance should be construed as an accurate representation of the arterial under study, for the following reasons:

- Turning movement counts were available for only two intersections. In order to perform the comparison, the unavailable movements had to be assumed. Departures from the assumed volumes would not change the conclusions based on scenario comparison, as these changes would consistently affect all three scenarios in the same way; however, the actual performance may be different than the calculated one because of discrepancies between actual and assumed traffic volumes.
- Due to lack of budget for data collection, traffic counts obtained for this study were limited to one-direction 24-hour counts at each external node.
- Signal timing data was not available. Instead, the study optimized signals for the arterial under study, and used the optimized signal plan in all scenarios.
- Two-way left-turn lanes cannot be accurately modeled in the presence of driveways. Two way left turn lanes had to be substituted for one one-way left turn lane in each direction. Therefore, individual scenario results overestimate the actual left-turn capacity and arterial performance. Individual scenario results would be valid only after calibration and sensitivity analysis, a considerable effort that is significantly beyond the scope of the study and the data availability. It is important to realize that scenario comparisons are the only objective of this study, and as such they are valid, since the added capacity was kept consistent in all three scenarios,
- The models cannot accurately capture gas stations at the corners, because of a built-in limit on the minimum distance between the driveway and the actual intersection. These gas stations had to be consolidated with the other adjacent
driveways even for the existing scenario. For analogous reasons, the minimum driveway spacing that can be modeled is 40 feet.

Traffic Data

Data Sources

1. Turning movements at West Avenue and Blanco intersection, and at Southwest Military and Northbound IH35, taken by the city.
2. Two-directional average daily traffic, taken by the state in 2000.
3. 24-hour hourly counts on each corridor end, counted in January 2002.
5. Texas Transportation Institute, IH10 Frontage Road at De Zavala Road, Technical Memorandum prepared for TxDOT, July 2000.
6. Field survey of land use and driveway spacing adjacent to the arterials (see figures 1, 2 and 3).

Data Reduction

The traffic data reduction process consisted of the following steps:

- Project the available turning movements counts based on the most recent data (source 3 on the list above);
- Estimate the turning movements on intersections other than those listed in source 1 above, based on information from sources 1, 4, 5, and 6;
- Estimate driveway demand based on sources 4, 5 and 6.
- Balance the volumes at all intersections, using data from source 3 as the starting point, and making sure the projected turning movements are compatible with the proportions observed in source 1.

Blanco Road

Traffic volumes for this arterial were available from three sources: ADTs, TransAnalysis external node counts, and turning movement counts for the West Avenue intersection. The models used the most recent external node counts (obtained by TransAnalysis), combined with the turning movement proportions from data obtained by HNTB from the MPO. The afternoon peak was modeled, in order to capture the largest traffic volumes in and out of the driveways (maximum number of business simultaneously open). Volumes were 1875 vph at the northbound external node, and 1160 vph at the southbound external node.

Table 1 summarizes the results of the three modeled scenarios for Blanco Road. The first column indicates the MOE used for evaluation. The next three columns indicate the model results, and the last column indicates the improvements that would occur if the proposed spacing were in place instead of the existing spacing.
### Table 1 Blanco Road Performance

<table>
<thead>
<tr>
<th>Arterial MOE</th>
<th>Baseline Scenario</th>
<th>Controlled Access</th>
<th>Existing Scenario</th>
<th>Improvement with Proposed Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Speed (mph)</td>
<td>12</td>
<td>8</td>
<td>6</td>
<td>Increase 1.3 times (33%)</td>
</tr>
<tr>
<td>Stopped Delay / vehicle (sec)</td>
<td>68</td>
<td>121</td>
<td>304</td>
<td>Decrease 2.5 times (151%)</td>
</tr>
<tr>
<td>Delay / vehicle (sec)</td>
<td>86</td>
<td>140</td>
<td>320</td>
<td>Decrease 2.3 times (128%)</td>
</tr>
<tr>
<td>Queuing Penalty</td>
<td>420</td>
<td>1300</td>
<td>2745</td>
<td>Decrease 2.1 times (111%)</td>
</tr>
</tbody>
</table>

A discussion of the baseline scenario (maximum theoretical performance) compared to the other scenarios is useful to better clarify the positive impacts of the proposed access management plan. The controlled access scenario can serve a certain traffic demand in and out of the driveways, at 67 percent of the baseline arterial speed, while the existing conditions cause the arterial speed to drop to half of the baseline speed. Controlled access increases the delays per vehicle by 63 percent, compared to the almost fourfold increase caused by the existing driveways. The queuing penalty approximately doubles when controlled access is introduced, while the existing driveways increase queuing penalty by 6 and a half times.

### Marbach Road

The only available data for this arterial were ADT at Marbach and Loop 410. TransAnalysis obtained 24-hour counts at the corridor external nodes. The models used 1300 vehicles per hour on the eastbound external node, and 950 vph on the westbound external node. All turning movements were assumed. Volumes on Loop 410 frontage roads were also assumed.

Table 2 summarizes the results of the three modeled scenarios for Marbach Road performance. The first column indicates the MOE used for evaluation. The next three columns indicate the model results, and the last column indicates the improvements that would occur if the proposed driveway spacing were in place instead of the existing one.

### Table 2 Marbach Performance

<table>
<thead>
<tr>
<th>Arterial MOE</th>
<th>Baseline Scenario</th>
<th>Controlled Access</th>
<th>Existing Scenario</th>
<th>Improvement with Proposed Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Speed (mph)</td>
<td>15</td>
<td>14</td>
<td>6</td>
<td>Increase 2.3 times (133%)</td>
</tr>
<tr>
<td>Stopped Delay / vehicle (sec)</td>
<td>45</td>
<td>46</td>
<td>212</td>
<td>Decrease 4.6 times (360%)</td>
</tr>
<tr>
<td>Delay / vehicle (sec)</td>
<td>62</td>
<td>60</td>
<td>229</td>
<td>Decrease 3.8 times (281%)</td>
</tr>
<tr>
<td>Queuing Penalty</td>
<td>25</td>
<td>137</td>
<td>2069</td>
<td>Decrease 15.1 times (1410%)</td>
</tr>
</tbody>
</table>
Marbach Road baseline performance changed very little when controlled access driveways were added, highlighting the effectiveness of the proposed driveway spacing plan. The delays were approximately the same for both the baseline and the controlled access scenarios, while the average speed on the arterial decreased less than 7 percent.

With the existing scenario, baseline delays increase 3.8 to 4.6 times, while the average speed drops to less than half of that observed with either the baseline or the controlled access scenarios. The queuing penalty increased over 15 times, indicating a large number of vehicles affected by queues, combined with long queuing times on the arterial.

**Southwest Military Drive**

Turning movement counts were available for the intersection with both IH35 Frontage Roads. All other turning movements were assumed. TransAnalysis obtained 24-hour counts at the corridor external nodes. The models used 2,500 vehicles per hour on the eastbound external node, and 2,000 vehicles per hour on the westbound external node.

Table 3 summarizes the results of the three modeled scenarios for Southwest Military Drive performance. The first column indicates the MOE used for evaluation. The next three columns indicate the model results, and the last column indicates the improvements that would occur if the proposed spacing were in place instead of the existing spacing.

<table>
<thead>
<tr>
<th>Arterial MOE</th>
<th>Baseline Scenario</th>
<th>Controlled Access</th>
<th>Existing Scenario</th>
<th>Improvement with Proposed Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Speed (mph)</td>
<td>14</td>
<td>12</td>
<td>7</td>
<td>Increase 1.7 times (71%)</td>
</tr>
<tr>
<td>Stopped Delay / vehicle (sec)</td>
<td>94</td>
<td>96</td>
<td>359</td>
<td>Decrease 3.7 times (274%)</td>
</tr>
<tr>
<td>Delay / vehicle (sec)</td>
<td>104</td>
<td>115</td>
<td>378</td>
<td>Decrease 3.3 times (229%)</td>
</tr>
<tr>
<td>Queuing Penalty</td>
<td>620</td>
<td>899</td>
<td>5019</td>
<td>Decrease 5.6 times (458%)</td>
</tr>
</tbody>
</table>

Southwest Military baseline MOEs did not change very significantly when controlled access driveways were added. The delays increased 2 to 10 percent, and the average speed decreased only 14 percent. The queuing penalty increased 45 percent.

With the existing scenario, however, baseline delays are multiplied by 3.8 to 4.6, while the speed drops to less than half of that observed in the baseline scenarios. The queuing penalty is over 15 times the baseline. A theoretical retrofit of this arterial to the proposed driveway spacing would cause very significant improvements in average speed, vehicle delay, and queuing penalty.
Summary of Conclusions

The three case studies clearly show the potential improvements in arterial performance that could be achieved by implementing the proposed access management plan for the San Antonio Metropolitan Area. Table 4 summarizes the scenario comparisons for the three case studies, in terms of negative impacts of each driveway scenario on the baseline performance, as well as the negative impact of the existing spacing compared to the proposed one.

Table 5 presents the same comparative summary, but by traffic volume range spanned by the case studies. The first two columns indicate the negative impacts on the baseline arterial performance if, respectively, the proposed and the existing driveway spacings were implemented. The last column indicates the negative impacts of the existing spacing, with respect to the performance with the proposed access plan. Small or negligible changes in performance are highlighted in *italics*.

Results of the Marbach Road and Military Highway indicate that the proposed driveway spacing can sometimes ensure access to the adjacent business while maintaining almost the same performance that would be achieved without driveways. Marbach Road has considerably lower volumes than the others; SW Military and Blanco have the same magnitude of traffic volumes, but Blanco has two through lanes while SW Military has three. Therefore, Blanco Road has the highest volume to capacity ratios of the three case studies.

On both Blanco and Southwest Military (which have higher volumes than Marbach), the proposed driveway spacing plan causes delays that are less than half of those observed with the existing scenario, and the drop in average speed with controlled access is about one third of the speed drop with the existing driveways.

The three case studies consistently point to the effectiveness of the proposed driveway spacing in reducing delays, reducing queues, and increasing average arterial speed. These effects were observed to be very significant in all three case studies, which span from medium to high traffic volumes.
<table>
<thead>
<tr>
<th>Negative Impacts</th>
<th>Controlled / Baseline</th>
<th>Existing / Baseline</th>
<th>Existing / Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Blanco</td>
<td>Marbach</td>
<td>SW Military</td>
</tr>
<tr>
<td>Decrease in Speed</td>
<td>33.3%</td>
<td>6.7%</td>
<td>14.3%</td>
</tr>
<tr>
<td>Increase in Stopped Delay</td>
<td>77.9%</td>
<td>2.2%</td>
<td>2.1%</td>
</tr>
<tr>
<td>Increase in Delay</td>
<td>62.8%</td>
<td>-3.2%</td>
<td>10.6%</td>
</tr>
<tr>
<td>Increase in Queuing Penalty</td>
<td>209.5%</td>
<td>448.0%</td>
<td>45.0%</td>
</tr>
</tbody>
</table>

**Table 5 Summary of Impacts of Existing and Proposed Driveway Spacing**

<table>
<thead>
<tr>
<th>Arterial MOE</th>
<th>Baseline Controlled vs Access</th>
<th>Baseline Existing vs Controlled vs Access Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High Volume</td>
<td>Medium Volume</td>
</tr>
<tr>
<td>Average Speed (mph)</td>
<td>Decrease 14%--33%</td>
<td>Decrease 6%--7%</td>
</tr>
<tr>
<td>Stopped Delay / vehicle (sec)</td>
<td>Increase 2%--78%</td>
<td>Increase 1-2%</td>
</tr>
<tr>
<td>Delay / vehicle (sec)</td>
<td>Increase 10%--60%</td>
<td>Increase 1-2%</td>
</tr>
<tr>
<td>Queuing Penalty</td>
<td>Increase 45% to 3 times</td>
<td>Increase 5--6 times</td>
</tr>
</tbody>
</table>
Appendix C

Access Management Criteria
Access Management Criteria

Basis for Access Management

Legal Background

Modern highway policy and planning incorporate the concept of access control to protect the public investment and the public’s health, safety, and welfare. The information contained in the "Functional Classification System" segment of this section establishes that the transportation system should be operated differently depending upon land use, facility type, speed, topography and myriad of other factors.

The legal basis for controlling access on streets and highways provides the means for balancing the public interest and private property rights in making access management decisions. Access law is mainly implemented through public police powers and eminent domain.

The legal feasibility of various access control and management techniques is determined by assessing each state’s legal authority to deny, to control, and to alter access points of landowners abutting a state highway or local street. Two conflicting points underlie the legal feasibility of access control: (1) the public has the right of safe and efficient movement on roadways regardless of ingress and egress at commercial access points; and (2) a landowner, by the nature of his property and its position along the highway, is entitled to suitable and sufficient access. Access control techniques must effectively satisfy these two competing requirements.

The legal basis for the management of access control recognizes this conflict between the public interest (i.e., safe, efficient, traffic movement) and private interests (property access). Direct access to an abutting street or highway is generally considered a valuable property right. Little agreement can be found, however, among the various states as to whether a property owner has a right to compensation for loss of direct access when a frontage road or other indirect means of ingress and egress to his property is made available.

When a government alters or restricts access, the question that arises first is whether the alteration or restriction is significant enough to be considered a compensable limitation on access. For example, courts have held that a landowner has no property right in the flow of traffic along the street which abuts his premises and cannot complain of public improvements or regulations, such as traffic control devices, one-way streets and centerline medians that have the effect of diverting traffic to other streets or result in inconvenience and circuitry of travel.

If, however, the government-imposed alteration or restriction has the effect of eliminating or materially altering direct access to a street or highway, the landowner then has a right to
compensation. The amount of the compensation may be mitigated, and possibility eliminated, by
the provision or availability of alternative access.

**Legal Means of Access Control**

The specific methods of controlling access and land development include: the law of
nuisance, police powers, contractual agreements, and eminent domain.

*The law of nuisance* is a time-tested concept for dealing with circumstances in which an
individual may be subjecting others to harm or inconvenience. Historically, the action of
nuisance was the normal method of protecting the interest of the public in the use of the highway
under the common law of England and in the statute law of eighteenth and nineteenth century
America. Although other methods have attracted more attention in recent years, the law of
nuisance is still the basis for cases dealing with highway access problems. The concept has
expanded the rough twentieth-century laws enacted for the purpose of promoting positively the
public convenience through zoning, subdivision controls, building codes, setback lines, and
similar measures. Frequently, violation of such land-use control is specified to be a nuisance.

*Police power* is the ability of a state (or community) to legislate and enforce restrictions
on behalf of the public health, safety, and welfare. Because the courts accept these powers, and
because they are enforceable to property owners, these powers are widely used. They cover
traffic regulatory and operational controls, as well as subdivision controls, licensing procedures,
zoning ordinances, and setback requirements.

*Contractual agreements* include restrictive covenants and conditional use agreements.
Restrictive covenants between developers and subsequent owners may be entered into to restrict
the use of property in accordance with the needs or plans of the development. Conditional use
agreements between a public agency and the owner of property abutting a highway may be used
to define, for example, the allowed land uses for which present or future access to the highway
may be granted.

*The power of eminent domain* has been described as the power of the sovereign to take
property for public use without the owner’s consent. The need for compensation is not inherent
in the concept because it developed under English common law, but it has been imposed by both
federal and state constitutions. Eminent domain, because it involves a taking, is the most
powerful as well as the most costly form of land control exercised by government.

**Implementation Aspects**
Access control techniques can be implemented with two basic legal powers: police power and eminent domain. The first power allows a government to restrict individual power for public welfare. The second power allows a government to take property for public use provided an owner is compensated for his loss. Police power is sufficient authority for most access control techniques associated with highway operations, driveway location, and driveway design. A government must cite eminent domain when building local service roads, buying abutting property and taking additional right-of-way, or denying reasonable access.

Police power allows a government ability to legislate restrictions for public welfare, but these restrictions must be part of general policy and must be reasonably consistent. Moreover, the reason for the regulation and the nature of the regulation must be compatible. This power can be applied to both roadway access and land use controls. Eminent domain requires a government to indicate that taking property or property rights are necessary for public purposes.

Legislation contributing to police power can be reviewed and subsequently replaced or reinforced by additional standards. For easy use of police power, consistent, consolidated, clear, and forceful regulatory policies should be enacted. Coordinating access policy into a clear and definitive code is necessary. Providing concrete evidence (traffic counts, accident counts, visual accounts of site conditions) confirming the hazards of access points or the improvements made by access control techniques will promote additional legislation and help attain access control.

Policies and guidelines provide a point of departure. However, codes and regulations that carry full weight of the law afford a firmer basis for enforcing actions in the courts. As long as reasonable access is provided, access regulation can be implemented and enforced. The control of future access points can be covered by an access code. The retrofit of existing access points may be covered by code where major changes in the nature in the size of the developments occur. The more typical "retrofit" access management operations may require extensive traffic engineering and safety rationale and negotiation among the activity centers or developments involved.

Desirable Access Management Standards

SECTION 1: PURPOSE AND AUTHORITY

Section 1. Purpose

The purpose of this code is to establish criteria to promote the safe and efficient movement of people and goods and to preserve the investment in the roadway system in the San Antonio – Bexar County Region.
Section 1 B. Authority

The criteria and procedures described in this document are established pursuant to state enabling legislation.

SECTION 2: DEFINITIONS

Access Connection - a driveway, intersection, turnout or other means of providing for vehicles to move between the public roadway and abutting private property.

Auxiliary Lane - that portion of adjoining the traveled way for speed change, turning, decelerating, accelerating, or other purposes supplementary to through traffic movement.

Band Width – the time in seconds that traffic can flow uninterrupted through a coordinated traffic control system.

Change in Use – a change in the use of a property causing the trip generation of the property to increase by more than 100 vehicles in any 60-minute interval or to increase by more than 10%, whichever is less. Or, resulting in a change in the mix of passenger vehicles and large vehicles of more than 10%. Or, resulting in the direction from which vehicles entering or leaving the site to change by more than 20%.

City Traffic Engineer – the City Traffic Engineer of the City of San Antonio.

Corner Clearance - the distance from an access connection to the nearest intersection. The distance is measured from the near edge of pavement of the intersecting roadway to the near edge of the access connection.

Corridor Plan – a plan identifying the location and features of access connections to a specific section of public roadway. The plan will show the following: 1) access connections to be retained, existing access connections to be modified or closed and new access locations, 2) the location of existing traffic signals and proposed future signals, including those to be relocated, 3) the type and width of any median, 4) the location and type (full or directional) of all median openings including existing opening to be retained, modified or closed and proposed future openings.

District – the San Antonio district of the Texas Department of Transportation.

District Engineer - the Engineer in charge of the San Antonio district of the Texas Department of Transportation.

Intersection - a junction of two public roads.
**Left-Turn Lane, Left-Turn Bay** - an auxiliary lane to permit a driver making a left-turn to clear the through traffic lane before decelerating to a stop.

**Large Vehicle** - any vehicle having more than two axles or dual wheels on any axle.

**Minimum Connection Spacing** - the minimum distance between access connections on the same side of the roadway as measured from center-to-center of adjacent access connections.

**Perception – Reaction Time** – the time needed by a driver to perceive a situation or condition plus the time to identify the specific situation or condition plus the time needed to evaluate and decide upon a specific cause of action plus the time to initiate that action.

**Directional Median Opening** - an opening is a nontraversable median that is designed to accommodate a specific movement, such as a left-turn/u-turn, and prohibit all other movements.

**Full Median Opening** - an opening in a nontraversable median that permits all movements, i.e., left-turns from the roadway, left-turn from an access connection or cross road and crossing movements from one side of the roadway to the other.

**Functional Intersection Area** – the distance traveled during the driver’s perception-reaction time plus the distance to brake to a stop plus the distance for storing a queue of stopped vehicles.

**Signal Spacing** - the distance between signalized access connections or intersections as measured center-to-center of the intersecting roadways.

**Stopping Sight Distance** – the distance required by a driver, traveling at a given speed; to come to a stop. It consists of the distance traveled during perception-reaction time plus the distance used while braking to a stop.

**Traveled Way** - that portion of a roadway for the movement of vehicles, exclusive of shoulders or auxiliary lanes.

**SECTION 3: ACCESS CATEGORY STANDARDS**

Described below is a proposed major thoroughfare system and access management standards that is based on roadway function. The system describes for each roadway classification the roadway function, desired level of access, desired emphasis of through movement, and typical speed ranges.

**SECTION 3A: Purpose and Use**

(1) The number, spacing, type and location of access and traffic signals have a direct and often significant effect on the capacity, speed, and safety of a roadway and are limited in a hierarchical method by this category system. The location, operation and design
standards within each category are necessary to ensure that the roadway will continue to function at the level (category) assigned.

(2) The standards in this section have been written so that the safety and operations of the complete general street system will be considered when determining access to the arterial roadway.

(3) The “Functional Characteristics and Category Assignment Criteria”, subsection of each category is intended to describe the existing or future function of roadways for which that category is most appropriate. The access category assigned to a roadway segment may consider the extent of the development on the abutting land, as it exists at the time the access category is assigned. Three levels of development are considered in the assignment of an access category to a roadway segment. These are:

a) sparsely developed – the abutting land is sparsely developed and there is considerable flexibility as to the location and design of future access;

b) partly developed – some development abutting the roadway segment has already developed but there is flexibility in the location of additional access; and

c) fully developed – the abutting land is heavily developed, numerous access connections already exist and access to any additional development will be highly influenced by the existing development pattern. However, opportunities to improve the access spacing and design may occur as abutting properties are redeveloped over a long period of time. The paramount objective for roadway segments categorized as ‘fully developed’ is to prevent further deterioration in the quality of service and to improve safety as may be practical. The purpose of spacing standards for this access category is to provide a ‘vision’ that might be obtained over a period of many years or several decades.

Roadway segments shall be classified based on as sparsely developed, partially developed or fully developed at the time an access category is assigned. The degree of development will be based on development already in place, a building permit has been issued on an application for a building permit has already been made, or a subdivision plat has been approved.

The existing design of the highway is not required to meet the design standards at the assigned category at the time it is assigned. A proposed access that may be allowed under the standards set forth in this section, but fails to meet the design or safety criteria of the City of San Antonio, may be permitted if a design waiver is approved by the Traffic Engineer of the City of San Antonio or by the District Engineer of the Texas Department of Transportation if located beyond the municipal limits and extraterritorial jurisdiction of the City of San Antonio.

(4) Traffic signals and their installation are also regulated by the Manual on Uniform Traffic Control Devices, (M.U.T.C.D.). Nothing in this section is intended or shall be
interpreted as requiring the City of San Antonio, Bexar County or the Texas Department of Transportation authorize a traffic signal or a left-turn movement at any location. No traffic signal shall be authorized without the completion of an analysis of traffic signal system operation, construction feasibility, and safety study as required by the Traffic Engineer of the City of San Antonio or, if outside of jurisdiction of the City, by the District Engineer of Texas Department of Transportation as well as meeting the U.M.U.T.C.D. signal warrants.

The City of San Antonio, Bexar County or the Texas Department of Transportation may at its discretion in consideration of granting an access permit, require design and operational modifications as it considers necessary, restrict one or more turning movements, or deny the access so long as such discretion does not violate law.

SECTION 3B: FUNCTIONAL CLASSIFICATION CATEGORIES

The proposed system of classifying roadways is consistent with the conventional system included in the City of San Antonio’ Unified Development Code. Typical speed ranges have been included with Table 1.
Table 1. Functional Classification System Description

<table>
<thead>
<tr>
<th>Functional Class</th>
<th>Level of Mobility</th>
<th>System Access</th>
<th>Level of Accessibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeway</td>
<td>Connects all urban sub regions together, connects urban and rural service areas with metro major activity centers; connection to outside cities.</td>
<td>To other freeways, principal arterial, and selected arterial; no direct land access.</td>
<td>Long trips at high speed within and through the metro area; express transit trips. Typical speed ranges between 55 and 70 m.p.h.</td>
</tr>
<tr>
<td>Primary Arterial</td>
<td>Connects two or more sub regions; provides secondary connections outside cities; complements freeway in high volume corridors.</td>
<td>To freeways, other principal arterial, and high volume collectors; no direct land access except major traffic generators.</td>
<td>Medium distance to long trips at high to moderate speeds within the urban area; express transit trips. Posted speeds typically range from 35 to 55 m.p.h.</td>
</tr>
<tr>
<td>Secondary Arterial</td>
<td>Connects adjacent sub regions and activity centers within sub regions.</td>
<td>To freeways, principal arterial, other arterial, and collectors; restricted direct land access.</td>
<td>Medium to short trips at moderate to low speeds; local transit trips. Posted speeds typically range from 35 to 55 m.p.h.</td>
</tr>
<tr>
<td>Collector</td>
<td>Connects neighborhoods within and between sub regions.</td>
<td>To arterial, other collectors, and local Streets; direct land access.</td>
<td>Primarily serves collection and distribution function for the arterial system at low speeds; local transit trips. Posted speeds typically range from 25 to 40 m.p.h.</td>
</tr>
<tr>
<td>Local (includes Conservation Access, Local Type A, Local Type B)</td>
<td>Connects blocks within neighborhoods and specific activities within homogeneous land use areas.</td>
<td>To collectors and other local Streets; direct land access.</td>
<td>Almost exclusively collection and distribution; short trips at low speeds.</td>
</tr>
</tbody>
</table>

SECTION 3C: ACCESS CATEGORIES AND STANDARDS

Access to a corner property located at the intersection of two roadways of different functional classification shall be to the roadway having the lower functional classification unless the City Traffic Engineer, or District Engineer, find that access on both frontages will improve safety or the traffic operations on the public roadway system. Where a corner property fronts on two roadways having the same functional classification, the City Traffic Engineer, or District Engineer, shall specify the street to which access is to be provided. Access to a corner property shall be located near the property line most distance from the intersection.

The same spacing standards and criteria for durations apply to public roadways and private access connections.

Primary Arterial, Category 2

Primary arterials are second only to freeways in providing movement throughout the San Antonio-Bexar County metropolitan region. This category is appropriate for roadways that have extensive continuity and that carry high volumes at relatively high speed in an efficient and safe manner. In accordance with the Unified Development Code of the City of San Antonio, no direct land access, except major traffic generators, is provided to this category of roadway. Directional traffic on primary arterials should be separated by a non-traversable median. Access points should be constructed only if they meet the spacing criteria described in the following sections.
Access Category 2a
Primary Arterial, Abutting Land is Sparsely Developed

Signal Spacing

The standard for the spacing of all intersecting public ways and other accesses that will be full movement, or are or may become signalized, is 2640 ft. Exceptions to this 2640 ft. standard will not be permitted unless the proposal documents that there are no other reasonable alternatives to achieve a 2640 ft. interval, there is a documented necessity for the intersection at the proposed location, and a signal study acceptable to the Traffic Engineer of the City of San Antonio if the proposed location is within the City of San Antonio or its territorial jurisdiction (ETJ) or to the District Engineer of the Texas Department of Transportation (TxDOT) if outside the city’s ETJ.

Where it is not feasible to meet the 2640 ft. spacing interval, a full signalized median opening may be permitted where a traffic signal progression analysis acceptable to the Traffic Engineer of the City of San Antonio, or the TxDOT District Engineer if outside the City’s ETJ, demonstrates that, at a minimum, traffic progression with at least 45% efficiency can be achieved for both peak and off-peak conditions.

Where topography or other existing conditions make 2640 ft. intervals inappropriate or not feasible, location of the access will be determined with consideration given to topography, established property ownerships, unique physical limitations and or unavoidable or pre-existing historical land use patterns and physical design constraints with every attempt to achieve a spacing of 2640 ft. The final location should serve as many properties and interests as possible to reduce the need for additional direct access to the state highway. In selecting locations for full movement intersections, preference will be given to public roads.

Unsignalized Median Openings

Where a nontraversable median exists, unsignalized median openings may be permitted at a distance 1320 ft from a signalized intersection provided that: (1) the opening is designed as a directional opening for left-turns and u-turns from the primary arterial, and (2) an auxiliary lane for the left-turns/u-turns in accordance with the procedure and criteria given in Section C(2).

If the roadway is undivided or has a continuous two-way left-turn lane, left-turns will be permitted unless an operational or safety problem is identified.

Access Connection Spacing

Direct land access at locations that do not conform to the signalized intersection spacing interval of 2640 ft is discouraged. When permitted, the spacing standard is 1320 ft on roadways having a speed equal to or greater than 55 mph, and 880 ft. on roadways where
the speed is 50 mph or less. The access shall be limited to right-in/right-out only unless it is located directly across from a directional median opening.

Where it is not feasible to comply with the above-stated spacing standards, and alternative access is not available, the following will be considered as minor deviations: the proposed location is within \( \pm 100 \) ft. of the standard spacing location on roadways where the speed is 55 mph or higher and within \( \pm 150 \) ft. on roadways where the speed is 50 mph or less.

**Auxiliary Lanes**

All median openings, signalized and unsignalized, shall have a left-turn in accordance with the provisions of Section C(3) lane that will permit left-turning vehicles to clear the through traffic lane at a speed not more than 10 mph less than the speed of through traffic and come to a stop before reaching the end of the longest expected queue based on a 95% probability of storing all left-turning vehicles. The length of the turn bay shall be analyzed for both the peak and off-peak conditions and designed for whichever is the longest. Dual left-turns are encouraged where the expected left-turn volume exceeds 200 vehicles per hour.

A right-turn deceleration lane should be provided at all signalized locations. Auxiliary lanes for right-turns are encouraged at all unsignalized access connections and will be required at all connections where the volume in the outside (curb) traffic lane exceeds 350 vehicles per hour.

Right-turn acceleration lanes may be required by the City Traffic Engineer (TxDOT District Engineer).

**Development Subsequent to Classification of a Roadway Segment**

No additional access rights shall accrue upon the splitting or dividing of existing parcels of land or contiguous parcels under or previously under the same ownership or controlling interest. All access to newly created properties shall be provided internally from any existing access or a new access determined by the above design standards.

**Access Category 2b**

**Primary Arterial, Abutting Land is Partially Developed**

**Signal Spacing**

The standard for the spacing of all intersecting public ways and other accesses that will be full movement, or are or may become signalized is 2640 ft.

Exceptions to this 2640 ft. standard will not be permitted unless the proposal documents that there are no other reasonable alternatives to achieve the 2640 ft., there is a documented necessity for the intersection at the proposed location, and a signal study
acceptable to the Traffic Engineer of the City of San Antonio or the TxDOT District Engineer is not within the jurisdiction of the City of San Antonio is completed in accordance with Section D (1).

**Unsignalized Median Openings**

Where a nontraversable exists, an unsignalized median opening that deviated from the 1320 ft. spacing provided that (1) it is designed as a directorial opening and (2) an auxiliary lane for left-turns as provided in accordance with Section D (2).

**Access Connection Spacing**

Access connections may be permitted if the alleyway spacing intervals: 1320 ft. on roadway segments where the speed is 55 mph or greater, 880 ft. where the speed is 45 or 50 mph and 660 ft. where the speed is 40 mph or less.

Where it is not feasible and alternative access is not available, a deviation of 100 ft. from the standard spacing interval will be considered to be a minor deviation.

**Access Category 2c**

**Primary Arterial, Abutting Land is Fully Developed**

This access category is applicable where the abutting land is heavily developed, numerous access connections already exist and there is little opportunity to achieve long and uniform access spacing. The guiding principles for access management on these roadway segments is to: (a) keep the safety and operations from deteriorating further, (b) increase access spacing and improve access design as opportunities arise and as abutting properties are redeveloped, and (c) encourage property owners to consolidate driveways, replace individual driveways with shared access drives, to develop alternative access and to interconnect adjacent parcels so that pedestrians and vehicles can circulate between them without using the abutting public roadway.

**Signal Spacing**

The ideal signal spacing on Category 2c roadways is the same as for Category 2b. Where development precludes such spacing, a uniform interval of 1320 ft. may be adopted. At the very minimum, no additional signal will be permitted where it would degrade traffic progression speeds or efficiency.

**Unsignalized Median Openings**

Unsignalized median openings or Category 2c roadways that have a nontraversable median, or when a nontraversable median is constructed, may be permitted where: 1) the median is of sufficient width to be designed as a directional opening and 2) a left-turn lane can be provided in accordance with section c(3).
Access Connection Spacing

The principle objective is to avoid further degradation in the safety of operation of a Category 2c roadway.

Marginal access spacing should not be less than the stopping sight distance for the 85\textsuperscript{th} percentile, off-peak speed: 155 ft. of 25 mph, 200 ft. of 30 mph, 250 ft. of 35 mph and 305 ft. of 40 mph. Where access connections already exist if spacings are less than these intervals, increased spacing and improved design will be implemented, to the extent feasible, where abutting properties are consolidated or redeveloped. Alternative access will also be encouraged when development occurs. Consolidation of two or more existing access connection, or relocation of an access connection to improve safety or questions, is encouraged even though the consolidation, or relocation, will result in a spacing that is less than the above spacings based on speed.

Auxiliary Lanes

Auxiliary lanes for left-turns and right-turns are encouraged at all signalized intersections and higher volume access connections. Local constraints may require that these auxiliary lanes will be much shorter than the standard design.

Secondary Arterial, Category 3

Secondary arterials constitute a large portion of major roadway system in San Antonio-Bexar County metropolitan region. This category is appropriate for roadways that have extensive continuity and that carry high volumes at relatively high speed in an efficient and safe manner. The major difference between Primary Arterials (Access Category 2 and Secondary Arterials (Access Category 3) is in the number of through traffic lanes. In accordance with the Unified Development Code of the City of San Antonio, direct land access is restricted. Directional traffic on primary arterials should be separated by a non-traversable median. Access points should be constructed only if they meet the spacing criteria described in the following sections.

Access Category 3a
Secondary Arterial, Abutting Land is Sparsely Developed

Signal Spacing

The standard for the spacing of all intersecting public ways and other accesses that will be full movement, or are or may become signalized, is 2640 ft. Exceptions to this 2640 ft. standard will not be permitted unless the proposal documents that there are no other reasonable alternatives to achieve a 2640 ft. interval, there is a documented necessity for the intersection at the proposed location, and a signal study acceptable to the Traffic Engineer of the City of San Antonio if the proposed location is within the City of San Antonio or its territorial jurisdiction (ETJ) or to the District Engineer of the Texas Department of Transportation (TxDOT) if outside the city’s ETJ.
Where it’s not feasible to meet the 2640 ft. spacing interval, a full signalized median opening may be permitted where a traffic signal progression analysis acceptable to the Traffic Engineer of the City of San Antonio, or the TxDOT District Engineer if outside the City’s ETJ, demonstrates that, at a minimum, traffic progression with at least 45% efficiency can be achieved for both peak and off-peak conditions.

Where topography or other existing conditions make 2640 ft. intervals inappropriate or not feasible, location of the access will be determined with consideration given to topography, established property ownerships, unique physical limitations and or unavoidable or pre-existing historical land use patterns and physical design constraints with every attempt to achieve a spacing of 2640 ft. The final location should serve as many properties and interests as possible to reduce the need for additional direct access to the state highway. In selecting locations for full movement intersections, preference will be given to public roads.

**Unsignalized Median Openings**

Where a nontraversable median exists, unsignalized median openings may be permitted at a distance 1320 ft from a signalized intersection provided that: (1) the opening is designed as a directional opening for left-turns and u-turns from the primary arterial, and (2) an auxiliary lane for the left-turns/u-turns in accordance with the procedure and criteria given in Section C(2).

If the roadway is undivided or has a continuous two-way left-turn lane, left-turns will be permitted unless an operational or safety problem is identified.

**Access Connection Spacing**

Direct land access at locations that do not conform to the signalized intersection spacing interval of 2640 ft is discouraged. When permitted, the spacing standard is 1320 ft on roadways having a speed equal to or greater than 55 mph, and 880 ft. on roadways where the speed is 50 mph or less. The access shall be limited to right-in/right-out only unless it is located directly across from a directional median opening.

Where it is not feasible to comply with the above-stated spacing standards, and alternative access is not available, the following will be considered as minor deviations: the proposed location is within ± 100 ft. of the standard spacing location on roadways where the speed is 55 mph or higher and within ± 150 ft. on roadways where the speed is 50 mph or less.

**Auxiliary Lanes**

All median openings, signalized and unsignalized, shall have a left-turn in accordance with the provisions of Section C(3) lane that will permit left-turning vehicles to clear the through traffic lane at a speed not more than 10 mph less than the speed of through traffic.
and come to a stop before reaching the end of the longest expected queue based on a 95% probability of storing all left-turning vehicles. The length of the turn bay shall be analyzed for both the peak and off-peak conditions and designed for whichever is the longest. Dual left-turns are encouraged where the expected left-turn volume exceeds 200 vehicles per hour.

A right-turn deceleration lane should be provided at all signalized locations. Auxiliary lanes for right-turns are encouraged at all unsignalized access connections and will be required at all connections where the volume in the outside (curb) traffic lane exceeds 350 vehicles per hour.

Right-turn acceleration lanes may be required by the City Traffic Engineer (TxDOT District Engineer).

Development Subsequent to Classification of a Roadway Segment

No additional access rights shall accrue upon the splitting or dividing of existing parcels of land or contiguous parcels under or previously under the same ownership or controlling interest. All access to newly created properties shall be provided internally from any existing access or a new access determined by the above design standards.

Access Category 3b
Secondary Arterial, Abutting Land is Partially Developed

Signal Spacing

The standard for the spacing of all intersecting public ways and other accesses that will be full movement, or are or may become signalized is 2640 ft.

Exceptions to this 2640 ft. standard will not be permitted unless the proposal documents that there are no other reasonable alternatives to achieve the 2640 ft., there is a documented necessity for the intersection at the proposed location, and a signal study acceptable to the Traffic Engineer of the City of San Antonio or the TxDOT District Engineer is not within the jurisdiction of the City of San Antonio is completed in accordance with Section D (1).

Unsignalized Median Openings

Where a nontraversable exists, an unsignalized median opening that deviated from the 1320 ft. spacing provided that (1) it is designed as a directorial opening and (2) an auxiliary lane for left-turns as provided in accordance with Section D (2).

Access Connection Spacing

Access connections may be permitted if the alleyway spacing intervals: 1320 ft. on roadway segments where the speed is 55 mph or greater, 880 ft. where the speed is 45 or 50 mph and 660 ft. where the speed is 40 mph or less.
Where it is not feasible and alternative access is not available, a deviation of 150 ft. from the standard spacing interval will be considered to be a minor deviation.

**Access Category 3c**  
**Secondary Arterial, Abutting Land is Fully Developed**

This access category is applicable where the abutting land is heavily developed, numerous access connections already exist and there is little opportunity to achieve long and uniform access spacing. The guiding principles for access management on these roadway segments is to: (a) keep the safety and operations from deteriorating further, (b) increase access spacing and improve access design as opportunities arise and as abutting properties are redeveloped, and (c) encourage property owners to consolidate driveways, replace individual driveways with shared access drives, to develop alternative access and to interconnect adjacent parcels so that pedestrians and vehicles can circulate between them without using the abutting public roadway.

**Signal Spacing**

The ideal signal spacing on Category 2c roadways is the same as for Category 2b. Where development precludes such spacing, a uniform interval of 1320 ft. may be adopted. At the very minimum, no additional signal will be permitted where it would degrade traffic progression speeds or efficiency.

**Unsignalized Median Openings**

Unsignalized median openings or Category 2c roadways that have a nontraversable median, or when a nontraversable median is constructed, may be permitted where: 1) the median is of sufficient width to be designed as a directional opening and 2) a left-turn lane can be provided in accordance with section c(3).

**Access Connection Spacing**

The principle objective is to avoid further degradation in the safety of operation of a Category 2c roadway.

Marginal access spacing should not be less than the stopping sight distance for the 85th percentile, off-peak speed: 155 ft. of 25 mph, 200 ft. of 30 mph, 250 ft. of 35 mph and 305 ft. of 40 mph. Where access connections already exist if spacings are less than these intervals, increased spacing and improved design will be implemented, to the extent feasible, where abutting properties are consolidated or redeveloped. Alternative access will also be encouraged when development occurs. Consolidation of two or more existing access connection, or relocation of an access connection to improve safety or questions, is encouraged even though the consolidation, or relocation, will result in a spacing that is less than the above spacings based on speed.
**Auxiliary Lanes**

Auxiliary lanes for left-turns and right-turns are encouraged at all signalized intersections and higher volume access connections. Local constraints may require that these auxiliary lanes will be much shorter than the standard design.

**Collector Roads, Category 4**

This category of roadway provide direct land access as well as the collection – distribution of traffic. Lower traffic volumes slower speeds and driver expectation permit more closely spaced access connections than provided on arterial roadways. A speed differential of more than 10 mph between turning vehicles and through traffic may be acceptable.

**Access Category 4a**

Collector, abutting land is sparsely developed on partly developed.
Signal Spacing

The standard signal spacing is 1320 ft. Where it is not feasible to achieve the 1320 ft. interval, a traffic signal may be permitted if traffic progression with at least 35% can be achieved during off-peak periods. Traffic progression during peak periods is not usually expected.

Access Connection Spacing

Stopping sight distance is the principal criterion for access connection spacing. This will enable drivers to clear an access connection before the need to possibly respond to an event at another connection. Minimum spacings are:

<table>
<thead>
<tr>
<th>Posted Speed (mph)</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Spacing (feet)</td>
<td>155</td>
<td>200</td>
<td>250</td>
<td>305</td>
</tr>
</tbody>
</table>

Auxiliary Lanes

A left-turn bay is required at all signalized access connections unless the City Traffic Engineer, or District Engineer, finds that one is not justified. The City Traffic Engineer, or District Engineer, may require a left-turn bay and/or a right-turn bay at any access connection – signalized or unsignalized.

Local Roads, Category 5

Local roads serve direct land access and provide connection with collector roadways. Properties having less than 200 ft. of frontage shall be limited to one access connection unless the City Traffic Engineer, or the District Engineer, finds that two connections will improve traffic operations or safety on the roadway system. At the discretion of the City Traffic Engineer, or District Engineer, two access connections may be considered where the abutting property has 200 ft. or more frontage on the local roadway.
SECTION D: DEVIATIONS

(1) Signal Spacing

Where it is not feasible to meet the signal spacing interval, a signalized intersection may be permitted where a traffic signal progression analysis acceptable to the City Traffic Engineer, or the District Engineer, if outside the City's ETJ, demonstrates that, at a minimum, traffic progression efficiency specified for the access category of the roadway segment can be achieved for both peak and off-peak conditions. The minimum progression efficiency shall not be less than that given in Table 2. The City Traffic Engineer (or the District Engineer) will specify, (1) the cycle length(s) and progression speed(s) for the a.m. and p.m. peaks, (2) the cycle lengths, and progression speed(s) for the midday period and any other off-peak period(s) to be analyzed, (3) the section of roadway to be used in the analysis, (4) traffic volumes, (5) the computer model to be used, and (6) any other conditions as may be appropriate.

Table 2. Minimum Progression Efficiency

<table>
<thead>
<tr>
<th>Functional Class</th>
<th>Access Category</th>
<th>Progression Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Peak Periods</td>
</tr>
<tr>
<td>Primary Arterial</td>
<td>2a</td>
<td>45%</td>
</tr>
<tr>
<td></td>
<td>2b</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>2c</td>
<td>(1)</td>
</tr>
<tr>
<td>Secondary Arterial</td>
<td>3a</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>3b</td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td>3c</td>
<td>(1)</td>
</tr>
<tr>
<td>Collector</td>
<td>4a</td>
<td>(2)</td>
</tr>
<tr>
<td></td>
<td>4b</td>
<td>(2)</td>
</tr>
<tr>
<td></td>
<td>4c</td>
<td>(2)</td>
</tr>
</tbody>
</table>

(1) No decrease in progression efficiency shall be permitted
(2) Traffic progression usually not provided

(2) Unsignalized Median Openings

An unsignalized median opening may deviate from the spacing standard if the location will not interfere with the safety or operation of a nearby signalized intersection. The following procedure will be used in this evaluation.

Step 1: Determine the functional distance (distance traveled during perception-reaction plus maneuvering distance plus queue storage) of the signalized intersections.

Step 2: Determine the space available for an unsignalized opening by subtracting the sum of the functional intersection distances from Step 1 from the distance between the two signalized intersections.

Step 3: Determine the functional distance (distance traveled during perception-reaction time plus maneuver distance plus queue storage) of the proposed unsignalized median opening.
Step 4: Compare the distance needed for the unsignalized opening from Step 3 with the distance available from Step 2.

Step 5: The unsignalized opening may be provided if the space available (Step 2) is longer than that needed (Step 3).

(3) Nonconforming Properties

A property that has frontage that is less than the access connection spacing, or that due to topographic or other aloud conditions will be considered to be a nonconforming lot. Such lots will be permitted one access connections. Vehicle use limitations included as a condition of the access permit will include volume limitation in accordance with the following equation.

\[ V = 50 + \frac{L + R^2}{2S}100 \]

Where:

- \( V \) = Permissible peak hour vehicular trips (total to and from the lot).
- \( L \) = Left distance between the lot centerline and either the centerline of the next adjacent non single-family residential lot, the centerline of the adjacent side street for a corner lot, or one-half of the highway frontage plus one-half of the side street frontage for a corner lot with alternative access. The maximum distance for \( L \) cannot exceed \( S \).
- \( R \) = Right distance measured similar to \( L \) above. The maximum distance for \( R \) cannot exceed \( S \).
- \( S \) = Spacing distance, based on the posted speed limit and (a) 4 above.
- \( A \) = Acreage of the lot, but no greater than 3.0 on category 2 and 3 segments and 2.0 on Category 4 roadway segments.

The Department shall increase the permissible peak-hour vehicular use \( (V) \) by a 15 percent bonus if a lot has either a or b. below. There is a maximum of two bonuses \( (V_{max}=1.3V) \) for those lots having both of the following features.

(a) Shared access with another lot. Motorist must be able to drive directly between the two lots.

Alternative access to a street other than a Category 2 or 3 roadways. On divided roadways, two one-way access points may be substituted for a two-way access point.
Appendix D

Stakeholder Meeting Summaries
Stakeholder Meetings – Regional Corridor Plan

1. Leilah Powell- Mayor’s Office
   9-16-02: Meeting notes attached

2. Chris Brady- Asst. City Manager (acting Dir. Development Services)
   9-17-02: Meeting notes attached

3. Kimberly Coleman- CSA Commercial Revitalization
   Contacted Kimberly; she reviewed the map that was at the City; she called and had a few questions about the map on 9-30-02 which we discussed.
   Didn’t feel the need for an individual meeting

4. NW Neighborhood Alliance
   Contacted Dominick Dina and he responded on 9-18-02 that they would like to be kept in the loop, but did not see the need in a meeting.
   We will provide him with written info and a schedule for possible City approval for their distribution

5. Land Development Services
   Briefed on 10-9-02: Meeting notes attached

6. Planning Commission
   Briefed on 10-9-02: Meeting notes attached

7. Real Estate Council
   Martha Magnum with the Real Estate Council was contacted on 9-19-02 about setting up a meeting with their representatives. She responded back on 9-26-02 that she would organize her attendees and get back with us on scheduling. Contacted her again on 11-04-02 and asked that we get together before the end of the year because of the study schedule. As of this date we have not received any further response.

8. City Council- Quality of Life Committee
   Materials were provided for the Committees review before the 10-24-02 meeting. The Consultant Team members as well as a representative from the MPO were available for the presentation but the Committee adjourned without hearing the presentation. We were then placed on the agenda for the 11-21-02 meeting, but were again bumped from that meeting.

9. Greater Bexar County Council of Cities- AACOG
   Briefed the Council on 10-16-02: Meeting notes attached

10. County Commissioners
    Dick Higby provided information from Brad to Gabe Perez for his discussion with the Commissioners. Dick presented a powerpoint presentation from HNTB to Commissioners’ Court on 11-19-02: Meeting notes attached
     They have not asked for an additional briefing since that time.
Summary of Stakeholder’s Meetings for the Regional Corridor Plan

Meeting with Leilah Powell, Mayor’s Office  9-16-02
Attendees: Jeanne Geiger, MPO; Tom Ellis, HNTB; Beth Wells, Bender Wells Clark Design; and Leilah Powell, Asst. to the Mayor, CSA

Jeanne Geiger gave a brief summary of the projects purpose and scope.

A summary of the proposed TxDOT access management policies, the UDC policies, and the suggested policies put together by the Study Team was circulated. It is not the intent of the Team to recommend changes to the UDC at this time, but to show the importance of access management in the efficient flow of traffic. The Mayor will be testifying before the TTC to show support by the City of San Antonio for the proposed TxDOT access management policies. Tex 21 has been on record as being opposed to the new policies, but the City of San Antonio is in favor. Ms. Powell suggested that a copy of the traffic simulations done for the project showing the increased traffic flow on congested streets after some driveways were removed might be a helpful tool for the Mayor.

The proposed Major Thoroughfare Plan Map graphic was discussed. The Plan should be reviewed periodically due to changes in conditions and new information. The Plan should not be changed without consideration for the overall impact of roadways being deleted or modified. A change should not be allowed unless an alternative can be shown that will work as well or better than the original alignment. Developers will not object to a plan that treats everyone the same, that keeps them on an even playing field. The problems begin when it is perceived that certain people are allowed to play by their own rules.

Ms. Powell cautioned showing too much activity around Camp Bullis. The group had mentioned discussions with the Oversight Committee about showing a possible future roadway through the base. We were told that the military is very concerned about encroachment around their bases and that this encroachment could be a reason to recommend closure. Anything perceived as a loss at Camp Bullis could also have a detrimental effect on Fort Sam Houston.

Ms. Powell suggested that a member of the Study Team be included in the ULI interviews for the Southside Initiative and that any recommendations from that report be considered in the Plan. HNTB will be provided with a copy of the Southside Initiative’s land boundaries map.

It was also suggested that Kimberly Coleman with the Neighborhood Commercial Revitalization Division of the Neighborhood Action Department be contacted to inform her of the study and solicit any input she might have regarding the Thoroughfare Plan.
The CSA Neighborhood Planning staff should also be briefed to solicit their input and request that they get the information about the Plan’s timeline to the neighborhood associations.
Summary of Stakeholders’ Meetings for the Regional Corridor Plan

Meeting with Asst. CSA City Manager, Chris Brady: 9-17-02
Attendees: Asst. CSA City Manager, Chris Brady; Asst. CSA City Manager Jelynne Burley, Jeanne Geiger, MPO; Tom Ellis, HNTB; and Beth Wells, Bender Wells Clark Design

Jeanne Geiger gave a brief summary of the projects’ purpose and scope.

A summary of the draft TxDOT access management policies, the UDC policies, and the suggested policies put together by the Study Team was circulated to show the importance of access management in the efficient flow of traffic.

The proposed Major Thoroughfare Plan Map graphic was discussed. Mr. Brady expressed the concern that developers are constantly trying to push the alignment of proposed major roadways off their property or align their development so it doesn’t have access to proposed thoroughfare so they won’t have to pay for building them.

The importance of having thoroughfares for mobility only with limited access in certain areas (specifically over the aquifer) was discussed. Wilderness Oak could be developed as such a roadway through sensitive areas.

City staff is looking for a defensible Plan that they will be able to hold developers to. The Plan should not be changed without consideration for the overall impact of those changes. A change should not be allowed unless an alternative can be shown that will work as well or better than the original alignment. The plan should treat everyone the same; that keeps developers on an even playing field. The problems begin when it is perceived that certain people are getting preferential treatment. This happens when political pressure is applied and a development is encouraged to proceed without adequate consideration for the overall impact of the change to the roadway system.

Mr. Brady suggested that examples might be shown where roadways were deleted from the Plan and the effect the change had on the overall system. He suggested that someone from the Planning Department might be able to identify some of these problems. This would be important justification when meeting with other groups and City Council.

Mr. Brady also suggested that the changes from the previous Thoroughfare Plan be more clearly delineated or that sectors of the proposed Plan be blown up when meeting with groups to emphasize the changes. The addition of some possible text outlining roadway category changes might also be helpful.

The stakeholder input process should follow whatever procedure necessary to secure approval for the Thoroughfare Plan.
Summary of Stakeholders’ Meetings for the Regional Corridor Plan

Meeting with Land Development Services Committee: 10-9-02
Attendees: Asst. Land Development Services Committee, various City and County staff (see attached sign in sheet), Jeanne Geiger, MPO; Brad Peel, HNTB; and Beth Wells, Bender Wells Clark Design

Jeanne Geiger gave a brief summary of the projects’ purpose and scope and reminded them that we had briefed them on the project last year when we first started.

Brad Peel with HNTB presented a handout of the power point presentation that was going to be given to the Planning Commission later in the day. He explained the project, the schedule for completion, and then went through the map quadrant by quadrant.

The proposed Major Thoroughfare Plan Map graphic was discussed. Brad pointed out areas of change, the rationale for the change, and additions based on new information. The Committee expressed some concern that there would not be an opportunity for the public to react to the map before adoption. It was explained that at this stage we were getting feedback before approval by the MPO Steering Committee and that before the actual plan was adopted it would go through the City’s process.

The Committee asked to have a copy of the map so they could take a closer look at the changes and if there was some way to highlight more clearly what had changed from the previous version. It was suggested that a date be put on the map so that any changes could be identified and not confused with earlier versions. Brad Peel with HNTB was going to provide graphics for the Committee.

Access control measures were discussed. The Committee asked if the City had the authority to implement these kinds of measures and Emil Moncivais assured them that they did if they chose to use it.

The only other discussion was who else would be briefed before the study was approved by the MPO. We discussed whom we had met with previously and outlined the other groups that would be contacted.

The Committee took no action, but thanked us for the briefing.
Summary of Stakeholders’ Meetings for the Regional Corridor Plan

Meeting with City of San Antonio Planning Commission: 10-9-02
Attendees: City of San Antonio Planning Commission, Jeanne Geiger, MPO; Brad Peel, HNTB; and Beth Wells, Bender Wells Clark Design

Jeanne Geiger gave a brief summary of the projects’ purpose and scope.

Brad Peel with HNTB presented a power point presentation. He explained the project, the schedule for completion, and then went through the map quadrant by quadrant.

The proposed Major Thoroughfare Plan Map graphic was discussed. Brad pointed out areas of change, the rationale for the change, and additions based on new information. The Commission was briefed on the discussions at the Land Development Services Committee meeting earlier in the day. It was again explained that at this stage the Consultants were getting feedback before approval by the MPO Steering Committee and that before the actual plan was adopted it would go through the City’s process.

The only other question dealt with whether or not surrounding jurisdictions had major thoroughfare plans and if so had we reviewed them. Brad Peel responded that all the entities that had plans were incorporated into the new Regional Plan.

The Commission took no action, but thanked us for the briefing.
Summary of Stakeholders’ Meetings for the Regional Corridor Plan

Meeting with Greater Bexar County Council of Cities: 10-16-02
Attendees: Council Members (see attached list), Jeanne Geiger, MPO; Joanne Walsh, MPO; Brad Peel, HNTB; and Beth Wells, Bender Wells Clark Design

Jeanne Geiger gave a brief introduction of the projects’ scope and funding.

Brad Peel with HNTB presented a handout of the power point presentation the other stakeholders have seen. He explained the project, the schedule for completion, and then discussed the access management tools tested in the study and their affect on the 4 specific areas studied.

The proposed Major Thoroughfare Plan Map was discussed. The purpose of the plan is to provide ground rules for developers. Brad pointed out areas of change, the rationale for the change, and additions based on new information. A question was asked about what traffic models were used for the study. Jeanne Geiger explained that the MPO has the official model and this is what TxDOT and the CSA use.

It was explained that the Consultants were getting feedback before approval by the MPO Steering Committee. The Council of Cities was one of several groups that have been briefed on the project.

Brad Peel explained that all the suburban cities that had major thoroughfare plans were incorporated into the new Regional Plan.

There was a question about specific construction plans for Hausman Road. The response was that specific construction plans were not consulted for the study, just alignments.

VIA Board Member Hank Brummett requested from the MPO the variables and assumptions of the official MPO traffic model.

There was some discussion after the presentation about the map graphics specific alignments of Scenic Loop Road where it intersects Bandera Road, and the extension of Retama Parkway northwest over the UP railroad tracks to Nacogdoches.

The Council took no action, but thanked us for the briefing.
Summary of Stakeholders’ Meetings for the Regional Corridor Plan

Meeting with Commissioners’ Court 11-19-2002
Attendees: Bexar County Commissioners (and County Judge), Richard Higby and Gabriel Perez- Bexar County

Bexar County Commissioners (and County Judge) were briefed during a work session. Major concerns expressed included: (1) that public involvement (major stakeholders / land owners affected by the changes) is adequate for proposed changes before adoption (after MPO approval), and (2) that changes can be made to accommodate a "major manufacturing plant" that may locate in the area.

Each Commissioner was furnished (at the work session) with a Regional Thoroughfare Map to review. Any Commissioner requesting more information or further briefing was asked to contact either Gabriel Perez or me.

The HNTB Powerpoint Presentation that was used for the LDSC "briefing," with some modifications was presented at the briefing. Interest (and emphasis) was more on the thoroughfares than on access management.

Attached is the overview that was furnished to the Judge and Commissioners.