SUMMARY

Background

The City of Austin is currently engaged in creating a new long-term vision and policy guide—the Imagine Austin Comprehensive Plan. A significant part of the process to create the plan was asking the public what type of urban form Austin should it have. Through the public involvement process, the community indicated that the way Austin grew over the past several decades should not continue. Instead of continued sprawling, automobile-centric, low-density development, Austin's urban form *should* be characterized by compact and walkable urban centers connected by a network of mixed-use corridors served by quality transit.

The process to capture the community's aspirations for Austin's future urban form began with Community Forum Series #2: Understanding the Dynamics of Change. Participants engaged in a mapping exercise to allocate where 750,000 more people would live and where 300,000 new jobs would be located over the next three decades. They recorded their preferences on a 6' X 6' map, using "sticky" notes representing different development types with different population and job densities. This process resulted in several scenarios, from which a Preferred Growth Scenario map emerged.

A major component of the Preferred Growth Scenario map is the Mixed-Use Corridor development type which was designated along most of Austin's major roadways. For the purposes of the exercise and computer modeling, the two-mile long and half a mile wide corridor represented an additional 7,500 people and 2,500 new jobs. Although these numbers were always intended more as part of the "math" for the mapping exercise and as parameters for computer modeling rather than absolute target densities, some in the community did not accept these assertions. Their concerns broadly centered on three points. The first two related to the mapping exercise and whether or not the assumptions underlying job employment and population figures were realistic and whether the real world application of that level of redevelopment would fundamentally change the character of adjacent residential neighborhoods. The third related to who would pay for the infrastructure for this new development.

Planning and Development Review Department (PDRD) staff looked to address these concerns. With assistance from the Austin Water Utility Department and the lead consultant firm for the Imagine Austin Comprehensive Plan process, Wallace, Roberts, & Todd (WRT), PDRD staff studied the following questions:

- What are the relative costs for infrastructure and services in typical low-density suburban development versus those associated with a denser, walkable, urban setting?

- Who is responsible for paying the costs associated with upgrading water and wastewater infrastructure when new development occurs?
- Can Austin's corridors realistically absorb the type of growth represented on by the Mixed-Use Corridor development type—2,500 more jobs and 7,500 more people?

Method

To address these concerns PDRD staff formulated a basic study design.

Literature Review—Staff reviewed professional literature discussing the costs associated with providing services and infrastructure to typical, low-density suburban development compared to providing these services and infrastructure for more dense urban development and redevelopment.

Local Examples—Staff reviewed the Municipal Utility District (MUD) applications for two proposed developments (Rio de Vida and Carma Easton) in Austin's extraterritorial jurisdiction (ETJ) southeast of the city limits to assess infrastructure costs.

Review of City of Austin Policies—Staff reviewed the section of the City Code of Austin (in section 25-9) relating to the provision of water and wastewater infrastructure for development. In addition staff reviewed some preliminary estimates generated by the Austin Water Utility related to the costs associated with water and wastewater upgrades for future development in the Transit Oriented Development (TOD) areas located along the Capital Metropolitan Transportation Agency's Red Line.

CityEngine Modeling and 3-D Visualizations—The CityEngine software package generated model runs for two of Austin's major roadways—North Lamar Boulevard and South Congress Avenue—to determine if these corridors could absorb the population increases envisioned by the Mixed-Use Corridor development type.

Summary of Findings

The study generated several finding:

- ❖ More dense, mixed-use and compact development is generally less expensive to serve with infrastructure and services than low-density suburban development.

- ❖ Policies promoting and leading to more compact and mixed-use development can save local governments money relative to those promoting or supporting low-density suburban-styled development.

- The question of who pays for water and wastewater infrastructure is very site-specific and is determined by the unique circumstances of individual project sites. Consequently, attempts to extrapolate these costs for new development along miles of roadway would not produce meaningful results. An analysis of this type would, at best, produce cost estimates on an "order of magnitude" scale. These numbers would also be useful for making gross comparisons between different types of urban forms–compact versus dispersed. In either case these types of estimates could not be used for real budgeting purposes

- Generally developers pay the full costs of providing water and wastewater infrastructure; however, the City of Austin will cost participate to upsize improvements if those improvements will serve a broader geographic area than the specific site.

- Redevelopment and infill projects provide the opportunity for the Austin Water Utility to replace aging and obsolete water and wastewater infrastructure at a lower cost than having to outsource the infrastructure replacements and upgrades.

- The land along Austin's major roadways can likely absorb and in some cases exceed the densities reflected in the Mixed-Use development type. The North Lamar Boulevard corridor was able to absorb 2,500 jobs and 7,500 people. The South Congress corridor was able to absorb 4,700 jobs and 13,200 people.

LITERATURE REVIEW: THE COSTS CONVENTIONAL SUBURBAN DEVELOPMENT COMPARED TO COMPACT WALKABLE DEVELOPMENT

Introduction

Over the past two decades the body of academic research looking at the effects of conventional, low-density, single-use suburban development, often referred to in the negative as sprawl, has grown considerably. These studies generally look at the range of costs—environmental, social, and fiscal—associated with this type of development. The following literature review focuses, primarily, on the fiscal costs associated with providing infrastructure and local government services for this dispersed form of development. The sampling of articles and reports for this review collectively concludes several points:

- From a purely economic perspective, conventional low-density, single-use suburban development is less expensive to build than infill or redevelopment due to lower land and construction costs;
- Conventional suburban development costs significantly more to serve with infrastructure and local government services than more dense and concentrated development, often described in the literature as smart growth;
- There are other costs associated with low intensity development that often do not have readily measurable dollar amounts;
- Shifting to policies that support more, deliberate compact development can save local governments significant amounts of tax payer dollars.

Literature Review

In *Paying the Costs of Sprawl: Using Fair-Share Costing to Control Sprawl* (1998) Snyder and Bird examine the costs of typical low-density suburban development and how to fairly allocate these expenditures to taxpayers. From a pure economic perspective, this type of development is lower cost than infill (re)development in inner cities due to lower land and construction costs in undeveloped, outlying areas. They define the effects of typical low-density suburban development, or sprawl, as

- Loss of open space and agricultural lands
- Auto dependence
- Urban blight/urban core disinvestment
- Greater resource consumption
- Higher infrastructure and services costs.

The authors cite that the total infrastructure costs for low-density suburban developments in California and Florida amount to nearly $20,000 per residential unit built. Because the social costs of sprawl are typically not included in the market price of homes in low-density suburban and exurban development, the authors suggest a number of mechanisms, such as impact fees and excise

taxes, to assign these costs to the producers and ultimately to the consumers this form of low-density development.

In *Conventional Development Versus Managed Growth: the Costs of Sprawl* (2003) Burchell and Mukherji compare the effects and costs associated with conventional suburban development (subdivision-style residential and strip non-residential) and those costs associated with more-managed growth patterns in or near existing urban areas. They posit that conventional development may present certain public benefits such as less expensive single-family housing, increased participation in local government, and lower social service costs due to a reduced social service base. Although the authors identify some advantages to conventional suburban development, they also point to the costs, especially when compared to more managed growth patterns. Specifically, they cite the greater amount of land consumed by and the increased transportation and water/wastewater infrastructure costs for conventional suburban development. The authors contend that, over the long run, managed growth is more cost effective and efficient. The table below provides comparative estimates of these measures for the United States between the years 2000-2025.

Type of Development	Land Consumption (acres)	Water / Sewer Costs ($)	Road Construction Costs ($)
Conventional (Sprawl)	18.8 million	190.0 billion	927 billion
Managed (Smart Growth)	14.8 million	177.4 billion	817 billion

---

In *Measuring Sprawl and its Impact* (2002) Ewing, Pendall, and Chen show that local governments are not the only parties burdened by the associated costs of conventional suburban development; the general public is as well are as well. These negative externalities are also not always easily calculated in monetary terms. The authors contend that the quality of life in conventional suburban communities can be diminished for numerous reasons:

- People spend more time in their cars
- They breathe more-polluted air
- Motorists who spend more time on the road incur higher risks of traffic fatalities, and
- Residents of low-density areas are less likely to walk or use alternate modes of transit than people in higher-density neighborhoods.

In *Sprawl Costs Us All: How Uncontrolled Sprawl Increases Your Property Taxes and Threatens Your Quality of Life* (1996) Hulsey argues that uncontrolled land use patterns in Wisconsin create a cost burden for all citizens. This is especially the case in areas where conventional, low-density suburban growth has been the predominant type of development over the past several decades. This form or urban development necessitates higher property taxes to pay for both public safety services and infrastructure needs. It also results in the loss of valuable green space as farmland and open space. It is estimated that between 1996 and 2010, Wisconsin taxpayers will have paid $4 billion in services (e.g., education, transportation, and public works services) needed for the 400,000 new residents who moved to the state over the same time period. In addition and not surprisingly, these residential developments cost municipalities more to service than open space or lower-impact developments such as farmland that they replace.

In *The Costs of Sprawl: Fiscal, Environmental, and Quality of Life Impacts of Low-Density Development in the Denver Region* (2003) Livingston, Ridlington, and Baker discuss the implications that rapid population growth and the resulting development have had in the greater Denver, Colorado region. Between 1982 and 1987, the rate of land consumption in the region outpaced that of the regional population growth. Over that five year period the region's land area grew by 43% while its population grew by only 30%. The Denver Regional Council of Governments (DRCOG), as part of its *Metro Vision 2020* initiative, adopted an urban growth boundary (UGB) to limit unsustainable development. Although meant to protect vital open space and agricultural lands, the intended protection may be compromised by the UGB and its policies. The boundary can and has been expanded with little or no evaluation process and the policies allow unlimited unsustainable, lower-density development outside of the UGB. The DRCOG is currently reviewing the current UGB policies and may recommend expanding its boundaries even though, as the authors argue, the current boundaries could greatly accommodate the region's projected population growth through 2030. Changing the policies would also prove very costly; taxpayers would incur costs related to infrastructure, water quality, and transportation if sprawling development continues outside of the current UGB. The authors state that these development-related costs could be reduced or eliminated altogether—while accommodating future population growth—should more compact development occur within Denver's UGB.

In *Investing in a Better Future: A Review of the Fiscal and Competitive Advantages of Smarter Growth Development Patterns* (2004) Muro and Puentes study the fiscal implications of conventional suburban development on municipalities. The authors conclude that responsible (smart growth)

development patterns reduce the operating costs cities may incur versus those associated with conventional, low-density suburban development. The authors define smart growth as a set of policies and practices that

- Limit outward expansion
- Encourage higher density development
- Encourage mixed-use zoning as distinct from fully segregating land uses
- Reduce travel by private vehicles
- Revitalize older areas
- Preserve open space.

The authors acknowledge that promoting more affordable housing may or may not be an explicit goal of smart growth programs.

They assert that local governments spend less providing public infrastructure and services to more compact development. These lower expenditures are due to shorter infrastructure extensions (roads, sidewalks, water lines, etc.) as well as less spent per capita for municipal services for each new residence. Between 1999-2000, states and municipalities had accrued capital expenditures amounting to almost $140 billion for infrastructure needs such as schools, roadways, sewer lines, and utility systems and more than $200 billion to provide services such as police and fire protection, road maintenance, etc.

Through compact development, the authors note, billions of taxpayer dollars could be saved through the more efficient provision of infrastructure and services. Responsible fiscal management is not the only result of smart growth; cities also gain positive economic benefits from compact development. Smart growth/more compact and thoughtful development, as the authors illustrate, can foster an increase in property values (as housing supply is limited and in high demand) and economic growth (due to the sharing of ideas, technology, and opportunities which is facilitated by clustering people and companies). The authors state that the overall health and viability of a region--including suburban, low-density areas—is dependent upon a strong, centralized, and smartly-developed city or urban area.

Plan It Calgary (2009) was a process to create an integrated development and transportation plan for the City of Calgary, Canada. As part of the *Plan It Calgary* process, two development scenarios were created to show possible future growth patterns. The first was a "dispersed" scenario reflecting current city policies and trends and represented a more sprawl-like pattern. The second was the "recommended direction" scenario that is more compact and clusters housing and employment around transit. A commissioned report by *Plan It Calgary* studied the costs of particular public services for each scenario. The costs are in the following table:

Capital Costs of Public Services by Development Scenario ($ Billion)				
Type of Infrastructure/ Service	**Dispersed Scenario (Sprawl)**	**Recommended Direction (Compact)**	**Difference**	**Percent Difference**
Road Capital Costs	$17.6	$11.2	$6.4	-36%
Transit Capital	$6.8	$6.2	$0.6	-9%
Water and Wastewater	$5.5	$2.5	$3.0	-54%
Fire Stations	$0.5	$0.3	$0.2	-46%
Recreation Centers	$1.1	$0.9	$0.2	-19%
Schools	$3.0	$2.2	$0.8	-27%
Total	$34.5	$23.3	$11.2	-33%

Not only is infrastructure for development in the more compact "recommended direction" scenario less costly, it also consumes 25 percent less land than the "dispersed" scenario. However, it is important to note that the cost estimates provided by the *Plan It Calgary* report are to be used for relative comparisons between the two scenarios. They are not reliable in absolute terms and should not be used for budgeting purposes and are based upon long-range planning projections.

Works Cited

Burchell, Robert, and Sahan Mukherji. 2003. "Conventional Development Versus Managed Growth: The Costs of Sprawl." American Journal of Public Health. 93.4: 1534-1540.

City of Calgary. 2009. "Plan It Calgary: The Implications of Alternative Growth Patterns on Infrastructure Costs." http://www.calgary.ca/docgallery/BU/planning/pdf/plan_it/plan_it_calgary_cost_study_analysis_april_third.pdf. Last accessed 14 July 2011.

Ewing, Reid, Rolf Pendall, and Don Chen. 2002. "Measuring Sprawl and its Impact." Washington, D.C.: Smart Growth America. http://www.smartgrowthamerica.org/sprawlindex/MeasuringSprawl.PDF. Last accessed 14 July 2011.

Hulsey, Brett. 1996. "Sprawl Costs Us All: How Uncontrolled Sprawl Increases Your Property Taxes and Threatens Your Quality of Life." http://www.sierraclub.org/sprawl/articles/hulsey.asp. Last accessed 14 July 2011.

Livingston, Ann, Elizabeth Ridlington, and Matt Baker. 2003. "The Costs of Sprawl: Fiscal, Environmental, and Quality of Life Impacts of Low-Density Development in the Denver Region." Denver: Environment Colorado Research and Policy Center. http://www.policyarchive.org/handle/10207/bitstreams/5153.pdf. Last accessed 14 July 2011.

Muro, Mark and Robert Puentes. 2004. "Investing in a Better Future: A Review of the Fiscal and Competitive Advantages of Smarter Growth Development Patterns." Washington, D.C.: The Brookings Institution Center on Urban and Metropolitan Policy. http://www.brookings.edu/~/media/Files/rc/reports/2004/03metropolitanpolicy_muro/200403_smartgrowth.pdf. Last accessed 14 July 2011.

Snyder, Ken and Lori Bird. 1998. "Paying the Costs of Sprawl: Using Fair-Share Costing to Control Sprawl." http://www.smartcommunities.ncat.org/articles/sprawl.pdf. Last accessed 14 July 2011.

LOCAL EXAMPLE—THE COSTS OF PROVIDNG WATER/WASTEWATER INFRASTRUCUTRE FOR TWO AUSTIN DEVELOPMENTS

To determine the costs associated with the provision of water and wastewater infrastructure for new projects in the Austin area, two proposed developments were examined, Carma Easton and Rio de Vida. It is important to note that these two projects are not typical of the conventional single-use low-density suburban development discussed in the literature review section of this study. Upon their build out, these projects will create new parts of Austin providing a range of housing choices, employment opportunities, and local and regional-serving services. These developments are also identified as Mixed-Use Centers on the Imagine Austin Preferred Growth Scenario.

The Carma Easton mixed-use project is 2,214 acres and is proposed southeast of Austin, just east of William Cannon Drive and McKinney Falls Parkway. The land use types include ~14,800 housing units (apartments, townhouses, single-family), office, commercial (including hotels), and civic land uses including a hospital. The urban form of the Carma Easton project very broadly draws from the principles of New Urbanism; however, the mix of uses proposed by this project are more segregated than might be found in a more typical New Urbanist development. In addition, approximately 10% to 15% of the site is set aside for parks and open space.

> New Urbanism is an approach to designing walkable cities, towns, and neighborhoods that promote communities containing a range of housing, work places, shops, entertainment, schools, parks, and civic facilities essential to the daily lives of the residents.

The Rio de Vida project is 2,130 acres and is located on both the east and west sides of SH-130 between FM 969 and the Colorado River. The project will include ~8,100 housing units (single-family houses, urban apartments, townhouses, and "condo" mansions), office space, shops, and restaurants which will eventually provide about 9,000 jobs. The urban form of Rio de Vida, especially those sections located east of SH 130, draw more directly from the principles of New Urbanism—a town center largely surrounded by residential uses. In addition, more than half the site (1,100+ acres) is set aside as parkland and open space.

As noted above, these two projects are not typical of the conventional low-density suburban development; however, they are both greenfield developments (new development on previously undeveloped land) located at the edge of Austin's urbanized area. As such, they provide proxy examples of the costs associated with providing water and wastewater infrastructure for large-scale, largely residential projects on the edge of Austin's urbanized land. However, a closer look at the developments reveals some marked differences in infrastructure costs.

The table below provides the Living Unit Equivalent (LUE) costs for both the water and wastewater infrastructure for the two projects.

Project	LUE* Water	LUE* Wastewater	LUE* Total
Carma Easton	$3,188	$3,256	$6,444
Rio de Vida	$1,421	$1,581	$3,002

**LUE (Living Unit Equivalent) is the typical flow that would be produced by a single family residence located in a typical subdivision.*
The figures for the infrastructure costs came from the City of Austin's Budget Office and were part of the development Municipal Utility District (MUD) applications.

The most significant reason for the cost differential is likely the more compact form of Rio de Vida. Although the two projects are approximately the same size, the developed portion of Rio de Vida occurs on ~1,000 acres whereas for Carma Easton it is ~1,900 acres (it should be noted that the total developable acreage for the two sites also will include uses in addition to the residential ones). Although Carma Easton has 45% more residential units than Rio de Vida, it also has 75% more single-family. This is another factor which makes Carma Easton a less dense development than Rio de Vida and may further explain the difference in the water/wastewater infrastructure costs per LUE.

Although there is only a 17% difference in the amount of multi-family units between the two projects, Rio de Vida specifically calls out their units as "urban apartments" which would seem to indicate that they will be denser and of a more urban building type than the garden-styled apartments typically found in suburban areas.

Unit Type	Carma Easton (~1,900 dev. acres)	Rio de Vida (~1,000 dev. Acres)
Townhouses	2,418	1,143
Apartments/ "Condo" Mansions* and "Urban" Apartment	6,729	5, 560
Single-Family	5,662	1,370
Total Units	14,809	8,073

**No clear definition was provided as to what type of a building is a "Condo" Mansion; however, it is assumed to be a similar to smaller apartment building where the individual units are owned separately owned but the public space is held in common. Rio de Vida proposed 1,505 of these units, which were folded into the Apartment Unit Type category for comparison purposes.*

CURRENT CITY OF AUSTIN COST SHARING POLICIES RELATING TO WATER AND WASTEWATER INFRASTRUCTURE

Throughout the process of creating the Imagine Austin Preferred Growth Scenario map, the issue of who would pays for the infrastructure for the types of development depicted (mixed use centers and mixed corridors) has been raised. The following section of this study reviews the **Code of the City of Austin** to determine who pays for what infrastructure and under what circumstances.

Policies and Practices

The issue of who assumes the costs associated with the provision of water and wastewater infrastructure for infill development and/or redevelopment relies on a number context specific circumstances. Generally, the developer of a site is responsible for the all of the costs associated with water and wastewater infrastructure. However, if the City requests that larger diameter pipes or more robust infrastructure related to water and wastewater service are needed to serve a larger area, the City will pay for all or some of the additional capacity. Section §25-9 of **The Code for the City of Austin**, spells out the circumstances under which the City of Austin will and will not cost participate to help pay for this type of infrastructure.

Type of Infrastructure	Cost Participate	Reimburse
Water Lines	8" to 23" pipes	24" or greater pipes
Wastewater Lines	8" to 23" pipes	24" or greater pipe
Additional Infrastructure	A pump station, reservoir, storage tank, lift station, force main or wastewater treatment plant	Generally not applicable

If a developer agrees to construct water and/or wastewater lines or associated infrastructure such as a pump or lift station that will become part of the City's system, they may apply to the City for cost participation or cost reimbursement for both hard and soft costs. Hard costs are those related to such expenses as materials and site preparation, while soft costs are those related to such expenses as engineering and architectural fees, insurance payments, and property taxes. These infrastructure improvements must be oversized to serve a greater geographic area than the developer's project. Depending on the size of the water and wastewater pipes the city will either cost participate or reimburse the developer.

It is important to note that cost participation and cost reimbursement are not permitted for a wastewater facility that provides service within the drinking water protection zone.

The percentage of cost participation is based upon the increased percentage in pipe diameter due to oversizing. The amount of cost participation for soft costs may not exceed 15% of the hard costs. The amount of cost participation for pump stations, reservoirs, storage tanks, wastewater treatment plants, lift stations, force mains and other associated infrastructure is calculated on the percentage of oversizing of the treatment capacity or pumping capacity. However, the amount of the cost reimbursement for an improvement is based on 100% of hard costs plus up to 15% of hard costs to reimburse soft costs.

Although it is an uncommon occurrence, there is another circumstance when the City will reimburse or cost share for water and wastewater infrastructure. If the water and/or wastewater infrastructure was already in the Capital Improvements Program (CIP) but not funded at the time of a project, developers can be reimbursed for some or all of the costs.

Infill and Redevelopment Cost Estimates

In response to a commuter rail service connecting the cities of Austin and Leander, the City of Austin engaged in several planning processes to focus growth around several rail stops. The resulting plans promote the development of transit-oriented development (TOD) at several points along the rail line. A TOD is a mixed-use community within walking distance of a transit stop that mixes residential, retail, office, open space, and public uses in a way that makes it convenient to travel by foot or by public transportation instead of by automobile. The TODs serve as good examples of the mixed use centers and mixed use corridors that the Imagine Austin Preferred Growth Scenario map presents.

Due to the wider variety of uses in a TOD, the water and wastewater infrastructure requirements for these areas can be greater than typical residential or greenfield developments. If the proposed TOD is an infill or redevelopment project within an existing urban context, it is very likely that the existing underground water and wastewater infrastructure may need to be upgraded to accommodate the expected increased density. In addition, many infill or redevelopment projects occur in long-established areas of the urban environment served by aging below ground infrastructure. As these projects move forward, they are often required to replace these pipes and, on occasion, add other related infrastructure such as lift or pump stations. These instances allow the Austin Water Utility to increase system capacity and efficiency and replace obsolete and inefficient below ground infrastructure.

Replacing below ground infrastructure in this manner is generally less expensive for the City when compared to receiving bids and contracting out these services or simply replacing the lines itself—unless the lines are very large, the City only cost participates for the increase in capacity.

An analysis of three of the TOD sites along the MetroRail line (MLK Jr., Plaza Saltillo, and North Lamar Boulevard/Justin Lane) indicated that a variety various infrastructure improvements would be required for these sites to develop. The analysis noted that

- Water demand for both domestic use as well as fire flow to meet the current fire code will be significantly increased for these areas
- All of theses areas are located in a part of the City with aged infrastructure that is nearing the end of its life cycle and many of the lines in the TOD areas were built more than 50 years ago of materials that have deteriorated over time.
- As redevelopment projects are proposed, the specific condition of affected pipes will be evaluated to determine which pipes have considerable remaining life and which do not.

The analysis estimated the general costs of water and wastewater infrastructure needs for the three TODs. The recommendation stated that $15 million for water and $15 million for wastewater should be allocated in the CIP spending plan for infrastructure improvements. It should be noted that these dollar amounts are rough estimates which may be reduced through cost participation with future development. The table below illustrates the amount and type of pipes that may need to be replaced or upgraded for each of the TODs.

TOD	Water	Wastewater
Lamar Blvd./Justin Ln.	3.5 miles	3.2 miles
Plaza Saltillo	3.5 miles	4.2 miles
MLK Jr.	1 mile	3.0 miles

The Austin Water Utility also recommended continued evaluation of water and wastewater needs in the TODs and updating the CIP plans as necessary. City Council has suggested that staff develop the same utility financing structure for TODs as the Austin Water Utility is doing in the University Neighborhood Overlay (UNO) area to help pay for infrastructure costs.

CITYENGINE MODELING—NORTH LAMAR BOULEVARD AND SOUTH CONGRESS AVENUE

Background

During Phase II of the process to create the Imagine Austin Comprehensive Plan, participants in Community Forum Series #2: Understanding the Dynamics of Change engaged in a mapping exercise to allocate where people would live and work in the future. They were given 6' X 6' base maps and tasked with distributing where 750,000 people would live and where 300,000 jobs would would be located within Austin and its current extraterritorial jurisdiction (ETJ) in the year 2039. To record their preferences on the map, they were provided "sticky" notes (stickers that could be moved if participants changed their minds about the location of sticker) representing different development types that represented different population and job densities. These development types ranged from the very dense Regional Center (30,000 people/20,000 jobs within a square mile) to the Very Low Density Residential (500 people within a square mile). The booklet created for this exercise with all the available development types can be found at:
http://www.ci.austin.tx.us/compplan/downloads/ iacp_cfs2_chipguide-and-othermaps.pdf.

One of the development types, the Mixed-Use Corridor (7,500 people and 2,500 jobs in a linear strip two miles long by half a mile wide), caused some consternation among segments of the community. Their concerns were:

- The corridors in Austin could not absorb the densities presented by the Mixed-Use Corridor
- In order to absorb the densities presented by the Mixed-Use Corridor the fundamental character of the single family neighborhoods adjacent to these corridors would have to change.

CityEngine

Late in the process of developing the Image Austin Comprehensive Plan, the lead consultant firm, Wallace, Roberts, and Todd (WRT), was approached by a software company, Procedural, with their CityEngine modeling software package. CityEngine provides the functionality to model and create 3-D cities and buildings. WRT, as part of their software trial period, offered the software's modeling services to the City of Austin to model elements of the Imagine Austin Preferred Growth Scenario.

Two different roadways were selected for model runs/visualizations—North Lamar Boulevard from 51st Street to Anderson Lane and South Congress Avenue from Oltorf Street to West Mockingbird Lane just north of Stassney Lane. To reflect the Mixed-Use Corridor "sticky" used in the mapping exercise, each of these corridor segments is about two miles long and one half mile wide. The two

roadway segments were selected based on previous work done on during the Imagine Austin planning process relating to a zoning analysis and whether or not the corridors were covered by one or more Future Land Use Maps (FLUM) from adopted neighborhood plans.

The initial part of this analysis began by establishing some parameters for the 3-D visualizations:

- Analysis includes two linear miles of a corridor as well as quarter mile on either side of the roadway.
- Two types of model runs would be preformed—a current zoning scenario and a mixed-use scenario.
- Multi-family or commercially zoned properties would be included and the single-family zoned properties would not.
- Where the data existed, properties were selected based on the Improvement to Land Ratio (ILR) of 1 or below—a measure of the value of a piece of property compared to any improvements or structures on the property. An IRL of 1 indicates that the land and any improvements are of equal value. An IRL less than 1 indicates the land is more valuable than the improvements. Where the data was missing, a review of existing conditions determined whether or not to include the parcel in the analysis. In several instances parcels with ILR greater than one were included where it made sense from a land development perspective, while small or irregularly-sized parcel may not have been included even if their ILRs were below 1.
- Areas in large 100-year flood plains were excluded.
- Building heights would be no taller than 60'.
- Where applicable, reductions in building heights were made to reflect the effects of the City of Austin's compatibility standards.
- Parking would be mostly structured with a few sites, particularly smaller sites, accommodated underground.
- Residential and commercial spaces were allocated within each building with commercial uses being located on the ground floors:
    - 800 gross square footage of building space equals one resident
    - 400 gross square footage of building space equals one job.
- Long stretches of building facades were split into multiple buildings. In some instances, new internal roadways were created.
- Due to budget constraints, only the mixed-use scenarios were included in the axonometric visualizations.

Model Run Results

The results of the model runs for the two corridors demonstrate that using a moderately dense and realistic FAR (1.43 to 1.50) it is theoretically possible to achieve and even exceed the densities represented in the mapping exercise's Mixed-Use Corridor development type (2,500 jobs/7,500 people). The model runs also indicate that under the existing zoning framework, it is possible to

exceed the densities of the Mixed-Use Corridor development type, although, there would be far more jobs than people along the corridor. For North Lamar Boulevard (21st Street to Anderson Lane) using a FAR of 1.50, the Mixed Use development type's population and job densities were achieved. Along South Congress Avenue, using an FAR of 1.43, the visualization model run exceeded the Mixed-Use corridor development type with a projection of 4,700 jobs and 13,200 people. Although portions of the Land Development Code were plugged into the model, it is unknown if the totality of the current zoning regulations and other aspects of the City of Austin Land Development Code (LDC) could realistically produce the type of built environment envisioned by the Imagine Austin process. The complexity and the underlying assumptions of many sections of the code should be reviewed to determine if they are a help or a hindrance to creating the desired urban form.

For a more detailed description of the model run analysis, the following section describes the process of the model runs.

North Lamar Boulevard and South Congress Avenue Model Runs and Visualizations

North Lamar Boulevard

The first model run and visualization was for the North Lamar Boulevard corridor (51st Street to Anderson Lane). The model run first looked at the current zoning to generate the "As-of-Right" scenarios. Three different model runs were conducted for this exercise—Scenarios 1A, 1B, and 1C. The following tables provide the numerical parameters for all the different model runs.

North Lamar Blvd As-of-Right Scenarios	Jobs	People	Comm FAR	Res FAR	Comm ILR	Res ILR
Scenario 1A	2,500	7,500	by Code	by Code	~0.4	~1.5
Scenario 1B	12,100	4,400	by Code	by Code	1	1
Scenario 1C	2,500	7,500	~0.54	~2.55	1	1

Input (fixed)
Output (variable)

For the first run, Scenario 1A, the number of jobs and people were held constant (2,500 jobs/7,500 people as per the Mixed-Use Corridor development type) as were the residential and commercial floor-to-area ratios (FAR) allowed by the Land Development Code (LDC). This resulted in ILRs that were relatively low for commercial properties (~0.4) and rather high for residential sites (~1.5). The second run, Scenario 1B, used the FAR allowed by the LDC and ILRs of 1 for the residential and commercia sites. This resulted in more jobs (12,100) and people (4,400) than represented by the Mixed-Use Corridor. The third run in this series, Scenario 1C, used the number of jobs and people represented by the Mixed-Use Corridor (2,500 jobs/7,500 people) and ILRs of 1. The results were a rather high commercial FAR of ~0.54 and a very dense residential FAR of ~2.55.

The floor-to-area ratio or FAR is a measure of how much development is allowed on a site. To determine how much square footage of development is allowed on a site, multiply the parcels area by the FAR number. A FAR of 1.5 on a acre (43,560 sq./ft) results in a developable areas of 65,340 sq./ft. The zoning along most of Austin; major roadways is CS (Commercial Services) and allows a very dense 2.0 FAR.

North Lamar Blvd Mixed-Use Scenarios	Jobs	People	FAR	ILR
Scenario 2A	2,500	7,500	by Code	~0.9
Scenario 2B	3,200	9,500	by Code	1
Scenario 2C	2,500	7,500	~1.48	1

Input (fixed)
Output (variable)

The second set of the model runs examined three Mixed-Use scenarios—Scenarios 2A, 2B, and 2C. These scenarios assumed that properties along North Lamar Boulevard would redevelop using a mixed-use building type. The first scenario run, Scenario 2A, used the Mixed-Use Corridor numbers (2,500 jobs/7,500 people) and the FAR allowed by the LDC. The result was an ILR of nearly 1 (~0.9). The second run, Scenario 2B, used the FAR allowed by the LDC and an ILR of 1. This resulted in more jobs (3,200) and people (9,500) than represented by the Mixed Use Corridor. The third run, Scenario 2C, kept the jobs and people constant (2,500 jobs/7,500 people) and used an ILR of 1. This resulted in a dense but realistic FAR of ~1.48. The results of Scenario 2C were used in the creation of the axonometric visualization for the corridor and are on page 21.

South Congress

The second set of model runs for this exercise was for South Congress Avenue (Oltorf Street to West Mocking bird Lane just north of Stassney Lane).

South Congress Ave As-of-Right Scenarios	Jobs	People	Comm FAR	Res FAR	Comm ILR	Res ILR
Scenario 1A	2,500	7,500	by Code	by Code	~0.22	~1.13
Scenario 1B	16,250	5,500	by Code	by Code	1	1
Scenario 1C	2,500	7,500	~0.27	~2.58	1	1

Input (fixed)
Output (variable)

The "As-of-Right" Scenarios followed the same method as did the "As-of-Right" Scenario models for North Lamar Boulevard. In the first, Scenario 1A, the number of jobs, people, and the FAR allowed by the LDC were kept constant. This resulted in a very low commercial ILR (~0.22) which indicates high redevelopment potential and a modest residential ILR (~1.13). The second, Scenario 1B, held the FAR allowed by the LDC and an ILR of 1 as constant. This produced many more jobs (16,250) and slightly more people (5,500) than the same process produced on North Lamar Boulevard and more than the Miced-Use Corridor development type. The third, Scenario 1C, held the jobs, people, and ILR as constants. As with the North Lamar Boulevard run, a very high residential FAR (~2.58) resulted; although the commercial FAR (~0.27) is close to that found with typical low-density commercial development.

South Congress Ave Mixed-Use Scenarios	Jobs	People	FAR	ILR
Scenario 2A	2,500	7,500	by Code	~0.75
Scenario 2B	3,900	11,700	by Code	1
Scenario 2C	2,500	7,500	~1.09	1

Input (fixed)
Output (variable)

The "Mixed-Use" Scenarios followed the same method as those used for the "Mixed-Use" Scenarios for the North Lamar Corridor. Scenario 2A held the number of jobs, people, and the FAR allowed by the LDC as constants and resulted in an ILR of ~0.75. Scenario 2B held the FAR and ILR constant and produced similar results as North Lamar's Scenario 2B—far more people (11,700) than jobs (3,900). Scenario 2C held jobs, people, and the ILR constant and resulted in a modest FAR (~1.09).

South Congress Analysis/Visualization	Jobs	People	FAR	ILR
Target	4,977	14,931	1.50	Manual analysis
Zoning Capacity	5,203	15,610	1.70	Manual analysis
Visualization	4,700	13,200	1.43	Manual analysis

input (fixed)
output (variable)

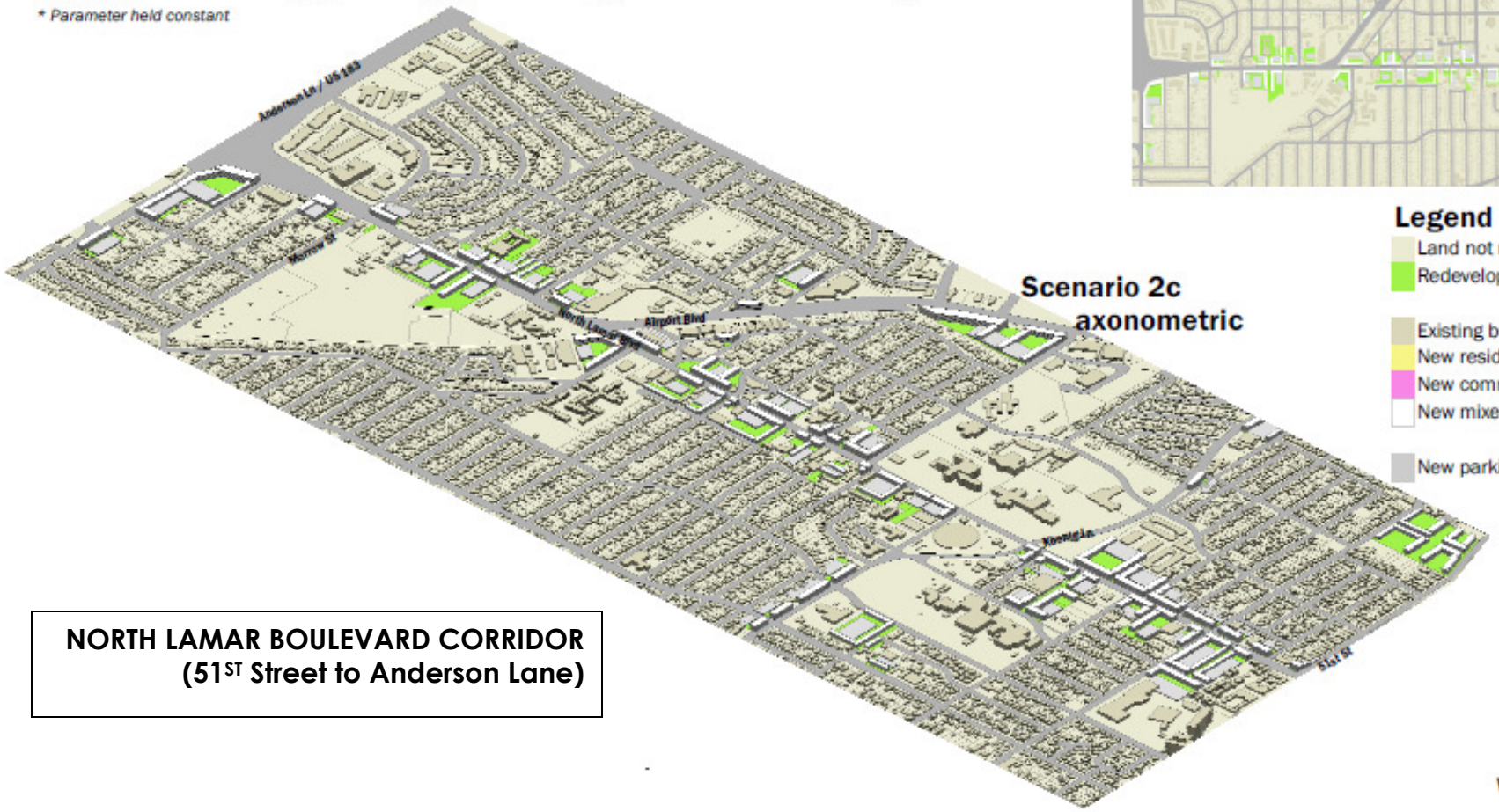
Based on the results of the results for the Mixed-Use model runs for North Lamar Boulevard and South Congress Avenue, a slightly different approach was taken to generate the visualization for South Congress. This roadway presented data issues that did not occur with the North Lamar Boulevard visualization. When generating the ILR for the visualization, many properties did not have the data to calculate the ratio. As a result, the decision to include parcels was made on a site by site basis based on whether or not it could be considered a reasonable candidate for possible redevelopment. In addition, there were several properties in the corridor that had ILRs greater than 1, but were sites that could be easily redeveloped such as self-storage or they were sites with large land areas but with modestly-sized improvements. Most of these occurred south of Ben White Boulevard/West US Highway 290 and the higher ILRs are likely due to the lower land values along this segment of the roadway relative to those to the north. The visualization for South Congress Avenue is page 22.

To generate the numbers used to create the South Congress Avenue visualization three different model runs were conducted with the manually generated ILRs being held constant for all three. The First, "Target Analysis", employed the FAR used to create the North Lamar visualization (1.50). This resulted in almost a doubling of the jobs (4,977) and people (14,931) represented by the Mixed-Use Corridor development type (2,500 jobs/7,500 people). The second run, the "Zoning Capacity Analysis", used a FAR of 1.70 which represents a weighted average of the FAR allowed by the LDC. This run resulted in more than a doubling of jobs (5,200) and people (15,610) than

represented by the Mixed-Use Corridor development type. The final run, the "Visualization Analysis", resulted in a slightly lower FAR (1.43) and lower number jobs (4,700) and people (13,200) than the previous two runs in this series.

	Jobs	People	Floor-area ratio	Improvement-to-land ratio
As-of-right-scenario				
Scenario 1a	2,500*	7,500*	By Code*	0.4 (commercial / 1.5 (residential)
Scenario 1b	12,100	4,400	By Code*	1.0*
Scenario 1c	2,500*	7,500*	0.54	1.0*
Mixed use scenario				
Scenario 2a	2,500*	7,500*	By Code*	0.9
Scenario 2b	3,200	9,500	By Code*	1.0*
Scenario 2c	2,500*	7,500*	1.48	1.0*

** Parameter held constant*



Legend

- Land not redeveloped
- Redeveloped land (unbuilt)
- Existing building
- New residential building
- New commercial building
- New mixed use building
- New parking structure

NORTH LAMAR BOULEVARD CORRIDOR
(51ST Street to Anderson Lane)

Working Draft 11 July 2011

	Jobs	People	Floor-area ratio	Improvement-to-land ratio
As-of-right-scenario				
Scenario 1a	2,500*	7,500*	By Code*	0.22 (commercial / 1.13 (residential)
Scenario 1b	16,250	5,500	By Code*	1.0*
Scenario 1c	2,500*	7,500*	0.27 (commercial) 2.58 (residential)	1.0*
Mixed use scenario				
Scenario 2a	2,500*	7,500*	By Code*	0.75
Scenario 2b	3,900	11,700	By Code*	1.0*
Scenario 2c	2,500*	7,500*	1.09	1.0*
Analysis/Visualization				
Target 3a	4,977	14,931	1.50*	Manually identified
Zoning Capacity 3b	5,203	15,610	1.70*	Manually identified
Visualization 3c	4,700	13,200	1.43	Manually identified

** Parameter held constant*

SOUTH CONGRESS AVENUE CORRIDOR
(Oltorf Street to West Mockingbird Lane)