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ArcGIS Urban: an application for plan assessment



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Abstract

Most cities in the United States rely on zoning to address important planning-related issues within their jurisdictions. Planners often use GIS tools to analyze these issues in a spatial context. ESRI's ArcGIS Urban software seeks to provide the planning profession with a GIS-based solution for various challenges, including zoning's impacts on the built environment and housing capacity.

This research explores the use of ArcGIS Urban for assessing the existing zoning and comprehensive plans in meeting the projected residential growth in the near future using the City of Arlington, Texas as a case study. The exploration provides examples and lessons for how ArcGIS Urban might be used by planners to accomplish their tasks and highlights the capabilities and limitations of ArcGIS Urban in its current stand. The paper is concluded with some suggestions for future studies.

Keywords: ArcGIS urban, Zoning, Land use, Urban planning

1 Introduction

As cities grow, it can be a challenge to provide enough housing for increasing populations. The vast majority of these housing units are built and maintained by private development. However, housing development is heavily influenced by a city's zoning code, as zoning is "a central part of planning's technical apparatus ... [and has] proved to be an immensely powerful mechanism to shape the city" (Sclar et al., 2019, p. 6). City governments thus play a crucial role in ensuring the market can meet demand for new residential units (Pogodzinski & Sass, 1990).

In a planning department's administration of the zoning code, the impacts of existing districts and their regulations are evaluated regularly, but typically on a case-by-case basis in which the focus is on individual developments and their surrounding blocks. However, the citywide zoning map also deserves attention, especially when it comes to large-scale issues like housing availability. Also, no planning concept exists in a vacuum:

City planners must consider comprehensive plans and future land use maps when considering the allocation of future residential growth.

Such complex and consequential assessments usually benefit from the latest technology and innovative methods (Amoroso et al., 2019). To effectively organize and analyze data, as well as visualize analysis results, planning professionals often rely on planning support systems (PSS). This ever-evolving set of tools and processes combines geographic information systems (GIS) with non-spatial data, models, and visualization techniques to facilitate key planning tasks (Klosterman, 1997; Goodspeed & Hackel, 2019).

ArcGIS Urban is a new web-based 3D application released by ESRI that can, among other planning-related capabilities, incorporate zoning and overlay districts from a GIS layer and then model household capacity based on current regulations. Additionally, the program can store multiple rezoning scenarios, which would allow for comparisons to find the optimal zoning configuration for a particular household unit target (ESRI, 2020b). Some cities, including Seattle and Honolulu, have successfully used this software to evaluate changes to their zoning code and the rezoning plans for specific

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areas (Patrick, 2019; Patrick, 2020). However, the tool is largely unknown to many planners and the applications are limited due to the infancy of the software. Also because the focus and advantage of ArcGIS Urban are on projects and scenarios in small areas, the application for planning decisions at a larger, especially citywide-scale could be challenging.

Using the City of Arlington, Texas, as a case study, this research explores how ArcGIS Urban might serve as a new, innovative component of a PSS, specifically to assist with the task of evaluating a city's zoning in terms of projected residential growth and the comprehensive plan. Specifically, the study attempts to show how ArcGIS Urban can be used to address the following questions:

- Given the projected population growth, can the City of Arlington accommodate the housing demand with the existing zoning and comprehensive plan?
- To what extent can the current zoning and comprehensive plan meet the demand for housing of the projected population?
- What may need to change in order to accommodate the demand for housing?
- What effect may the change result in?

This study adds to the currently limited case studies that could help urban planners recognize the functionalities and limitations of a new software. In addition, the approach presented in this study is transferable. The illustration provides an example on how ArcGIS Urban may be used innovatively to assist city planners in addressing the population growth and housing accommodation challenges at a city-wide scale. Planners elsewhere can use the same approach for similar challenges under their own context. By helping planners know the software and showing how it can be used creatively, the study facilitates a wider use of ArcGIS Urban. In the following, we first briefly review the current studies on zoning impacts and applications of ArcGIS Urban in city planning. After the description of the assumptions and technical steps for the case study, we present a few examples of the application results. The final session summarizes the application process and lessons learned, and offers a few suggestions for further study.

2 Zoning impacts and City planning

Zoning had been used as a tool to overcome many problems associated with urbanization such as pollution, overcrowding, unsafe living conditions, and unpredictable development in the early decades of the twentieth century (Sclar et al., 2019; Talen, 2012). Zoning in the modern society has also played a significant role in affecting housing, the landscape and the social

environment of cities, as it has been a factor in decreasing the supply of rental units and raising the housing costs for low-income families over the years (Quigley & Raphael, 2004). According to Pollakowski and Wachter (1990), “the most important land-use-related effects on housing price stem from zoning restrictiveness,” and price increases are more likely due to a decreased supply, rather than an increased quality of housing (p. 322). Essentially, zoning can distort the housing market and keep it from entering a “well-functioning” state in which “when prices rise, supply increases, and then prices stop rising and sometimes even fall” (Glaeser et al., 2006, p. 1). The social implication of zoning via housing price change is significant.

Scholars have insisted that in order to pursue planning goals in the most effective manner, a city's comprehensive zoning ordinance and its potential effects “should be continually evaluated and subjected to empirical understanding of ‘on the ground’ outcomes” (Talen et al., 2016). Klosterman (1999) describes a “what if?” planning support system “that can be used to determine what would happen if clearly defined policy choices are made and assumptions concerning the future prove to be correct”, including predictions about population growth and densities. Klosterman's PSS allocates land use based on demand in light of environmental constraints and man-made restrictions such as zoning. Klosterman (1997) emphasizes that a PSS will not be “a closed black-box” used only by insiders but “must be seen as providing the information infrastructure for planning that facilitates interaction among planners, and between planners and other actors, both within and outside of government”. Goodspeed and Hackel (2019) elaborate that an effective PSS must also include the organizational practices that enable all parties to work together to analyze, design, evaluate, and continually update the process to better accomplish planning tasks. A web-based, interactive platform might be the best way to provide access to all stakeholders -- regardless of IT infrastructure or GIS experience (Goodspeed & Hackel, 2019). This type of platform aligns with the “fully integrated, flexible, and user-friendly system” originally proposed by Klosterman (1997).

3 ArcGIS Urban and applications in city planning

ESRI's ArcGIS suite of software programs are commonly used by planners in both the private and public sectors. These GIS programs have evolved over time with advances in technology and user demands. The most significant recent change might be the shift toward web GIS, including ESRI's ArcGIS Online and their latest desktop product, ArcGIS Pro, which integrates with the online platform.

Building off the successes of ArcGIS Online, ESRI introduced the web-based, planning-focused platform, ArcGIS Urban, in 2019 (Schoebitz, 2019). Billed as a “a web-based solution that applies GIS technology to urban planning to streamline plan creation, analyze the impact of plans, visualize current projects, and facilitate public engagement”, ArcGIS Urban aims to provide municipalities with a go-to platform for visualizing, analyzing, and getting feedback on projects and plans throughout their jurisdictions (ESRI, 2020b). One of the main features for ArcGIS Urban involves plugging in zoning regulation parameters and assigning zoning districts to study areas to see their impacts on the urban landscape through 3D zoning envelopes created on-the-fly, as shown in Fig. 1. Additionally, the program calculates capacity indicators like population, households, jobs, required parking, and environmental impact factors based on multipliers inputted for each space use type.

Though only slightly more than 2 years old, ArcGIS Urban is being used by cities across the country to tackle various planning challenges. The City of Seattle, Washington, is one of those municipalities, and they are especially focused on using the program to assist in the building permitting and zoning processes. Due in large part to the “boom” of technology companies headquartered in Seattle, the city faces a myriad of growth-related issues, including “the need to absorb 60 new residents daily while maintaining housing affordability and balancing the impacts of a widening prosperity gap” (Patrick, 2020). ArcGIS Urban allows the city planners and their teams to view proposed developments in the urban context and to identify which Seattle neighborhoods are seeing the most change. Furthermore, the team is using the problem to keep track of how well its zoning

accommodates more density and households, and to evaluate various scenarios for consideration (Patrick, 2020).

Across the Pacific, another city has used ArcGIS Urban to address zoning and housing challenges. The City of Honolulu faces the tricky balance of managing the effects of tourism with the housing needs of its own population (Patrick, 2019). To provide enough affordable housing, the city proposes a number of zoning-related changes, including increasing the allowed height of apartment buildings to permit more floors and units. The planning team used an Urban model to view how this proposed upzoning would look in a 3D context. According to the department’s GIS administrator, the team was thrilled “when they realized that they could quickly and easily change values in the zoning code and see what difference in development would be” (Patrick, 2019).

In North Carolina, the City of Charlotte is in the process of adopting ArcGIS Urban to serve as a centralized platform for tracking development changes. This shift from “flat site plans” to an accessible 3D model “could give council members, planners, and the public access to a whole new perspective on proposed developments, [allowing them] to view it from multiple angles and see how it works within the surrounding neighborhood” (Portillo, 2020). The planners also hope to publish the 3D scenarios as web scenes on the city’s website. Charlotte’s proposed use of the program demonstrates that ArcGIS Urban could enhance both internal and public understanding of their city’s evolution.

The aforesaid initiatives share the common goal of using ArcGIS Urban to evaluate impacts of developments in specific locations or to track development

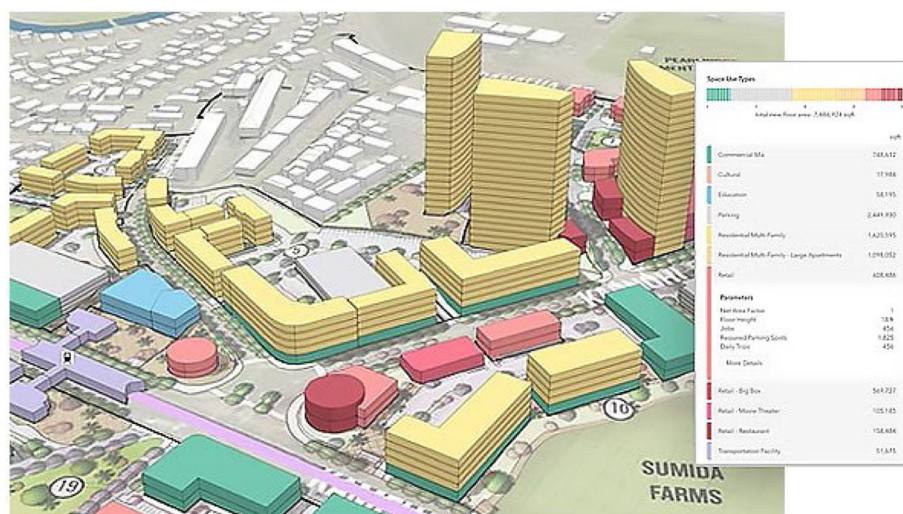


Fig. 1 Example Zoning Plan Scenario in ArcGIS Urban (Source: ESRI, 2020c)

changes. However, the number of applications are limited due to the infancy of ArcGIS Urban. Additionally, there exists a lack of information on the potential to use the program as a planning support system for an entire city. Broader application examples are needed to explore the usefulness of the program.

4 Plan assessment with ArcGIS Urban: assumptions and data

Many planners see the potential for ArcGIS Urban to assist with addressing housing deficits and growth management (ESRI, 2018; Patrick, 2019; Patrick, 2020). This study takes the next step and puts that potential to the test by attempting to use ArcGIS Urban to analyze one city's existing zoning code in light of its projected growth and comprehensive plan. In the following, a brief description of the city and the challenges are provided, followed by the assumptions, data, and analytical steps adopted for the study.

4.1 Past and future growth in the City of Arlington, Texas

The City of Arlington is the third largest city in the Dallas-Fort Worth (DFW) Metroplex and the seventh largest in Texas, with an estimated population of 398,854 in 2019 (U.S. Census Bureau, 2019a). Its city limits and surrounding cities are shown in Fig. 2. Per American Community Survey estimates, Arlington consists of 138,

639 households with an average household size of 2.85 in 2019 (U.S. Census Bureau, 2019b). Since the 2010 Census, the number of residents is estimated to have grown by 9.14%.

Much more growth is expected over the next few decades. According to the North Central Texas Council of Governments (NCTCOG), Arlington is projected to have 532,260 residents across 188,632 households by 2045 (NCTCOG, 2017). While this rate pales in comparison to some other municipalities in the DFW metroplex, Arlington's growth is significant for an established, virtually landlocked city (U.S. Census Bureau, 2019a; Lenzen & Medeles, 2019). The anticipated growth presents a challenge for the city to accommodate the growth.

4.2 Data & assumptions

Several datasets are used for this study. The data include the population and household projections from NCTCOG (2017), the comprehensive plan and current zoning regulation from the City of Arlington (2015, 2020), and the existing parcels from Tarrant Appraisal District (2020) as listed in Table 1.

This study is based on the following assumptions:

1. The existing zoning regulations are in the current *Unified Development Code (UDC)*;

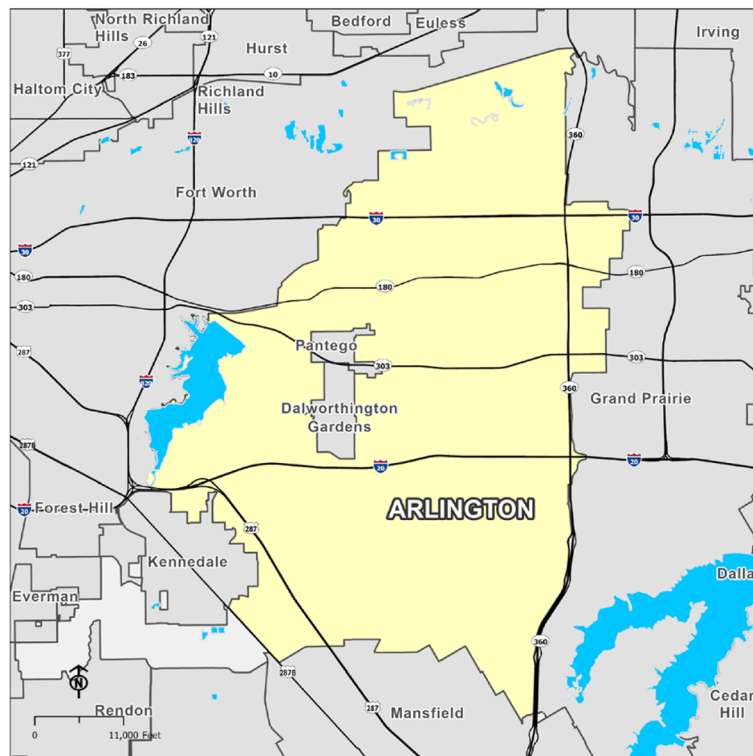


Fig. 2 Arlington's City Limits and Surrounding Cities (Arlington, 2018)

Table 1 List of datasets and sources

| Dataset | Unit & counts | Source |
|----------------------------------|------------------------------------------------|----------------------------|
| 2045 NCTCOG Demographic Forecast | 225 traffic survey zones (TSZs) | NCTCOG |
| Comprehensive Plan | 4 types of future development areas | City of Arlington |
| Existing Zoning | 21 zoning districts with 6162 polygon features | City of Arlington |
| Parcel Layer | 108,077 Parcels | Tarrant Appraisal District |

2. Planned Developments (PD) are classified by their base zoning districts and follow those respective standards from the *UDC*, rather than the unique regulations that each PD might be designated;
3. The existing city limits and general parcel fabric stay the same with no expansion during the study period;
4. TSZs not completely within the City’s jurisdiction (such as those partially within city limits) are excluded from the model; and
5. Population growth is as of the projection by NCTCOG (2019).

4.3 Analysis approach

The analysis contains four broader steps:

1. Estimate the number of current households and density by TSZ. This step is necessary as the NCTCOG does not provide current household estimates, which is the base for calculating changes. This task is accomplished using the ESRI’s demographic estimates at the census block group level at the time of study and tools to extract 2020 total households throughout the city (ESRI, 2020a), and proportionate residential land area and apply the portion of households to respective TSZs. Specifically, residential land areas are extracted out from the land use layer, then the residential land areas are overlaid with the TSZ and census data

2. Identify areas that are inadequately zoned. This task is completed by first calculating the number of households that each TSZ can accommodate in the planning period based on the existing zoning code as displayed in Table 2. For example, if an area of 10 acres is designated as Rural Residential with a RE zone, this area would be assumed to accommodate 10 households. Similarly, if an area of 10 acres is designated as Rural Residential with a RS-20 zone, the number would be 20, so on and so forth. The results are then compared with the number of households projected by NCTCOG (2019). Areas with deficits, that is the projected number of households is greater than the number of households that can be accommodated, are identified. This step is critical in limiting the scope of the study when applying ArcGIS Urban for the assessment of the existing zoning plan at the citywide level.
3. Create rezoning scenarios within ArcGIS Urban to discover whether they can be rezoned to meet the forecasted demand, given the menu of zoning districts and the proposed development pattern in the comprehensive plan. The rezoning possibilities included upzoning the existing residential districts,

Table 2 Residential densities and zoning desired for future development areas

| Future Development Areas | SF Density (unit/acre) | MF Density (unit/acre) | Permitted Residential Zoning* | Zoning District / Overlay | Max Dwelling Units per Acre |
|------------------------------------|------------------------|------------------------|-----------------------------------------|---------------------------|-----------------------------|
| Rural Residential | 4 | - | RE, RS-20, RS-15, VG | RE | 1 |
| Established Residential | 8 | 30 | RS-7.2, RS-5, RM-12, RMF-22 | RS-20 | 2 |
| Mixed Use Residential | 12 | 60 | RS-7.2, RS-5, RM-12, RMF-22, NMU | RS-15 | 4 |
| Downtown / University Neighborhood | 18 | 100 | RS-7.2, RS-5, RM-12, RMF-22, NMU, RMU | RS-7.2 | 6 |
| Regional Activity Center | 22 | 90 | RS-7.2, RS-5, RM-12, RMF-22, NMU, RMU** | RS-5 | 8 |
| Regional Industrial Center | - | - | - | RM-12 | 12 |
| | | | | RMF-22 | 22 |
| | | | | VG | 4.5 |
| | | | | NMU | 40 |
| | | | | DNO* | 40 |
| | | | | LCMUO* | 40 |
| | | | | EDO* | 40 |

*Based on maximum allowed densities and development area descriptions
 ** Mixed use developments in the Downtown, Entertainment District, and Lamar Collins areas may exceed the average target density; pending development review.

namely from single-family districts to higher density multifamily districts, changing surrounding commercial districts to mixed use, and other similar scenarios that increase population density, such as infill development.

4. Present the results of the proposed plan scenarios.

The analysis in the first two steps can help address the questions about if and to what extent the City of Arlington accommodates the housing demand with the existing zoning and comprehensive plan, as well as to identify the areas with housing deficits. The last two steps provide planning options for addressing the questions of what may need to resolve the housing deficit issue and the effects associated with the options. They also facilitate public engagements and decision making. The results are presented in the following section.

5 Assessment results and illustration of the proposed scenarios

The analysis results indicate that overall, the majority of the TSZs in the city would permit the necessary type and intensity of housing developments based on the current comprehensive plan and zoning ordinance to meet the projected demand for 2045. Thirty-two TSZs (totaling 11.6 mile²) would likely have a housing deficit. The analysis also reveals that twenty-eight of these TSZs can be rezoned, either by changing the zoning from a commercial to residential district or increasing the housing density in a district while still following the development patterns outlined in Arlington's *99 Sq Mi* comprehensive plan. However, the rest of four TSZs would require significant changes that are not allowed by the current comprehensive plan (Table 3). Fig. 3 displays the locations of the thirty-two TSZs.

Since each TSZ is associated with its own spatial context and restrictions based on the comprehensive land use plan, the scenario analysis is performed for each TSZ in order to allow the flexibility of alternative scenarios. Figures 4, 5 and 6 show three examples of the proposed changes in order to meet the projected demand in 2045.

5.1 Parking lot refill development

This study area is located north of I-20 between Matlock Road and South Collins Street. It is home to the

Arlington Highlands retail center and GM Financial Arlington Operations (Google, 2020). As shown in the map on the left of Fig. 4, it is in a Regional Activity Center, per the comprehensive plan. According to NCTCOG's estimates, this area will add 1734 households in the next 25 years, despite having no households in 2020.

With some Regional Mixed-Use (RMU) zoning and around 800,000 square feet of mixed-use infill projects, the model shows that this area would be able to create enough apartments to house the projected growth. As shown in the map on the right of Fig. 4, a possible site for this development is in the large parking lots on the east side of the study area, which is the orange 3D buildings represent the high-density residential space use type. This would place it along the interstate and a major arterial, which seems like an ideal location for such a large project.

5.2 Industrial redevelopment

Located at southwest of the intersection of I-20 and Highway 360, this study area is projected to grow significantly from 516 households in 2020 to 4969 in 2045 (Fig. 5). The north part of the study area is primarily large industrial warehouses, while the south part consists primarily of existing RS-5 and RS-7.2 residential subdivisions with some Community Commercial (CC), as shown in the map on the left of Fig. 5. The TSZ is also home to James Bowie High School (Google, 2020).

Within the Regional Activity Center future development area, the rezoning scenario (shown in the map on the right of Fig. 5) proposes redeveloping some of the industrial warehouses along East Bardin Road into a large Regional Mixed-Use project. This alone could create enough households to absorb the 863% growth rate. New York Avenue provides a nice buffer to the detached single-family homes to the west -- so much so that the mixed-use buildings would not have to restrict their height to 40 ft, like they would if within 40 ft of a residential property line (City of Arlington, 2020).

5.3 Downtown medium-density redevelopment

This study area makes up part of Downtown Arlington, though is outside the Downtown Neighborhood Overlay (Fig. 6). It consists of the blocks surrounded by South Center Street to the east, North Cooper Street to the north, West Abram Street to the south, and West

Table 3 A summary of the growth demand and assessment of the current plan

| | HH in 2020 | Projected HHs in 2045 | Growth (HH) | #TSZs |
|--------------------------------|------------|-----------------------|-------------|-------|
| Total included in study | 138,909 | 183,951 | 45,042 | 225 |
| Accommodated | 138,909 | 140,397 | 18,967 | 193 |
| Required changes | 0 | 38,304 | 23,652 | 28 |
| Non-accommodated | 0 | 5250 | 2423 | 4 |

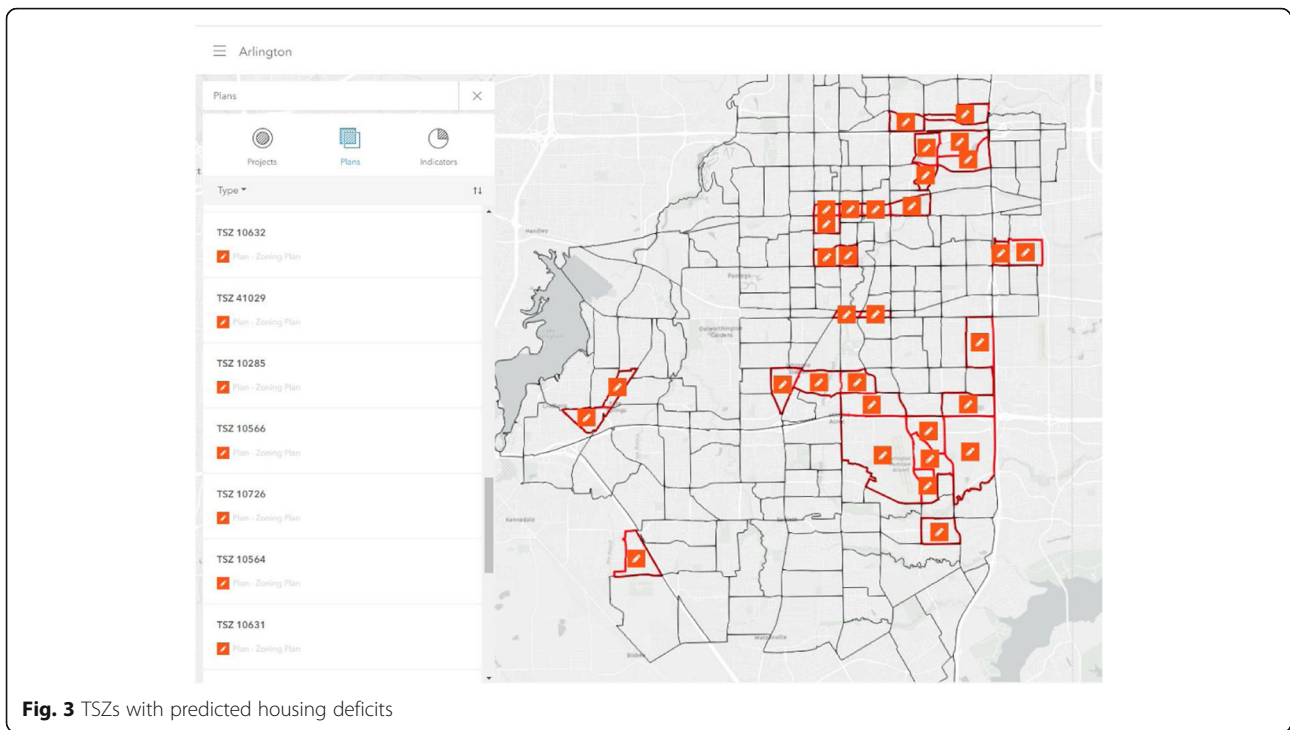


Fig. 3 TSZs with predicted housing deficits

Division Street to the north. It includes Arlington City Hall and the George W. Hawkes Downtown Library (Google, 2020). The existing zoning is almost all Downtown Business (DB) with some Light Industrial (LI) and General Commercial (GC). As shown in the map on the left of Fig. 6, this TSZ is part of the comprehensive plan’s Downtown / University Neighborhood.

While densities up to 100 units per acre are envisioned for this future development area, the study area is only expected to grow to 54 households over the next 25 years, thus any rezoning does not need to be as drastic as in other parts of Arlington. The rezoning scenario, depicted in the map on the right of Fig. 6, calls for limited redevelopment with a mix of RMF-22 multi-family apartments and RM-12 townhomes. Even this much housing along West

Main Street could be a major change to the downtown urban fabric, though, so any real-life planning in this study area would likely require multiple scenarios to ensure the best fit with existing businesses and buildings.

In short, the results shows that if the City of Arlington follows its current comprehensive plan and zoning ordinance, it would be able to accommodate most of the projected housing demand. The results also reveal that some areas [about 10%] would require adjustments in the current land use and zoning plans, while other areas, though very small (about 1% of Arlington’s total square miles), would need further study of options beyond the current plans and zoning ordinance regulations such as increasing the maximum density. The examples illustrate how ArcGIS



Fig. 4 Parking Lot Refill Development

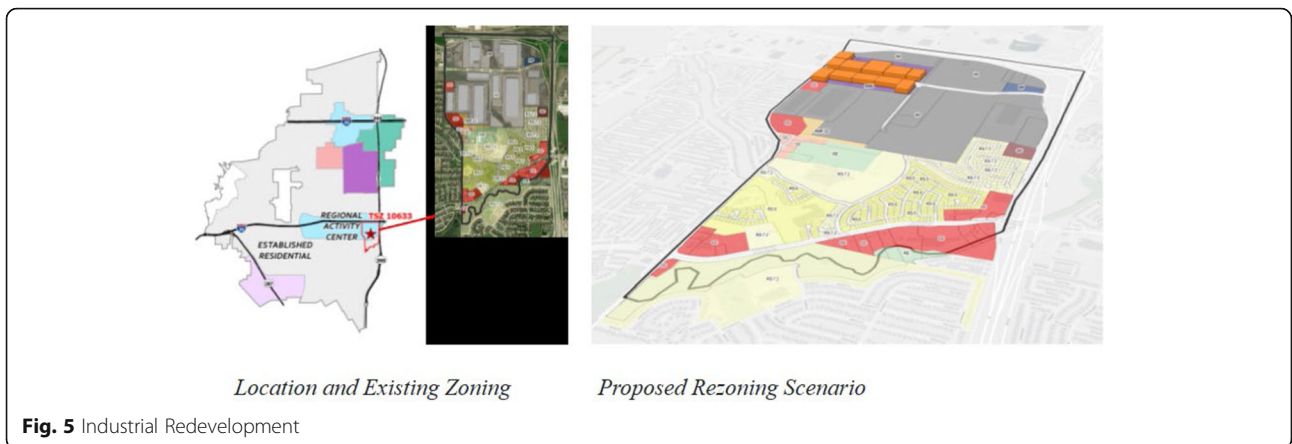


Fig. 5 Industrial Redevelopment

Urban might be used in analyzing, presenting and visualizing the effects of planning alternatives.

6 Summary and discussion

This study aims to explore the applicability of ArcGIS Urban for land use and zoning planning to meet the projected residential growth demand. The case study helps planners and policy-makers in the City of Arlington identify the deficits of the existing zoning and comprehensive plan in meeting the future housing demand. Planners and policy-makers can fine-tune the current zoning and comprehensive plan, and assess the effects of the new plan or policies by following the process of this study. Planners and policy-makers in Arlington can also use ArcGIS Urban to engage the public in adopting new zoning and comprehensive plan.

In a broader context, this study adds to the currently limited case studies and demonstrates that ArcGIS Urban could serve as an effective planning support system (PSS) in conjunction with ArcGIS Pro and ArcGIS Online. In addition, it provides insights into the relationships among housing demand, zoning, and the comprehensive plan. Moreover, the process used in this study is

transferable for planners and non-academics elsewhere to perform evaluations with ArcGIS Urban.

This study is by no mean without limitations. Like any modeling or “what if” studies, the analysis must base on some assumptions, which bears the question of how realistic the results of the Urban model might be. For example, the assumption for the PD zoning used in this study simplifies the process but would ignore the PD’s unique regulations and lead to incorrect outcomes for those areas where there exist differences between PD and common zoning regulations. Other assumptions could also have affected the model outcomes. Due to the time limit and paper length constraint, the study only focuses on one scenario with incremental changes for each area with projected housing deficit. Nevertheless, this study can service as an example for inspiring others to explore and use ArcGIS Urban, and the analytical approach adopted by this study could be applied by planners in other municipalities for their planning efforts.

This study generates several observations. First, ArcGIS Urban is excellent in modeling and visualizing the existing conditions and the proposed scenarios. It really shines when it comes to evaluating multiple scenarios for a plan area in terms of population and aesthetic



Fig. 6 Downtown Medium-Density Redevelopment

impacts. It can often be difficult to imagine how policies and plans translate into reality in the built environment, and ArcGIS Urban offers a way to do so with readily available data and without specialized artistic or 3D modeling skills. This task would be made even more real if the user imported a 3D layer of existing buildings and a 3D layer of trees and street furniture, thus adding yet other sources of context to help with visualizing and decision making. Furthermore, integration with other ESRI products, such as ArcGIS Online and ArcGIS Hub, extends the reach of these 3D scenarios and allows them to be shared online to other stakeholders, potentially impacting the public reception of proposed projects and planning initiatives.

Second, ArcGIS Urban provides selection and editing tools for choosing sites within the defined area, but not any efficient methods for identifying areas across the entire city/study area where rezoning would be necessary. For instance, within a TSZ, ArcGIS Urban can clearly display the existing conditions (zoning districts and parcels) and make it easy to reconfigure them. However, it lacks geoprocessing tools for accomplishing typical GIS analysis such as selections, queries, joins, and field calculations. Similarly, ArcGIS Urban assumes that zoning district regulations are static, but in reality, they sometimes change based on a property's surrounding context. For instance, the *Unified Development Code* (UDC) dictates different setback minimums depending on the type of streets. Neighborhood (NMU) and Regional Mixed-Use (RMU) districts have unrestricted heights unless within 40 ft of a residential property line (City of Arlington, 2020). Fortunately, many geoprocessing and site selection can be done in ArcGIS Pro, published to ArcGIS Online, and brought into ArcGIS Urban. The ability to work back and forth among these programs can minimize, if not eliminate, geoprocessing and query obstacles. Other tools, such as the ArcGIS UrbanConnector, the 3D Basemaps, can be used in conjunction with ArcGIS Pro, ArcGIS Online, and ArcGIS Urban to facilitate data processing model building tasks.

Third, ArcGIS Urban has the ability to quickly provide estimates associated with each scenario ranging from population to carbon emissions to parking and display the indicators. However, some of these calculations can be less than reliable if left to the defaults. The basis for these so-called capacity indicators are the values stored with each space use type (e.g., area per household) which are then multiplied by the building footprint area, not the parcel area. The user can update these stored values as needed.

Fourth, while not demonstrated in this study, ArcGIS Urban provides project and feedback options. The project option allows planners and municipal administrators to document individual development projects, their

development status, and other information related to the project. The feedback option allows the public to enter their comments on a specific plan or project. It is a nice feature for public engagement in planning. However, the feedback can be further enhanced with sorting comments/feedback by subject categories.

Last, ESRI released a new version of Urban in October 2020, after the completion of the modeling portion of this study. The update included the ability to “validate Zoning Plans against any Land Use Plan scenario” (ESRI, 2020d). It appears that this feature would enable the user to upload a future land use layer (or something more general like Arlington's future development areas) as a land use plan and have the model check whether the proposed development matches the development pattern outlined in a city's comprehensive plan. This automatic feedback would promote the comprehensive plan layers from mere visual reference layers to data actively incorporated in the model's calculations. Nevertheless, ArcGIS Urban does require large computer and graphic processing power, and high speed internet connection.

In general, the rezoning scenarios in ArcGIS Urban could be an asset to any planning department with robust GIS data seeking to go beyond flat plats or site plans, or to create area or corridor plans for various parts of their city. These teams should be prepared to either have to simplify their zoning regulations for the model or to spend a lot of time tweaking regulations for specific parcels within each plan scenario. ArcGIS Urban is still a new program, and ESRI seems committed to improving it with each release. In time, it may prove to be a full-fledged PSS, or something closer to it with fewer limitations.

This project has focused exclusively on ESRI GIS products, primarily ArcGIS Urban. Future studies might want to explore and compare other 3D visualization and modeling tools for planners, to see how they could contribute to planning processes or perhaps even serve as a complete planning support system in a manner that Urban currently cannot. Some of other scenario simulation programs such as Urban Canvas, formerly Synthicity until it was acquired by Autodesk in 2015; UrbanSim, an open source platform created by Paul Waddell of the University of California, Berkeley; and UrbanFootprint, co-founded by Peter Calthrope of the Congress for New Urbanism fame (Shieber, 2020; Waddell, 2020). More work could be done to identify best practices for using ArcGIS Urban to communicate controversial zoning changes.

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(Software application or custom code)
ArcGIS Urban.

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