

Land-use Compatibility is a Matter of Design, Not Distance

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Mixed-use development is essential for a sustainable, high-quality urban lifestyle. Mixed-use development implies fewer automotive trips, shorter travel times, smaller dwelling units, enhanced walkability, and a stronger sense of community. Despite these clear advantages, single-use zoning remains prevalent in cities today as advocates point to issues like compatibility of land-use and the isolation of noise, pollution, and hazards. Single-use zoning was essential for public health and welfare at the turn of the 20th century, mixed-use development is essential for health and welfare in the 21st century. As our society has evolved, land-use compatibility has become a matter of design, not distance.

INTRODUCTION

While land-use zoning that separates the workplace and commercial space from residential development was meaningful prior to the Clean Air Act of 1970, single use zoning is not compatible with 21st century sustainable development practices. Traditional, single-purpose zoning generates sprawl and is not sustainable. Instead, design can and should resolve issues stemming from the mixing of land uses: agricultural, industrial, office, commercial, and residential. Houston, Texas is cited as the largest city in the United States without single-use zoning and generates multiple mixed-use centers (Gonzalez, 2017). This article uses case studies in Houston, Dallas, and Lubbock, Texas and in Washington, D.C. to illustrate the impact of multi-use zoning and mixed-use, whether unplanned or planned.

BACKGROUND

A History of Urban Industrial Pollution and Single Land-use Zoning

Single use zoning has its roots in Industrial Age efforts "to improve the quality of life in Europe's major cities. During the 19th century, city planners in Europe began to separate factories and industrial centers from residential development...the separation of residential uses from industrial land-uses proved very successful in improving the quality of life for urban residents and in increasing their life span" (Lamer, 2010, 2). 19th century industrial cities were choked with air pollution and sanitation issues Coal burning was to blame for the majority of 19th century London's air pollution (Ritchie, 2017) shown in Figure 1. Cities in the United States faced similar concerns from burning coal and, beginning in the early 1920's, enacted single-use zoning ordinances to ensure separation of incompatible uses such as dwellings and factories (Benzkofer, 2015). For example, "it was 10:15 a.m. on Feb. 1, 1957, when this picture

shown in Figure 2 was taken at State and Lake streets in downtown Chicago, but it might as well have been midnight as smog descended on the city and blotted out the sun” (Benzkofer, 2015), as shown in Figure 2.

**FIGURE 1
LONDON, LATE 19TH CENTURY**



Hardie, 1950

**FIGURE 2
CHICAGO, 1957**



Wieting, Chicago Tribune

Environmental Era

Many of the issues that required the separation of land uses, such as burning coal for heat and power, were resolved during the environmental era. The 1970 Clean Air Act in the United States marked the beginning of a new world-wide environmental era. The Clean Air Act required that when new industrial facilities were designed and built, good pollution control must be part of the design. This legislation meant that as new, cleaner facilities were built, the country's industrial base became cleaner overall. Since the passage of the Clean Air Act, public health was protected as economic growth proceeded (Environmental Protection Agency, 2019c). In London, air pollution was reduced due to "a complex mix of factors, including economic restructuring away from heavy industry, switching energy sources, and increased environmental regulation" (Ashworth, 1986). In terms of quantifiable results, suspended particulate matter (SPM) during the 19th century in London was at a level of 620 milligrams per cubic meter compared with 15 milligrams per cubic meters SPM in 2016 (Ritchie, 2017). In London, dirty industry, which required the separation of residential zones and industrial zones, exists today primarily in the form of aging coal plants (Ritchie, 2017). Similarly, in the United States, the Environmental Protection Agency (2019b) reports, "Aggregate emissions of six common pollutants dropped 70% between 1970 and 2015." The strict separation of land-uses, while appropriate for the Industrial Age, is no longer required with clean industry. Separation of land-uses today is more of a detriment to public health than a cure due to sprawl.

Urban Sprawl

Urban sprawl is readily seen as a form of suburban development that involves the low-density expansion of cities over a wide geographical area, usually into undeveloped land. Sprawl is "characterized by low-density residential housing, single-use zoning, and increased reliance on the private automobile for transportation" (Rafferty, 2019). In sprawl, "different land uses-housing, retail stores, offices, industry, recreational facilities, and public spaces such as parks are kept separate from each other, with the separation enforced by both custom and zoning laws" (Frumkin, 2002). Zoning policies that restrict land uses cultivate a culture of single-use zoning that encourages sprawl and enables an automobile driven culture. The use of an automobile is required with sprawl because the distances between home and other points of interest are too great for walking and bicycling. In addition, population densities in sprawled areas typically prove too low for public transportation.

In the United States, "Aggregate emissions of six common pollutants dropped 70% between 1970 and 2015" (Environmental Protection Agency, 2019d). In their place, the separation of land uses has increased the impact of a different set of pollutants due to sprawl, including carbon dioxide. According to Dr. Jennifer Vanos (2017, personal communication), a climate science researcher, increased carbon dioxide concentrations in the atmosphere contribute to global warming, heat island effects in cities, and issues of community health. In particular, single use zoning creates a society that requires extended vehicular trips to travel from home to work and back. The average commute from home to work is 30 miles roundtrip (United States Department of Transportation, 2003) with .89 lbs. of carbon dioxide generated per mile (Environmental Protection Agency, 2019a). A 15-gallon tank of gasoline generates approximately 300 pounds of carbon dioxide. Concentrations of carbon dioxide in the atmosphere have increased 27.5% since 1960, from 315 ppm in 1960 to 414.7 ppm in 2019 as recorded at the Mauna Loa Observatory (Global Greenhouse Gas Reference Network, 2019). In short, single-use zoning requires longer automotive trips, which increases the carbon dioxide concentrations in the air.

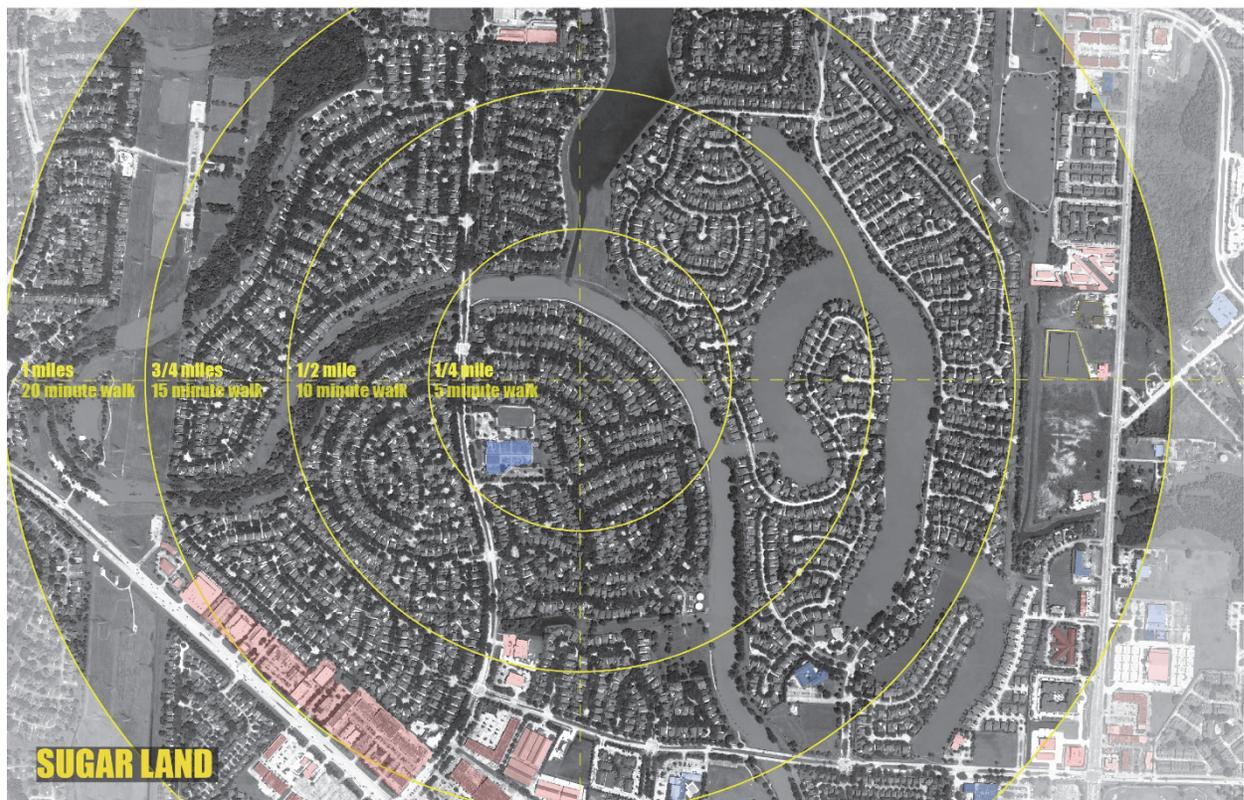
Sprawl leads to multiple unanticipated social and environmental impacts. First, sprawl causes longer commute times, and so traffic fatalities are more than double in areas with sprawl. Second, non-drivers such as children and the elderly are stranded in sprawl areas relative to economic resources. Third, sprawl has economic implications as municipalities are not able to generate enough taxes to cover services for low density development. Fourth, environmentally, the U.S. Department of Agriculture estimates that sprawl destroys 50 acres of agricultural land during every hour of the day (Lamer, 2010). As discussed earlier in this paper, the average home to work daily commute of 30 miles also contributes significantly to overall automotive emissions of carbon dioxide. Mixed-use development provides an alternative to urban

sprawl, promising shorter commutes and encouraging alternative forms of transportation such as shared rides, bicycling and walking. This paper suggests both planned and unplanned mixed-use areas without single use zoning as healthier more sustainable alternatives to urban sprawl.

Sprawl: Sugarland, Texas

Sugarland is a suburb nineteen miles southwest of Houston. It is surrounded by high-quality residential areas ideal for the stay at home parent with a mini-van. Schools and walking paths are within the residential neighborhoods such as Plantation Colony (Figure 3). Sugarland is an employment center of business parks and distribution centers. All goods and services are located on major highways leading to, or around, Houston. In terms of accessible amenities, an elementary school, pocket park and bayou with bicycle and walking trails are accessible by walking. A shopping center is also within $\frac{3}{4}$ of a mile of the center of the neighborhood. Given ample resources, residents can maintain a relatively high quality of life, or so it seems at first glance. However, the commute to downtown Houston is 21 miles, which takes roughly 30 minutes without traffic.

FIGURE 3
PLANTATION COLONY AERIAL VIEW IN $\frac{1}{4}$ MILE SEGMENTS



It is likely that at least one member of the suburban household near Sugarland commutes 35 minutes to downtown Houston for work. This time can increase dramatically due to traffic and time of the day. Commutes of at least 35 minutes have been linked to issues of health and happiness (Kylstra, 2014). While the commute to work ranks as one of the most unpleasant experiences one can endure, isolation also impacts household members not commuting (Berg, 2011). Non-driving adolescents and elderly are particularly isolated. The suburban pattern of sprawl is unhealthy for the individuals commuting, people living in isolation, and the planet.

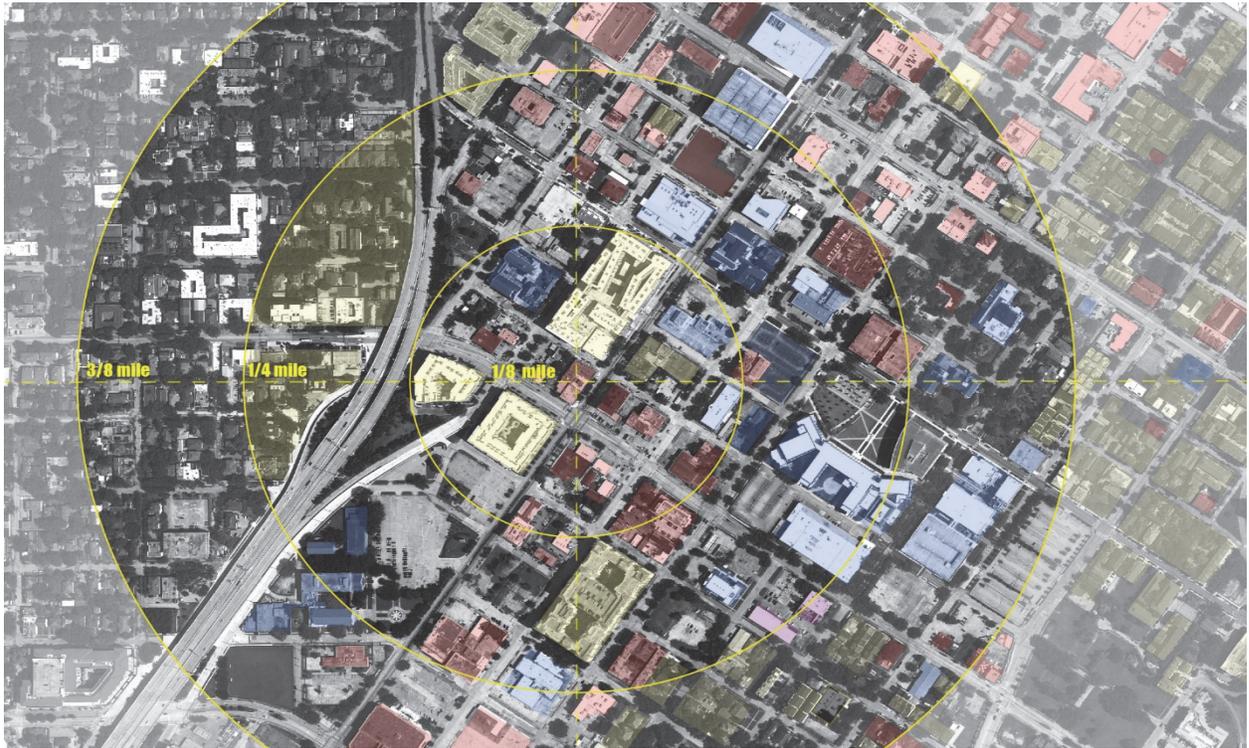
UNPLANNED MIXED-USE

Mixed-use development according to the Community and Regional Development Institute at Cornell University (2019) “...focuses attention on spatial patterns of development that concentrate physical growth in designated development centers and minimize the travel required (especially by car) between routine origins and destinations (home, work, shopping).” Organizations such as Smart Growth America and the Congress for New Urbanism advocate for the multiple benefits associated with mixed-use development and work to establish principles for successful, smart growth in urban environments. Benefits of mixed-use development range from reduced pressure for farmland conversion to lower required overall spending on public infrastructure (Smart Growth America, 2019). Perhaps the concept of smart growth’s most attractive promise is that it can increase the mix of available and affordable housing and transportation choices, while helping to foster a strong sense of place and high quality of life. Mixed-use development can occur in unplanned areas due to a lack of land-use zoning or grandfathered in single-use zones. Mixed-use development may also be planned as part of new development. In this section, we explore unplanned mixed-use developments in Houston, Lubbock, and Dallas, Texas.

Midtown Houston

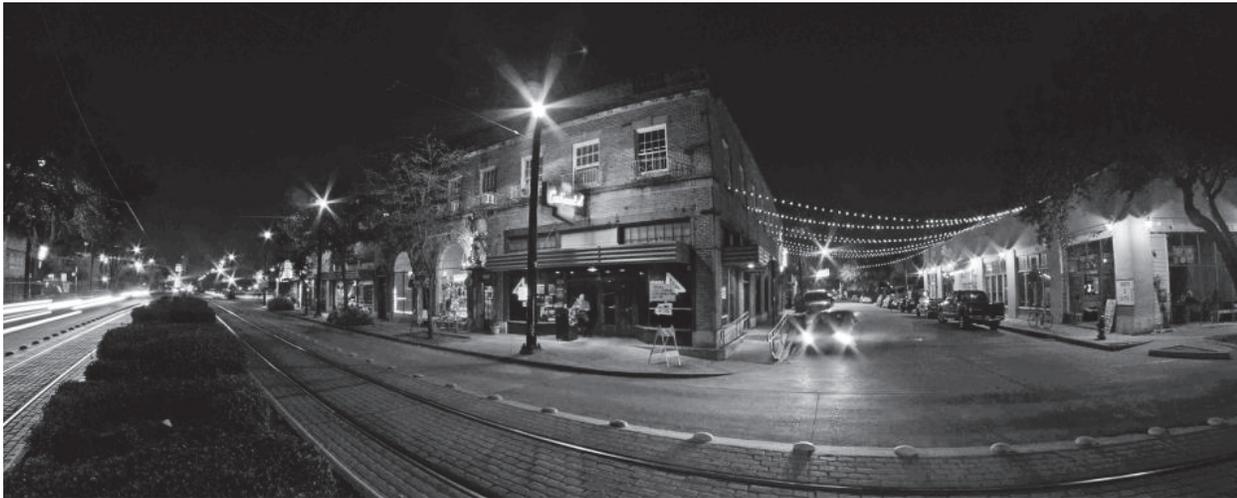
Midtown Houston is an unplanned mixed-use area 2 miles from the downtown Houston area. It is a 10-minute drive, a 10-minute bicycle commute, and a 10-minute light rail commute (ride time) to the Central Station Metro stop. Multiple attractions are within a 10-minute walk. Herman Park, a 400-acre central park, is either a 10-minute bicycle trip, a 5-minute drive, or a 10-minute light rail trip away from most parts of Midtown. The Houston ISD High School for the Performing Arts and Houston Community College are both within a 10-minute walk. Housing types include single-family residential, mid-rise apartments, condos, and everything in between. The Midtown Houston neighborhood serves as a model for the kind of access, mobility, and choice that are critical for happiness and environmental sustainability.

FIGURE 4
MIDTOWN HOUSTON AERIAL VIEW IN 1/8 MILE SEGMENTS



Individuals may prefer one lifestyle over another. However, mixed-use environments promote sustainable living due to access by various modes of mobility and less space per household. Mixed-use neighborhoods provide the possibility to walk or bicycle to work, recreation and services. Midtown Houston, Texas is a mixed-use neighborhood with commercial, residential, governmental and public spaces all in close proximity. In Figure 4, residential uses are colored yellow, commercial and mixed-use areas are red, and government/public uses are blue. As an example of mixed-use, normally prohibited by single-use zoning, the Continental Club (Figure 5) is a music venue in Midtown Houston with apartments above the club. Who would want to live above a late-night music venue? The first author asked that question of the club manager and discovered that the individuals who rent the space above, work at the club and are not home when the club is active. Living above your work is an ancient, and sustainable life style.

FIGURE 5
HOUSTON'S CONTINENTAL CLUB AT NIGHT



Continental Club Facebook Page

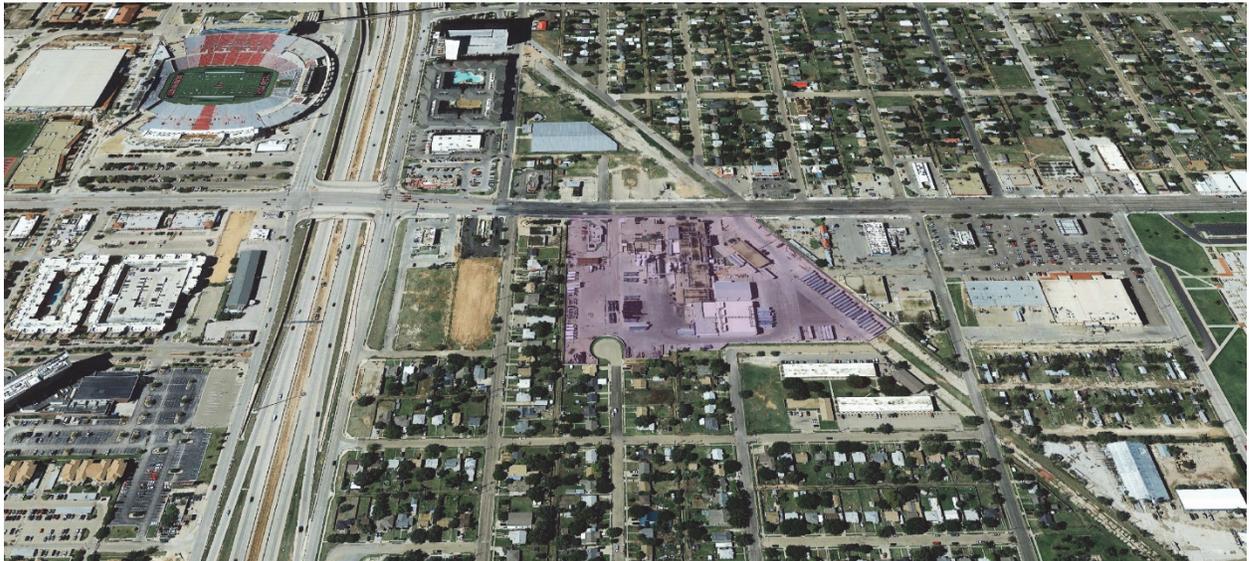
Visible in Figure 5 is the Metro light rail line in front of the Continental Club, which connects midtown to downtown, Herman Park, and the Houston Medical Center (13-minute METRORail trip). Since the light rail is located nearby, Midtown residents make fewer and shorter transportation trips, reducing emissions. The midtown living units tend to be in recycled buildings, conserving materials. These residential units are smaller in size, so they require less energy to heat and cool. Figure 5 also shows the street trees and planted medians in Midtown that cool and clean the air. Mixed-use areas often include a variety of housing types, including high-rise, mid-rise, duplexes and single family residential. Single family residential areas do exist within a 10-minute walk to Midtown Houston. They are protected by deed restrictions and historic overlays. While mixed-use development occurred naturally in Midtown Houston, in other places it may occur despite single-use zoning.

Grandy's Dairy Factory

Unplanned mixed-use often occurs when cities expand into previously un-zoned areas. For example, Grandy's Dairy Factory in Lubbock, Texas (Figure 6) was established as Bell Dairy in 1925. It was located outside the city on a rail line. Today it is surrounded by single family residential, new multifamily residential, retail stores, and Texas Tech University. The factory continues to operate today, providing nearby employment and serving as a crucial hub for the mixed-use community that arose around it.

The Grandy's Dairy Factory project revitalized an industrial area through design. The Dairy Factory project was the result of a collaboration between the dairy, its neighbors, and UrbanTech, an urban design studio affiliated with Texas Tech's College of Architecture. In 1997, Urban Tech worked with the factory and Dairy neighbors to close a street, expand the factory into a then-abandoned railway property, control truck entrances and design the edge between the factory and the neighborhood. Issues of expansion and controlled truck entrances were negotiated with the City of Lubbock and the railroad. The City of Lubbock closed a street dividing the Dairy property and sold the property to the Dairy. Truck traffic was allowed to enter only on a nearby major street, University Avenue. Grandy's Dairy purchased also land abandoned by the relocated railway for expansion. A landscaped fence was constructed to screen the Dairy and trucks from adjacent single family residential. In the Grandy's Dairy Factory project, issues that often justify single-use zoning were resolved by design.

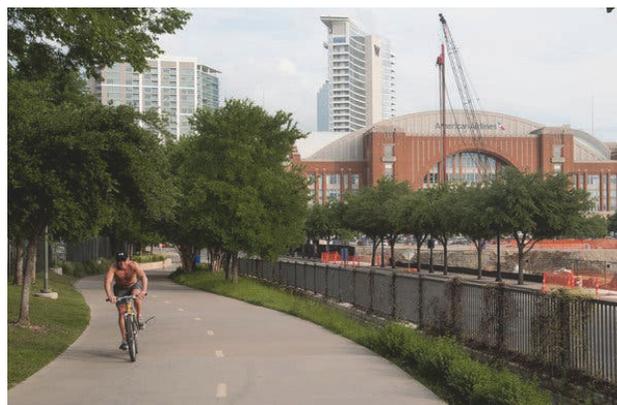
FIGURE 6
GRANDY'S DAIRY FACTORY SITE OUTLINED IN PURPLE



Katy Trail

Katy Trail in Dallas, Texas is a Rails to Trail project. Like Grandy's Dairy, which found itself on prime real estate in Lubbock, this industrial zoned railway corridor is now a mixed-use corridor of renovated warehouses, multifamily housing, restaurants, retail, offices and older neighborhoods of single family residences. The Katy Trail's two termination points are the American Airlines Arena (south) and Southern Methodist University (north). The railway, formerly a barrier edge to single-use zoned neighborhoods and industrial/commercial zoned districts, is now a mixed-use connector and generates new mixed-use development. Shown in Figure 7, the Katy Trail functions as a highway for pedestrians to travel between businesses, public events, and their homes.

FIGURE 7
KATY TRAIL BIKE PATH



Rex C. Curry

FIGURE 8
KATY TRAIL ICEHOUSE



Rex C. Curry

The Katy Trail creates a healthier lifestyle for the communities as over one million people use it per year for various purposes (Gose, 2014). The Katy Trail's most popular element is the Katy Trail Icehouse bar and restaurant, which has its main entrance on the trail and is shown in Figure 8. The Katy Trail Icehouse features a large outdoor seating space and is integrated into the trail. New development, including condos and apartments, has also been built off the trail. In total, adapted reuse of the Katy Trail “have helped transform Uptown from a blighted empty expanse into what many consider to be the only true ‘live, work, play’ urban neighborhood in a city known for suburban sprawl” (Gose, 2014). Like Midtown Houston, the evolution of the Katy Trail from low-traffic industrial zoned space to an appealing, profitable mixed-use neighborhood demonstrates the flexibility of unplanned development unrestrained by zoning codes.

PLANNED MIXED-USE

Regis Park

Regis Park: An Agrarian Community is a planned, mixed-use community on open land, in contrast to the Katy Trail, which redeveloped underutilized industrial real estate. Where Katy Trail contains industrial residuals, Regis Park is surrounded by existing industrial uses by design. Regis Park (Figure 10) creates a sense of place, offering short trips to work and relevant services. Shorter commutes will, in turn, reduce automotive emissions and pollution as well as promote better health through walking. Regis Park is anchored by an equestrian charter school, a proposed civic equestrian arena, and a mix of multifamily and single-family residential types, some with stables for horses. The community features multiple intersecting riding trails and includes a working farm and market. Retail stores and office uses are also blended throughout the community.

Mixed-use housing allows residential spaces to be created near employment centers and benefits both. In this case, the Regis Park project serves the Lubbock Business Park, Lubbock International Airport, Lubbock County Detention Center, and small communities located to the north and east of Lubbock. The Regis Park site is located near Lubbock's Preston Smith International Airport within an industrial zoned area. The City of Lubbock's 1954 Zoning Map established a residential enclave in the southwest area of the city and limited industrial development primarily to the northeast area of the city. The city of Lubbock's current zoning map, the Zoning Map of 1986 (Figure 9), reflects the same separation of land uses. The City of Lubbock approved residential and commercial uses within an industrial zone for the first time with Regis Park. UrbanTech petitioned the City of Lubbock Planning and Zoning Commission for a change of zoning. After receiving zoning commission approval, the development team had to get final approval from the Lubbock's City Council. In both instances, the development team convinced city

officials that the two hundred and eighty-eight acre project would provide individuals the opportunity to live close to retail, greenspace, workplaces, and schools, following sustainable development principles.

**FIGURE 9
CITY OF LUBBOCK PROPOSED LAND-USE MAP, 1986**

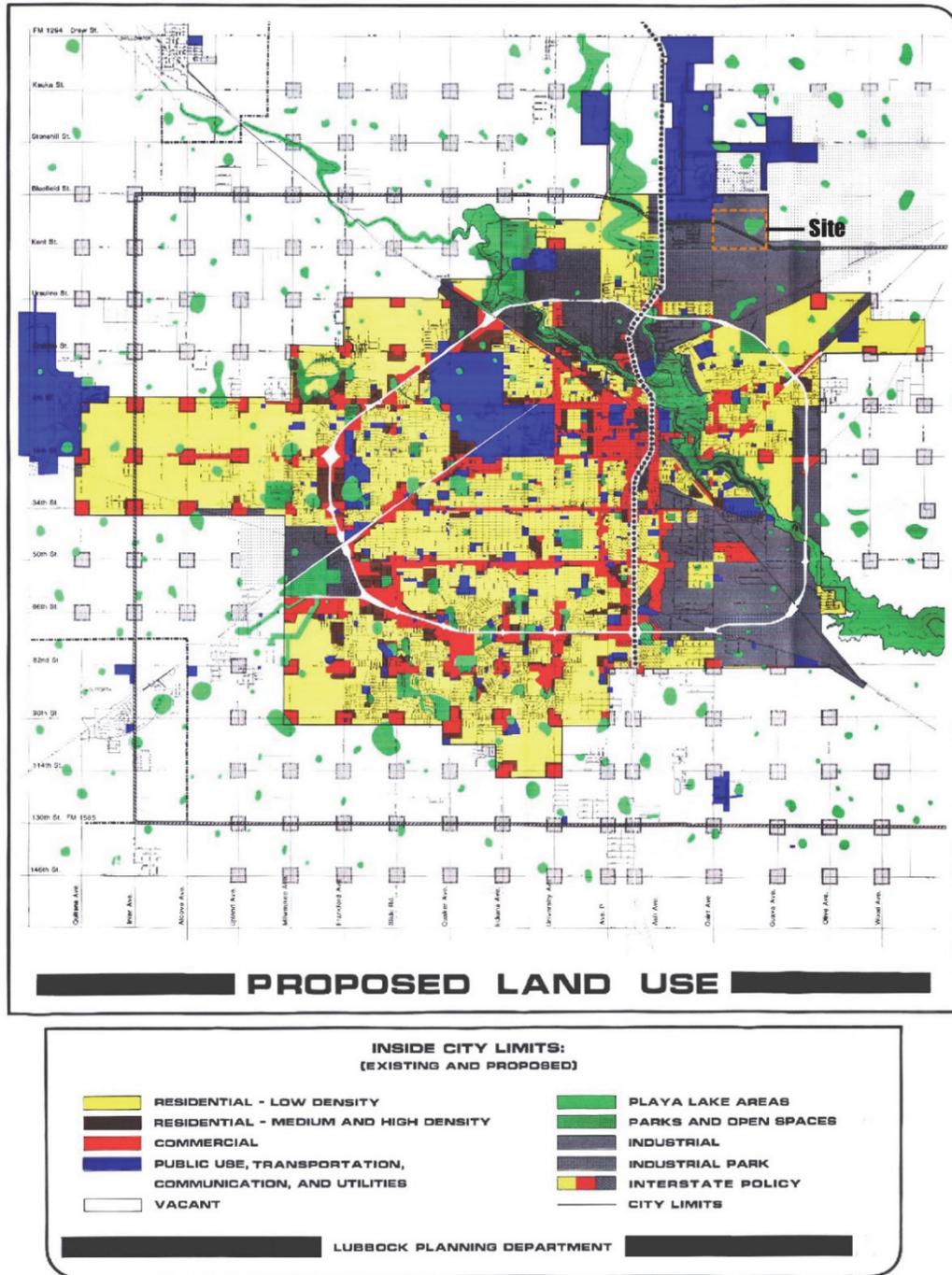
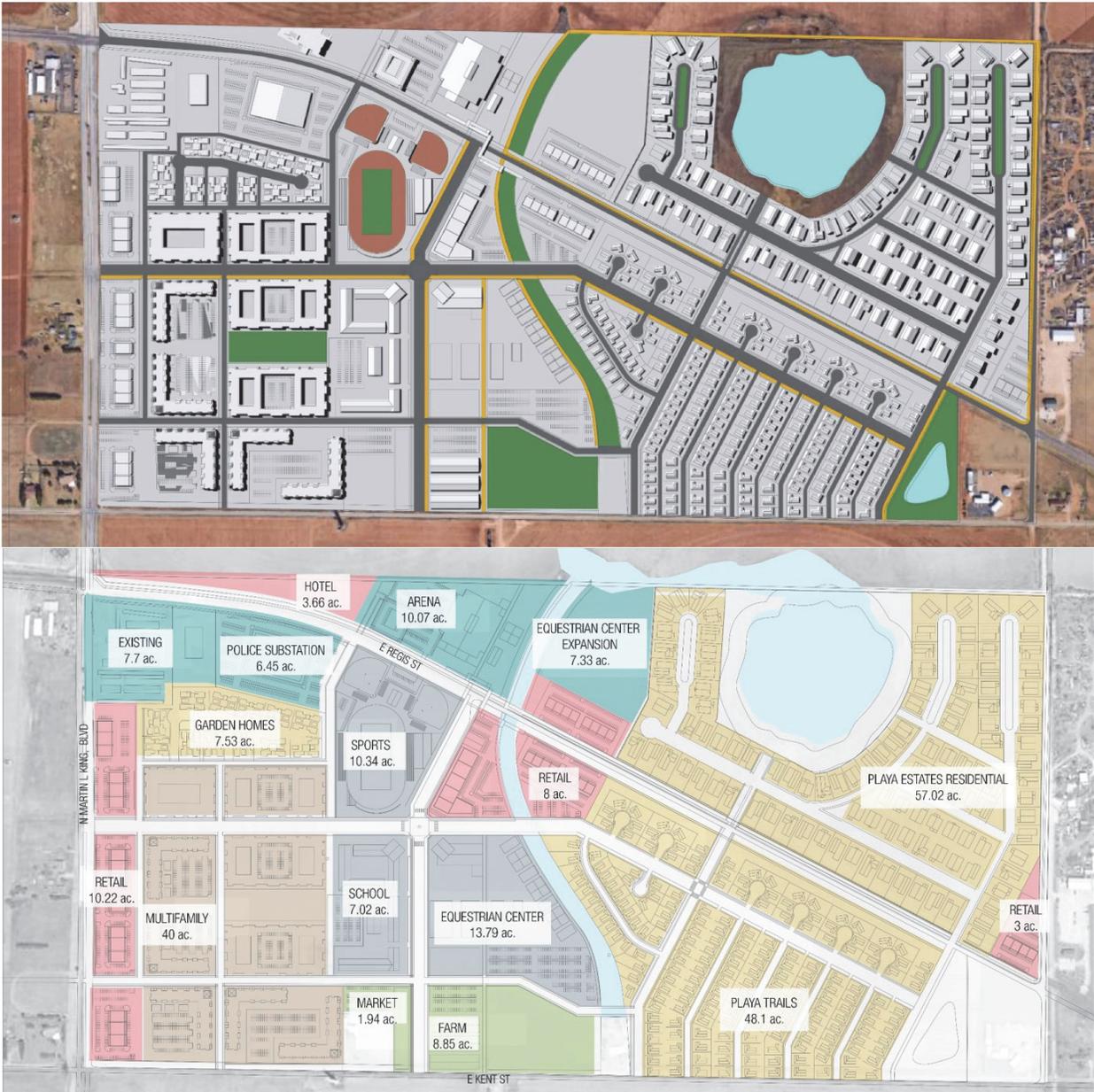


FIGURE 10
REGIS PARK: AN AGRARIAN COMMUNITY MASTER PLAN



UrbanTech

Bluejacket Brewery

Another example of planned mixed-use, the Bluejacket Brewery (Figure 11) was founded in the mixed-use Yards Development, a section of Washington DC that was historically part of the Navy Yards Ship and Munitions Manufacturing Complex. The Navy Yards complex manufactured boilers for Navy Ships, munitions, and other products. The brewery got its name from the bluejacket manual Navy enlisters received when they joined. Today the Bluejacket Brewery is classified as a factory within the residential-commercially zoned area but is deemed a compatible land-use within this mixed-use development. In Washington D.C., breweries are considered an industrial land-use according to the building code (Figure 12). The fact that planned mixed-use communities are including industrial uses is

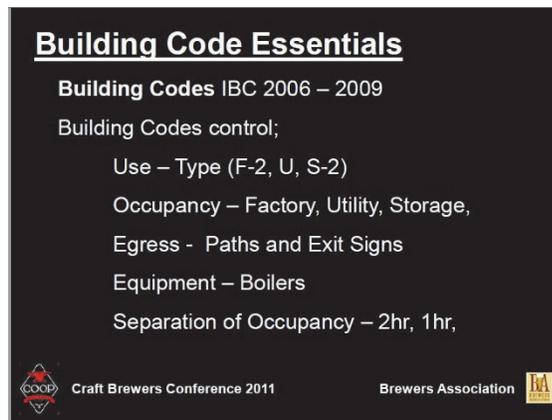
significant. Industrial uses allow for mixed-use developments that feature employment centers and the ability to live close to work. Such shorter commutes can lead to a high quality of life and limit harmful emissions.

FIGURES 11 BLUEJACKET BREWERY



Gatewood, 2017

FIGURES 12 BUILDING CODE ESSENTIALS

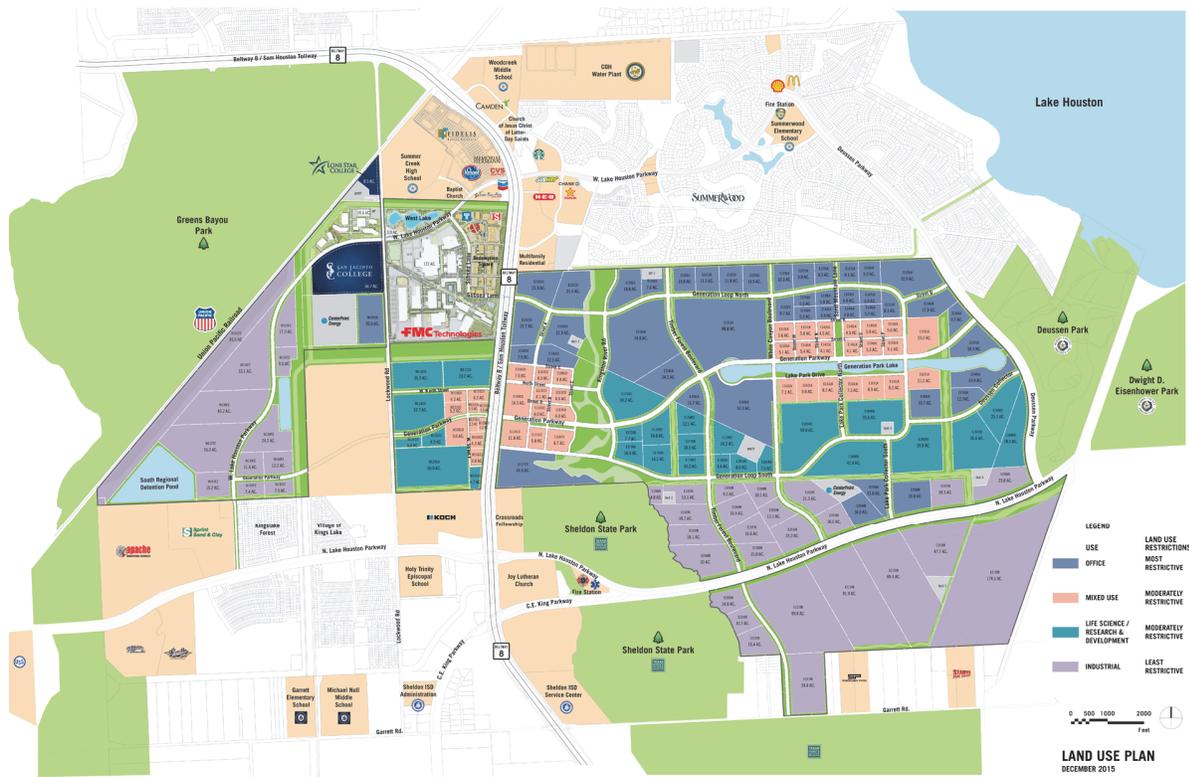


Brewer's Association

Generation Park

As a point of contrast for Regis Park, which was originally zoned for industrial uses, Generation Park in northeast Houston is a mixed-use development which includes new industrial uses in a predominately residential area. The sizeable development is approximately the same area as downtown Houston.

**FIGURE 13
GENERATION PARK MASTER PLAN**



The Generation Park masterplan (Figure13) uses various colors to illustrate land use. The violet-colored sections indicates industrial uses, aqua represents research park areas, dark blue illustrates office park space, and salmon represents mixed-use areas, including residential. Natural areas are shown in green. Existing residential units are shown in white and surround the development. Newer developments such as Generation Park recognize the importance of mobility and access to a sustainable lifestyle. Motivation for choosing to live in a mixed-use area may be for a higher quality of life, however quality of life and sustainably are connected. The same shorter commute times and natural settings with greater population density all support sustainability goals.

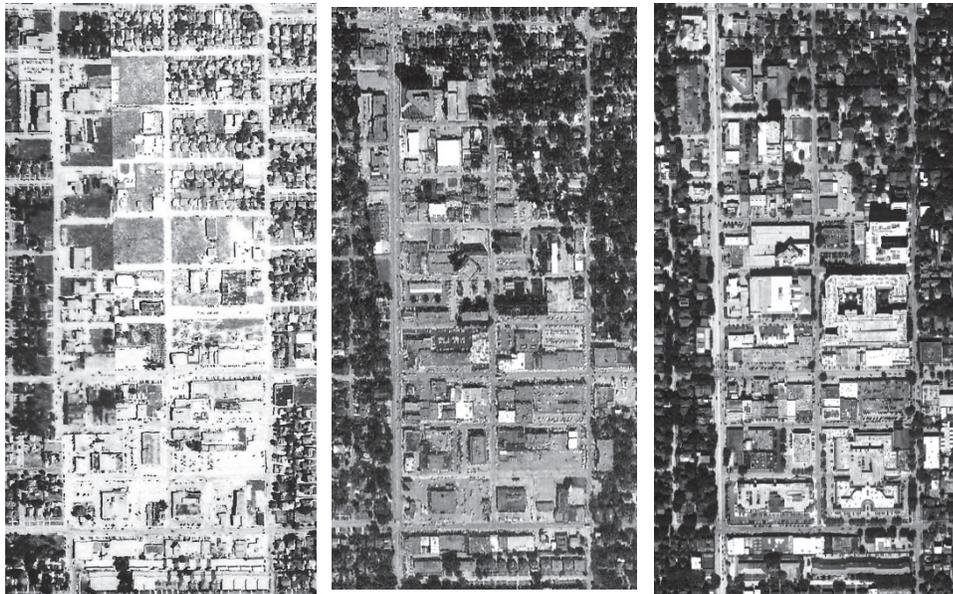
CONCLUSION

The Rice University area in the City of Houston is a final example of different types of land-use control. In Figure 14, you can see three specific uses of zoning: single-use, no land-use zoning, and deed-restricted. West University Place is a separate municipality with single-use zoning, predominantly single-family residential. It is bordered by the City of Houston with no land-use zoning. A predominantly residential zone located within the City of Houston is nearby. The residential area just north of Rice University, labeled Houston in Figure 14, is controlled by deed restrictions. The West University area, in contrast to its neighbors, does not feature any single-use zoning and organically evolved into a mixed-use neighborhood. The next paragraph discusses the plurality of land uses available in the City of Houston neighborhood just blocks from West University Place.

FIGURE 14
RICE UNIVERSITY AREA LAND-USE ZONING COMPARISON



FIGURE 15
HOUSTON'S RICE VILLAGE AREA DEVELOPMENT WITHOUT LAND-USE CONTROL



L to R, 1944, 1953, and 1989

FIGURE 16
HOUSTON'S RICE VILLAGE IN 2017



Viggiano, 2019

Figures 15 and 16 show the same City of Houston parcel in the popular Rice Village area from, 1944, 1953, 1989, and 2017. From 1944 to 2017, the entire Rice Village area has transformed from a limited number of single-family residences and vacant parcels to a predominately retail zone to the mixed-use community it is today. For most American cities, single-use zoning codes that arose in the 1920's do not permit the mixing of uses as seen in West University. Portions of the City of Houston—like the West University area and Generation Park are examples of mixed-use development occurring in different modes. Planned mixed-use projects like Generation Park have the advantage of a master plan, whereas unplanned mixed-use like West University function as more of a juxtaposition of elements. Planned mixed-use is akin to building a new house, whereas unplanned mixed-use is closer to redeveloping or renovating an existing one.

Environmental conditions of the 21st century have significantly improved since the 19th century, which negates the value of single-use zoning. Single-use zoning generates sprawl, which requires long automobile trips that are a major source of carbon dioxide pollution. In contrast, mixed-use development, planned or unplanned, is more sustainable and livable. Shorter commute times, greater density, a stronger sense of community and easier access to nature all support long-term sustainability and livability goals. As we make our way further into the 21st century, land use compatibility is a matter of design, not distance.

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