



The reshaping of land use and urban form in Denver through transit-oriented development

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ABSTRACT

As large cities seek to expand their transit systems to accommodate increasing travel demand, provide alternatives to growing road traffic congestion, and improve accessibility, more research attention has been focused on the land use effects of transit, most notably in the form of transit-oriented development (TOD). Many cities in the USA are starting or expanding rail transit systems with objectives that include more focused economic development near transit stations and along transit corridors. Denver, Colorado is one of the cities that is aggressively expanding its rail transit system and encouraging high-density, mixed-use development in the station areas. This study analyzes TOD data from the Denver Regional Transportation District and the Denver Regional Council of Governments for 0.5-mile areas around current and proposed rail transit stations. Early evidence indicates that the scope of transit-oriented development in Denver is considerable, resulting in nearly 18,000 residential dwelling units, 5.3 million square feet of retail space, 5.4 million square feet of office space, and 6.2 million square feet of medical space within one-half mile of existing or planned transit stations from 1997 to 2010. As one of the critical elements of the regional land use and transportation plan, the rail transit system and the emphasis on transit-oriented development is contributing to an increase in the average density of the Denver urbanized area.

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Introduction

Many large cities in the United States are experiencing an explosion of interest in starting new or expanding existing rail transit systems to improve accessibility and encourage transit-oriented development (TOD). *Reconnecting America* (2011) has identified a total of 643 potential new fixed-guideway projects in 106 metropolitan regions. Of these projects, 138 are in the construction and engineering phase that will yield 1464 miles of new transit. Most of the cities with these projects have witnessed an upsurge in interest for residential, office, and retail development in areas directly served by their rail transit systems. Demographic changes, frustration with motor vehicle traffic congestion, high gasoline prices, and other factors are creating strong demand for housing, retail, and offices in walkable, mixed-use neighborhoods close to transit (Center for Transit-Oriented Development, 2011).

As one prominent example of this trend, Denver, Colorado is presently developing a 157-mile regional rail transit system, and is in the forefront of encouraging major changes in its land use and urban form featuring transit-oriented development. This is especially true as the ambitious rail transit program called

“FasTracks”, approved by regional voters in 2004, was labeled a regional land use and transit development program, not just a transit program.

With the FasTracks emphasis on regional land use development, TOD has become a major focus within the entire Denver region. The City and County of Denver, the Denver Regional Council of Governments [DRCOG] (the area’s metropolitan planning organization), and the Denver Regional Transportation District [RTD] (the area’s transit agency) now all have TOD programs with full-time TOD staff. The Metro Denver Economic Development Corporation has a TOD focus, and TOD plans are being created at different scales from individual station areas to the entire region. The City and County of Denver has even developed its own TOD typology that separates its rapid transit stations into seven individual TOD station types, recognizing the important differences between different places and destinations within the region.

The goal of this paper is to examine the impact on land use and urban form that transit accessibility and TOD are having in the Denver region. It begins with a brief overview of the concepts of accessibility and transit-oriented development, and the role they play in reshaping land use and urban form within transit corridors in large cities in the US and throughout the world. The focus then shifts to the Denver region by discussing the reintroduction of rail transit there, including the FasTracks program and its current

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status. It then reviews the state of TOD throughout the Denver region and analyzes the impact of TOD in Denver, at the station and corridor scales. The report concludes by summarizing how TOD is being incorporated into the land use and urban form of the entire Denver metropolitan region.

Theoretical and empirical effects of accessibility and TOD on land use and urban form

Defining accessibility

Accessibility generally refers to the physical access of reaching goods, services, activities, and destinations, and is typically linked to the provision of transportation (Litman, 2012). Traditional transport and land use theory postulates that the increased accessibility provided by new and better transportation linkages will result in increased land values and intensification of land use in areas directly served by the linkages (Alonso, 1964; Goldberg, 1970; Mills, 1972; Muth, 1969; Wingo, 1961). Historically, cities have grown and developed in response to improvements in transport technology, from walking and horsecars to electric streetcars to automobiles and highways (Adams, 1970; Muller, 2004). With each new form of transport, cities have grown farther outward as the speed and convenience of the new transport has resulted in time–space convergence and metropolitan expansion (Janelle, 2004). As the most recent major transport technology, the automobile and highway system has contributed to low-density suburban and exurban sprawl extending 30–40 miles away from the traditional central business district (CBD) in the largest metropolitan areas (Harris, 1997; Hartshorn & Muller, 1989; Lang, 2003; Lewis, 1983).

While newer forms of transport have increased speed and distance traveled, they have also contributed to a more dispersed urban land use/activity pattern which can have the paradoxical effect of reducing accessibility. Activities in a sprawling urban pattern are more widely separated, and can be more difficult to access even with cars and highways, particularly if vehicle congestion erodes the functionality of the system. It is thus possible that slower modes such as transit, cycling, and walking can provide greater accessibility in higher-density settings.

More recent transport and land use theory suggests that the concept of accessibility can be utilized as an alternative approach to transportation system and service evaluation. Instead of focusing on vehicle travel conditions (traffic speeds, congestion delay, roadway Level-of-Service ratings) or mobility (movement of people or goods), an accessibility approach focuses on people's ability to reach desired goods, services, and activities, or more broadly, opportunities (Hanson, 2004; Litman, 2012). Accessibility-based analysis thus expands the range of possible solutions to transport problems, including not only improved transportation, but also more efficient land use patterns to minimize distances traveled and consideration of telecommunications technologies as a substitute for travel (Litman, 2012). One particularly important accessibility-based approach to solving urban transport problems is changing land use patterns through transit-oriented development.

Defining transit-oriented development

Although there are many different definitions of transit-oriented development, they nearly all have a number of similar components. To begin, they tend to focus on the area within approximately half-mile, or what is considered a walkable distance, to a transit station (Center for Transit-Oriented Development, 2011). Increased density is usually mentioned, along with mixed land uses, and improved accommodations for pedestrians

(Arrington & Cervero, 2008; Cervero et al., 2004; Curtis, Renne, & Bertolini, 2009; Dittmar & Ohland, 2004). The location of the station should support new land use development, while the development should help to increase transit ridership, pedestrian and bicycle travel, and other alternatives to the use of private cars (Cervero, 2009). Parking is usually limited, and the potential for intermodality increased. Livability around the stations is most often a central focus, with the reduction of regional congestion, and an improved regional environment, both secondary goals.

The California Department of Transportation (2011) has a good basic definition that captures the essence of most TOD:

Moderate to higher-density development, located within an easy walk of a major transit stop, generally with a mix of residential, employment and shopping opportunities designed for pedestrians without excluding the auto. TOD can be new construction or redevelopment of one or more buildings whose design and orientation facilitate transit use.

The City (2006) and County of Denver defines TOD as follows:

TOD is more than simply development near transit. Successful TOD creates beautiful, vital, and walkable neighborhoods; provides housing, shopping and transportation choices; generates lasting value for citizens and public and private stakeholders; and provides access to the region's jobs, government centers, healthcare facilities, and cultural and recreational destinations.

Following that general definition, the City and County of Denver expects that TOD should achieve five main goals in order to succeed:

1. *Location efficiency* is the conscious placement of homes, jobs, civic uses, shopping, entertainment, parks and other amenities close to transit stations to promote walking, biking and transit use.
2. *Rich mix of choices* is about expanding housing, transportation and shopping choices.
3. *Value Capture* needs to be a key objective of all parties involved with TOD.
4. *Place-making* was one of the greatest limitations to the first generation of TOD projects in cities with older transit systems such as Washington, DC, San Francisco and Chicago.
5. Transit stations are a “portal” or entry point to the regional transit network, and part of a metropolitan economy composed of employment, residential, cultural, recreational and shopping amenities.

From this definition and these goals, it can be seen that TOD in Denver is being viewed from a very strong land use development perspective. This perspective emanates from the original goal of FasTracks as a regional land use plan as well as a transit development plan.

The role of transit-oriented development in reshaping land use and urban form

There has been a significant upsurge in interest and activity concerning transit-oriented development in large and medium-sized cities around the world (Cervero, 1998; Curtis et al., 2009). In many European and Asian cities, transit-oriented development has been standard operating practice for a long time, given the higher-density land use configuration and stronger historical emphasis on transit development and its utilization. Significant

synergies between transit and land use have been documented for numerous world cities, including Copenhagen (Knowles, 2006, 2012), Hong Kong (Cervero & Murakami, 2009), Madrid (Mejia-Dorantes, Paez, & Vassallo, 2012), Seoul (Cervero & Kang, 2011), and Stockholm (Cervero, 1998). In Latin America, newer transit systems, including several innovative bus rapid transit systems, have resulted in increasing transit-oriented development in cities such as Mexico City (Gilat & Sussman, 2003), Bogota (Rodriguez & Mojica, 2008), and Curitiba (Smith & Raemaekers, 1998).

In the US, the rising level of interest in transit and transit-oriented development has been spurred by a number of factors, including:

1. Rapidly growing motor vehicle traffic congestion nationwide and increasing desire for multi-modal alternatives.
2. Growing distaste for suburbia and strip development.
3. Growing desire for quality urban lifestyles, including more walkable environments away from motor vehicle traffic.
4. Higher prices for gasoline and increased costs of motor vehicle ownership and use.
5. Changes in family structures: more single-person households, young professionals, and empty-nesters.
6. Growing national support for "smart growth" and urban sustainability.
7. New focus of federal, state, and local policy, especially support for new rail transit systems.

Transit-oriented development has become part of a broader smart growth movement in US cities. Relying on concepts such as new urbanism, infill development, affordable housing, historic preservation, and urban growth boundaries, the main thrust of the smart growth movement is to encourage more high-density development in already built-up areas that contain a mix of land uses close enough together to encourage more walking, biking, and public transit use. Recognizing the significant economic, environmental, and social costs of low-density suburban and exurban sprawl, smart growth encourages higher-density development within the already urbanized footprint of a metropolitan area, thus minimizing infrastructure and energy costs. Instead of expanding and widening highways which would encourage more low-density sprawling development on greenfield sites, rail transit systems and accompanying transit-oriented development are expected to concentrate new higher-density development near transit stations and along transit corridors (Goetz, *in press*).

Specifically with regard to transit-oriented development, it is expected that new rail transit would provide increased access within a metropolitan area to more urban activities, thus improving the value of land near transit stations, and increasing land use activity at those sites. However, what is less clear is the degree to which the new transit lines will be able to refocus higher density development within an automobile/highway-dominated urban landscape. In other words, if the improvement in accessibility provided by the new transit lines is marginal, then the land use impacts would also be expected to be marginal (Giuliano, 2004). Accordingly, the greatest potential for transit and transit-oriented development is in the highly-congested urban centers and corridors where intense traffic has resulted in greatly reduced accessibility via motor vehicles, thus providing a competitive advantage to transit, walking, and biking. In those settings where accessibility via transit can be increased substantially, it is expected that transit would be most viable, and thus transit-oriented development would be most successful (Du & Mulley, 2006; Polzin, 1999; Rodriguez & Targa, 2004).

The US has experienced a sharp increase in rail transit systems in most major metropolitan areas. Frustrated by rapidly increasing roadway and highway traffic congestion, US cities have been

investing more heavily in public transportation, especially rail transit, as one of the potential alternatives in improving urban mobility. Today, 42 US metropolitan areas have some form of rail transit system (heavy, light, and/or commuter rail), including 27 that have been started within the last 20 years. Most of the newer systems are either light rail (19 start-ups since 1990) or commuter rail (14 since 1990).¹ Furthermore, another 30 rail projects involving 23 cities (five new rail transit cities) have been approved under the Federal Transit Administration New Starts program (Federal Transit Administration, 2011). Altogether, 138 fixed-guideway projects are currently in the construction or engineering phases of development (Reconnecting America, 2011).

Together with the growth of rail transit systems, considerable TOD activity has been occurring in many of the new station areas. The cities which have the largest and oldest rail transit systems in the country, such as Boston, Chicago, New York, and Philadelphia have experienced the most transit-oriented development. There is a much stronger transit-land use linkage in these cities as transit has been a more prominent feature of the urban transportation landscape (Casello, 2007). Post-1950, heavy rail transit systems were built in Atlanta, Baltimore, Cleveland, Los Angeles, Miami, San Francisco, and Washington DC with many of these experiencing considerable TOD activity, and great potential for further development. Cervero and Landis (1997) found that after 20 years of operation, the BART system in San Francisco had its greatest impact on downtown access and development, especially in new downtown office space. The Rosslyn–Ballston Orange line corridor on the Washington Metro system in suburban Arlington County, Virginia has witnessed more high-rise, mixed use development along a rail corridor over the past three decades than any other place in the US (Cervero, 2009). Since the 1980s, many cities, including Baltimore, Buffalo, Dallas, Denver, Houston, Los Angeles, Minneapolis, Phoenix, Pittsburgh, Portland, Sacramento, Salt Lake City, San Diego, San Jose, Seattle, and St Louis have started new light rail transit systems, and are experiencing dramatic increases in TOD activity.

The return of rail transit to Denver

The Denver metropolitan area is located just east of the Front Range of the Rocky Mountains in the western US state of Colorado (see Fig. 1). With a 2010 metropolitan area population of 2.54 million, the Denver–Aurora metropolitan statistical area ranks as the 21st largest in the US, and the entire region has experienced very rapid growth in the post-1950 period (Murray, 2002).

The last electric streetcar ran in Denver in 1950 due to strong growth in automobile use and a sharp decline in transit service after World War II. At one time, streetcars accessed virtually the entire city. After several idealistic attempts to restart regional rapid transit systems in the 1970s and 1980s, a 5.3-mile light rail line, called the Metro Area Connection (MAC) was opened in 1994, and rail transit returned to the region.

The MAC line experienced higher than predicted ridership, and in 1995, federal funds were obtained to help build the 8.7-mile Southwest Corridor extension to the MAC line, later renamed the Central/CPV Corridor (see Fig. 2). The Southwest Corridor, which opened in 2000, is located in an operating freight rail corridor, and along Colorado Highway 85. It offers access to several outlying park-and-ride lots and the suburbs of Englewood and Littleton. Being located in an existing rail corridor, land acquisition costs were reasonable. Ridership thus far has exceeded projections,

¹ Several cities started both light rail and commuter rail lines since 1990, including Dallas, Los Angeles (also heavy rail since 1990), Minneapolis, Portland Oregon, Salt Lake City, and Seattle. Denver is scheduled to open its first commuter rail line in 2016 to add to its light rail system which started in 1994.

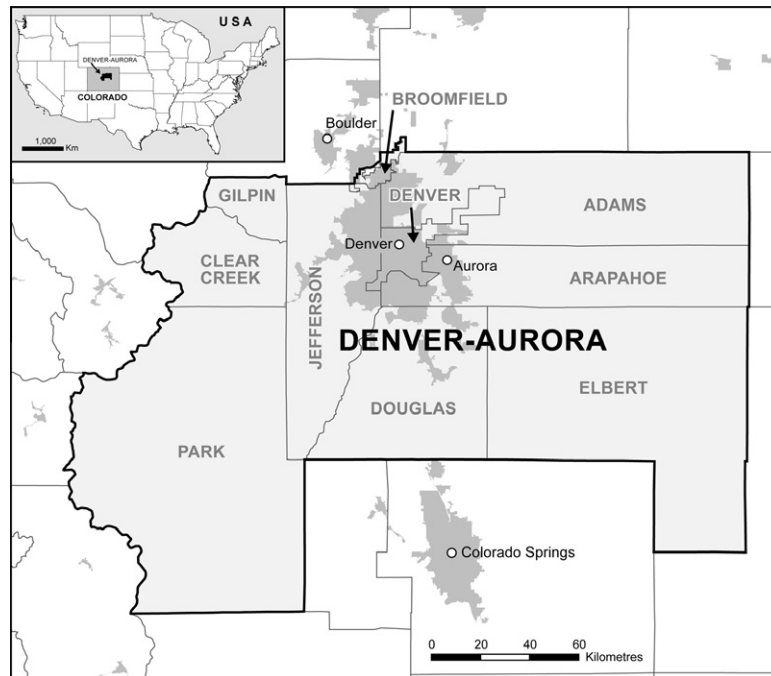


Fig. 1. The Denver–Aurora metropolitan area.

and additional parking has been added at several of the park-and-ride lots.

At the same time that the Southwest Corridor line was being built, planning for a Southeast Corridor rail line was in progress. This corridor parallels Interstate 25 (I-25) and is the primary route south out of Denver, linking the Denver CBD with the edge-city Denver Technological Center near the intersection of I-25 and Interstate 225 (I-225). I-25 is a very congested roadway, but the original plan was to build only a new light rail extension next to the interstate. In the end, the rail extension was packaged together with highway widening and the entire project was named the TRansportation EXpansion (TREX) project. The TREX project opened in 2006.

In the mid-1990s, Denver again began to undertake long-range planning for a regional rail transit system. However, in 1997 a regional rail transit plan entitled “Guide the Ride” was defeated in a public vote by 58–42%. In 2004, a new plan entitled “FasTracks” was proposed. This plan, which made a much stronger linkage between transit and regional land use passed, 57–43. The FasTracks plan involves the expansion of transit service in three existing corridors, the construction of new transit service in six other corridors and the development of the Denver Union Station into a multi-modal transit hub *Regional Transportation District (2011a)* (see Fig. 2). While original projections called for the plan to be completed within 12 years, cost increases and revenue shortfalls have lengthened the overall construction time frame (Goetz, Andrew, & Sutapa Bhattacharjee, 2011).

Today, the Central/CPV Corridor, the Southwest Corridor, the Southeast Corridor, and Phase I of the US 36 BRT Corridor are operating. The West Corridor is scheduled to open in 2013, renovation of Denver Union Station by 2014, and Phase II of the US 36 BRT by 2015. Construction has begun on the East Corridor to the Denver International Airport, the Gold Line to Wheat Ridge and Arvada, a portion of the Northwest Corridor, and the extension of the I-225 Corridor as part of recently negotiated public–private partnerships in which private consortiums will design–build–finance–operate–and–maintain the lines with construction to be completed by 2016. At this time, the dates for completion of the Northwest and North Metro Corridors are still uncertain.

Regional mode share comparisons

From Table 1, it can be seen that the mode share pattern of commuters in downtown Denver is very different from that in the city, the metro region, and the United States. Specifically, 43.3% of downtown commuters take public transit, while only 33.4% drive alone. This rate of transit ridership is nearly ten times the national average. In addition, in the downtown, 6.6% of commuters bicycle and 4.3% walk. These rates are also substantially higher than the national average. From 2007 to 2010 in the downtown, transit ridership has increased almost 7%, bicycle commuting has nearly doubled, and walking has grown one-third.

According to the *Commuter Survey*, in the overall city of Denver, 70.3% of commuters drive alone, which is over double the percentage that drive alone in the downtown, and only slightly lower than the national average (76.6%). Only 6.2% use transit, which is one-seventh the number that use transit in the downtown, but still slightly over the national average (4.9%). Only one-third the number of people bicycle commute in the city than in the downtown, and walking is also used a bit less. The only non-auto commuter mode that exhibits higher use in the overall city than downtown is carpooling at a rate of 10.06%.

From 2007 to 2010, the percentage of people commuting by transit in the city of Denver has actually decreased from 7.7% to 6.2%. The percentage walking has also decreased a little and the percent driving alone has remained stable. However, the percentage of people in Denver bicycle commuting has risen since 2007 to 2.2% which is significantly higher than the national average of 0.5%.

According to the *Commuter Survey*, in the Denver MSA, 76.3% of commuters drive alone, and only 4.1% use transit. These numbers are almost identical to those found across the United States. Bicycle commuting here drops to less than 1%, and walking less than 2%. Both of these rates are significant drops from that found in the city and the downtown. The regional bicycle commuting rate, though not high, is still 50% greater than the national rate, but the regional walking rate is almost a percentage point less than that found nationally. Carpooling is 9.6% throughout the metro region, which is similar to the rate found in the city and across the US.

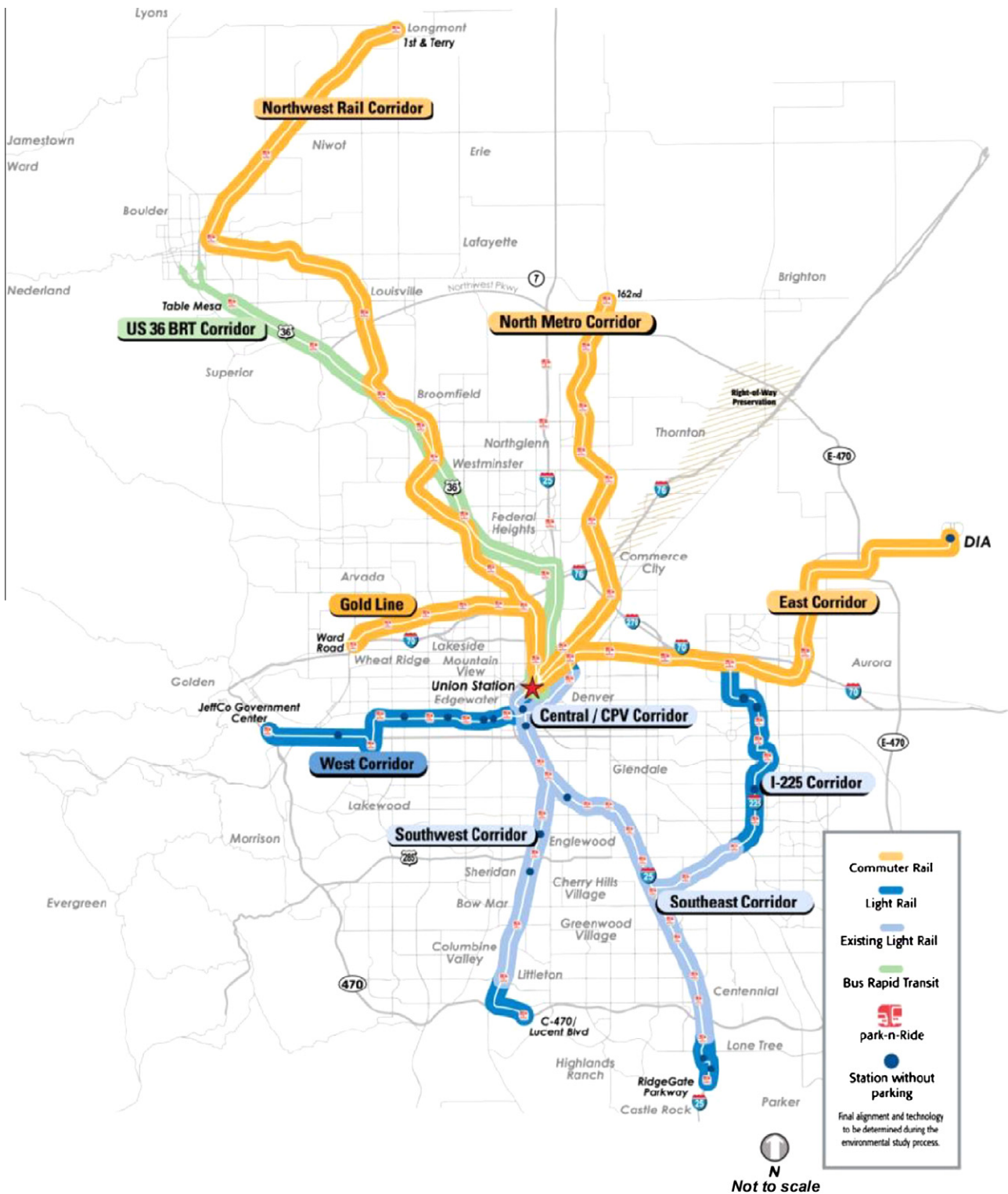


Fig. 2. Denver existing light rail lines and Fastracks program. Source: Regional Transportation District, 2011c.

TOD in Denver today

There are three major public bodies involved with TOD today in Denver. They are the Denver Regional Transportation District (RTD), the City and County of Denver, and the Denver Regional Council of Governments (DRCOG).

The Denver RTD has a full-time TOD director and staff, and states its TOD mission as follows (Regional Transportation District, 2011b):

RTD's TOD mission is to help facilitate TOD opportunities that increase ridership or enhance transit investments throughout the District through station design and close coordination with local jurisdictions and developers.

The City and County of Denver is very involved with TOD planning. They completed a new land use and transportation plan called "Blueprint Denver" in 2002 that changed the zoning in transit station areas to allow higher-density and mixed use

Table 1

Mode share comparisons 2007–2010: Downtown Denver, Denver City, Denver–Broomfield–Aurora metropolitan statistical area and the United States.

Year	Bicycle (%)	Walk (%)	Carpool/vanpool (%)	Transit (%)	Drive alone (%)	Motorcycle	Did not work	Work-home (%)	Bike and walk combined (%)
<i>Downtown Denver Commuter Survey Data^a</i>									
2010	6.60	4.30	7.10	43.30	33.40	1.70%	4.50%	1.20	10.90
2009	4.00	2.40	6.00	41.40	37.60	2.10%	3.20%	5.90	6.40
2008	6.00	3.80	5.20	42.70	36.10	n/a	4.00%	2.00	9.80
2007	3.70	3.00	7.00	36.50	41.60	n/a	6.14%	1.22	6.70
<i>Denver City, Place Data^b</i>									
2010	2.20	3.89	10.06	6.23	70.33	0.25%	n/a	6.28	6.09
2009	1.81	3.67	10.37	7.79	69.43	0.27%	n/a	5.87	5.48
2008	1.59	4.29	11.65	9.09	66.74	0.52%	n/a	5.25	5.89
2007	1.60	4.26	9.60	7.70	70.15	0.28%	n/a	5.05	5.86
<i>Denver–Broomfield–Aurora Metropolitan Statistical Area (MSA)^c</i>									
2010	0.79	1.88	9.62	4.14	76.31	0.27%	n/a	6.16	2.67
2009	0.72	2.15	9.46	4.64	75.60	0.27%	n/a	6.25	2.87
2008	0.76	2.10	10.52	4.88	74.60	0.45%	n/a	5.82	2.86
2007	0.72	2.29	9.81	4.70	75.57	0.20%	n/a	5.76	3.01
<i>United States Census Data^d</i>									
2010	0.50	2.80	9.70	4.90	76.60	1.20%	n/a	4.30	3.30
2009	0.55	2.86	10.04	4.99	76.11	0.21%	n/a	4.27	3.41
2008	0.55	2.82	10.70	5.01	75.54	0.28%	n/a	4.10	3.37
2007	0.48	2.84	10.40	4.88	76.08	0.20%	n/a	4.08	3.32

^a Downtown Denver Commuter Survey Results 2007–2011.^b United States Census Data, ACS yearly estimates and 2010 Census data. Denver City as a Place. Note: 2011 Census Information Unavailable.^c United States Census Data, ACS yearly estimates and 2010 Census data. Denver–Aurora–Broomfield MSA. Note: 2011 Census Information Unavailable.^d United States Census Data, ACS yearly estimates and 2010 Census data. Note: 2011 Census Information Unavailable.

development (City, 2002). In 2006, they completed an overall TOD Strategic Plan, and they are in the process of developing station-area plans for most of the stations within the city limits. Many of these plans are already adopted, some are in process, and others are about to begin. They also have developed a TOD Station Typology noting that “one size does not fit all” (City, 2011). Fig. 3 below

exhibits the typological designation of most of the individual stations within Denver and Table 2 below explains this typology.

DRCOG sees itself “as a resource for planners, developers, policy-makers and citizens who are interested in the implementation of Transit-Oriented Development” (Denver Regional Council of Governments, 2011a). They make easily available corridor and

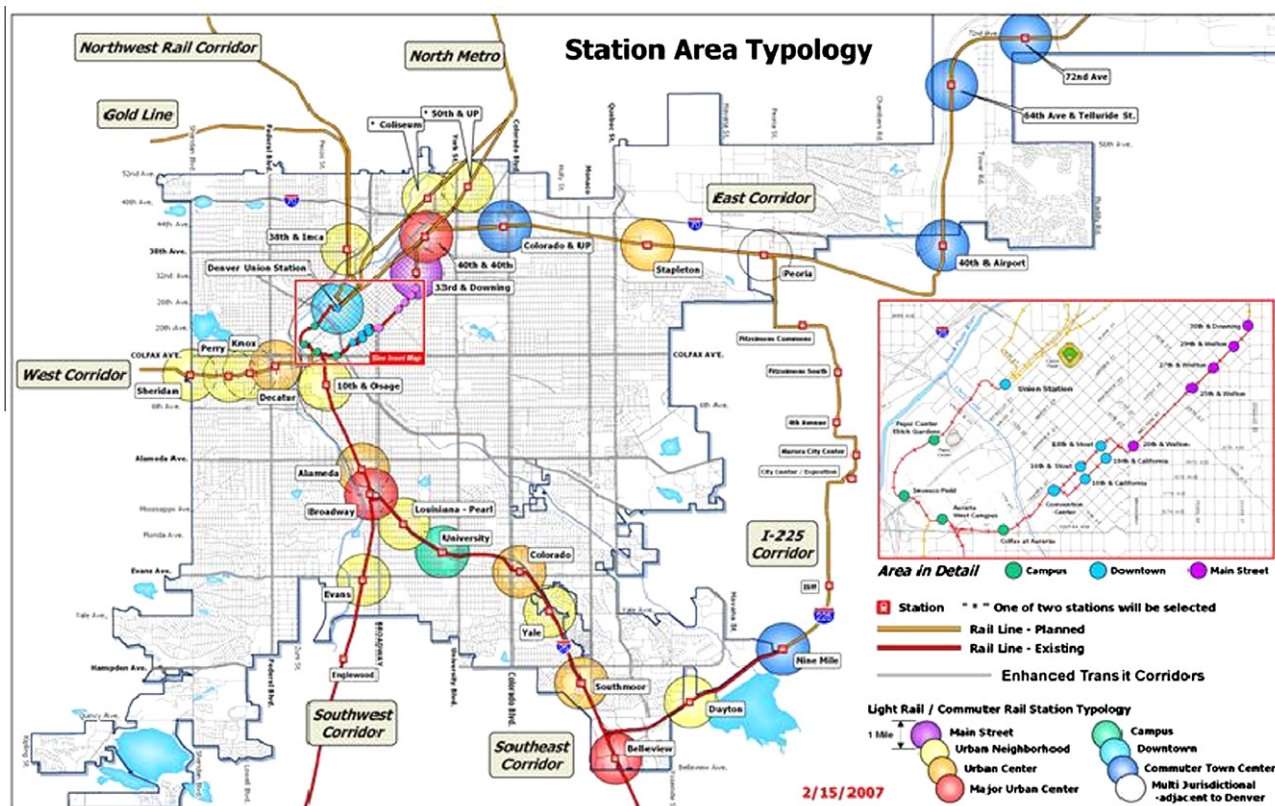









Fig. 3. Station area typology. Source: City and County of Denver, 2011.

Table 2Denver's TOD Station Typology. Source: [City and County of Denver, 2011](#).

TOD Typology	Desired land use mix	Desired housing types	Commercial employment types	Proposed scale	Transit system function
Downtown 	Office, residential, retail, entertainment, and civic uses	Multi-family and loft	Prime office and shopping location	Five stories and above	Intermodal facility/transit hub. Major regional destination with high quality feeder bus/streetcar connections
Major Urban Center 	Office, retail, residential and entertainment	Multi-family and townhome	Employment emphasis, with more than 250,000 sf office and 50,000 sf retail	Five stories and above	Sub-Regional destination. Some Park-n-ride. Linked with district circulator transit and express feeder bus
Urban Center 	Residential, retail and office	Multi-family and townhome	Limited office. Less than 250,000 sf office. More than 50,000 sf retail	Three stories and above	Sub-Regional destination. Some Park-n-ride. Linked with district circulator transit and express feeder bus
Urban Neighborhood 	Residential, neighborhood retail	Multi-family, townhome and small lot single family	Local-serving retail. No more than 50,000 sf	2–7 stories	Neighborhood walk-up station. Very small park-and-ride, if any. Local and express bus connections
Commuter Town Center 	Office, retail, residential	Multi-family, townhome, small lot single-family	Local and commuter-serving. No more than 25,000 sf	2–7 stories	Capture station for in-bound commuters. Large park-n-ride
Main Street 	Residential, neighborhood retail	Multi-family	Main Street retail infill	2–7 stories	Bus or streetcar corridors. District circulator or feeder transit service. Walk-up stops. No transit parking

(continued on next page)

Table 2 (continued)

TOD Typology	Desired land use mix	Desired housing types	Commercial employment types	Proposed scale	Transit system function
Campus/Special Events Station 	University Campus, Sports Facilities	Limited multi-family	Limited office/retail	Varies	Large Commuter destination. Large Park-n-ride

station-area maps and demographic data, including a database of real estate development activity within one-half mile of existing and future transit stations. They have also conducted a study entitled “Who is TOD in Metro Denver” that strived “to benchmark how people in metro Denver are responding to TOD policy and investment decisions reshaping the regional landscape, particularly land uses around rail-transit stations” (Denver Regional Council of Governments, 2011b). The study surveyed business owners, employees and residents.

RTD has been publishing a yearly TOD Status Report since 2005. In this report, RTD summarizes TOD through the examination of development activity, and planning and zoning activity. In addition, TOD activity within individual corridors and at individual stations (existing and planned) is reviewed. The development overview section of the 2010 TOD Status Report contains a review of regional TOD trends. This review begins by mentioning the slowing of growth within the Denver region overall due to the effects of the global economic crisis after a period of very strong growth from 2006 to 2009. Fig. 4 illustrates a spike in new units of residential TOD in 2009, followed by a sharp decline in 2010, with a moderate recovery projected for 2012.

Fig. 5 illustrates strong growth in new office development from 2006 to 2009, followed by a drop to more moderate levels in 2010. Projections for 2011 and 2012 indicate continued moderate growth in office development.

The retail sector is illustrated in Fig. 6, and shows a large spike in 2006 for TOD retail development, which was followed by a sharp drop-off in 2007, moderate increases in 2008–2009, and then nearly nonexistent development in 2010. Projections for 2011 and 2012 indicate a slow recovery in the retail sector.

Analyzing the impact of TOD within the Denver region

A geographic analysis of the following TOD-related data sources was conducted.

- RTD Transit-Oriented Development Status Report 2010.
- DRCOG TOD Development Project data.
- DRCOG Denver Region Project data.
- Center for Transit-Oriented Development Population and Household Density.

Patterns of development by corridor, patterns of development by station type, a comparison of TOD to overall regional development, and a comparison of TOD population density to regional population density were all conducted and the results follow.

Corridor development

According to Table 3 and Fig. 7, the I-225 corridor (currently under construction) has received the majority of the total square footage of new TOD of the nine transit corridors. However, this figure is misleading, as over 75% of this TOD is the Anschutz/Fitzsimons Medical Campus. This campus, which is in the city of Aurora, 11 miles east of the downtown, is:

the world's only completely new education, research and patient care facility and the largest academic health center between Chicago, Texas and the West Coast... the campus consists of three zones that promote collaboration and innovation (University of Colorado–Denver, 2011).

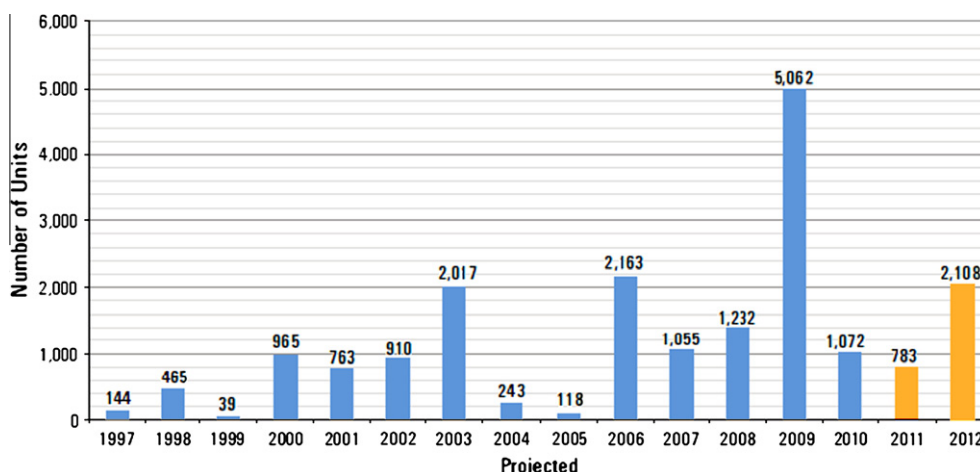


Fig. 4. Residential TOD by delivery year. Source: Regional Transportation District, 2011c.

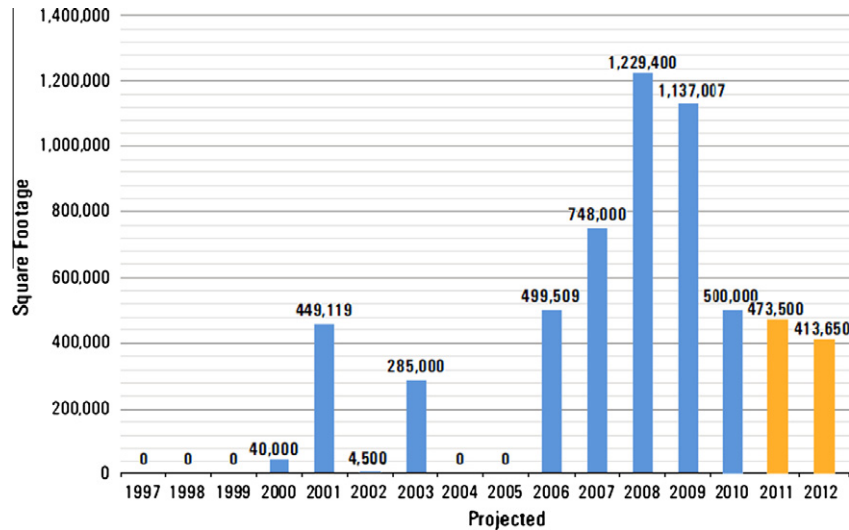


Fig. 5. Office TOD by delivery year. Source: Regional Transportation District, 2011c.

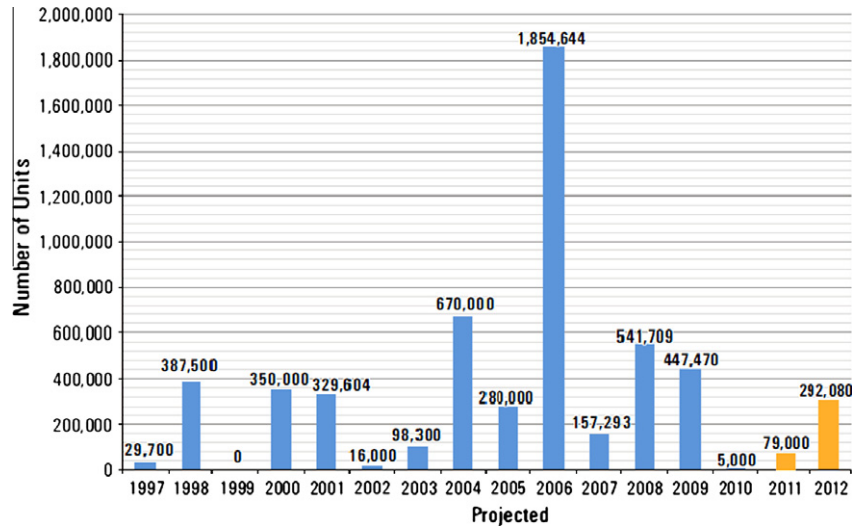


Fig. 6. Retail TOD by delivery year. Source: Regional Transportation District, 2011c.

Table 3

Denver Transit-oriented development by corridor. Source: Regional Transportation District, 2011c.

Corridor	Residential (dwelling units)	%	Hotel (# of rooms)	%	Retail (ft ²)	%	Office (ft ²)	%	Gov't (ft ²)	%	Cultural (ft ²)	%	Medical (ft ²)	%	Education (ft ²)	%	Total (ft ²)	%
Central/CPV	8196	46	4127	76	885,683	17	2,609,933	49	1,986,890	86	103,000	64	0	0	342,000	20	5,939,829	28
East	0	0	500	9	19,000	0	20,000	0	216,322	9	0	0	0	0	0	0	255,822	1
Gold	518	3	0	0	283,324	5	55,372	1	0	0	0	0	0	0	0	0	339,214	2
I-225	838	5	153	3	81,793	2	160,000	3	0	0	0	0	5,220,000	85	1,379,606	80	6,842,390	33
North	276	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	276	0
Metro																		
Southeast	5512	31	365	7	576,069	11	1,931,551	36	0	0	0	0	40,000	1	0	0	2,553,497	12
Southwest	763	4	0	0	663,257	13	50,000	1	100,000	4	40,000	25	0	0	0	0	854,020	4
US 36	1594	9	262	5	2,325,408	44	259,209	5	0	0	17,373	11	0	0	0	0	2,603,846	12
West	0	0	0	0	425,186	8	280,000	5	0	0	0	0	900,000	15	0	0	1,605,186	8
Total	17,697		5407		5,259,072		5,366,066		2,303,172		160,373		6,160,000		1,721,606		20,993,393	
% of total ft ²					25%		26%		11%		1%		29%		8%			

The development of these facilities at this location was influenced greatly by the inclusion of the I-225 corridor in the FasTracks plan. The Montview Station will be located in the heart of the Medical Campus when the light rail line is complete.

The only other TOD in the I-225 corridor, besides at the Medical Campus is 3% of the total square footage of office TOD and 2% of the total square footage of retail TOD. This percentage of retail is one of the smallest of any corridor. The new office developments are

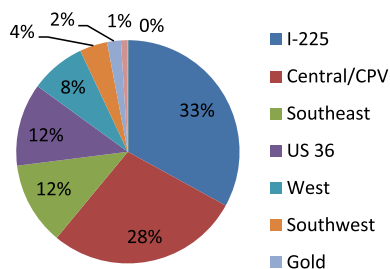


Fig. 7. Percent of total development by corridor.

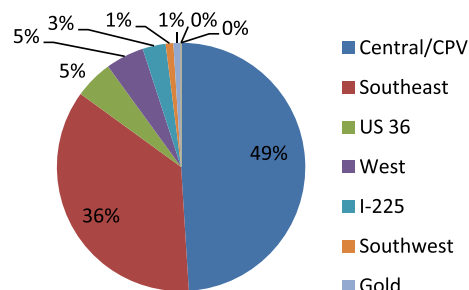


Fig. 9. Percent of office development by corridor.

small scale projects scattered across several different station locations.

The Central/CPV corridor has received the most overall square footage of TOD of the eight remaining transit corridors. Nearly 50% of the new office TOD and 46% of the new residential TOD has occurred in this corridor (see Figs. 9 and 10). Seventy-six percent of the new hotel TOD has also taken place here (see Table 3). Downtown Denver in general has been experiencing a rebirth from its economic downturn during the 1980s. In 1995 Coors Field for the Colorado Rockies baseball team opened in the LoDo (Lower Downtown) area, and the entire area gentrified. The Denver Convention Center, located about a mile away, expanded in 2004, and the development of new hotel rooms was quick to follow. The downtown began to market itself as a tourist destination, and overall many more people began to come Downtown. At the same time, the 5.3 mile MAC light rail line opened with five downtown stations.

This resurgence of Downtown Denver is a trend that is predicted to continue with a major focus on the redevelopment of Union Station into a regional transit hub. This 19.85 acre site has a master plan (see Fig. 8) to become a New Urbanist-style mixed-use development, with the potential to add up to 1.5 million square feet of new commercial space (Denver Union Station Project Authority). There were several years of debate as to the best way to develop this area with the main two options being the one chosen and a more traditional high-rise office plan. In the end, with

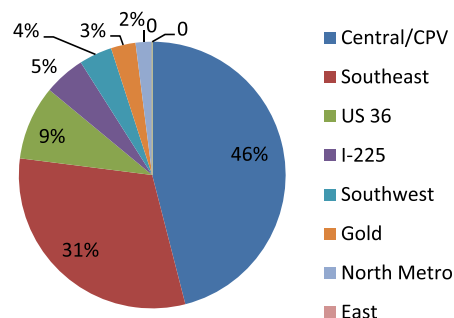


Fig. 10. Percent of residential development by corridor.

the fact that Union Station is becoming the regional transit hub, the plan providing much wider accessibility was chosen.

The corridor with the third most overall square footage of new TOD of the nine transit corridors is the Southeast. Thirty-six percent of the total office TOD and 31% of the total residential TOD has occurred in this corridor. With its location along I-25, and access to the Denver Technological Center, it is not surprising to see the level of office development found here. Residential TOD in this corridor is found more at the stations close to downtown. A good example is at Louisiana and Pearl Streets where directly



Fig. 8. Union station area. Source: Denver Infill Blog.

across from the station, a multi-family housing project with ground floor retail was completed soon after the station opened (see Fig. 11).

The corridor with the fourth most overall square footage of new TOD of the nine transit corridors is the US 36 Corridor. This corridor has experienced 44% of the total retail TOD, which is significantly more than all other corridors (see Fig. 12). Most of this square footage is the Flatirons Crossing Shopping Center in Broomfield, half way between downtown Denver and Boulder, which is adjacent to a station on the US 36 BRT line. The US 36 Corridor has also experienced the third most residential TOD and the third most office TOD, though neither of these amounts to more than 5% of the total. The city of Boulder has also recently rezoned the corner of 30th and Pearl to become a new regional bus facility. The rezoning strongly supports TOD, and the development of the entire area is being done through a joint agreement between the city and RTD.

The West corridor is the corridor that exhibits the fifth-most square footage of new TOD of the nine transit corridors. As mentioned previously, this corridor will open in 2013. This corridor is the densest of all nine corridors and runs through existing Denver neighborhoods before accessing the cities of Lakewood and Golden and also Jefferson County. Being already located in a dense area, it is not surprising that there has been no new residential TOD. Instead, 8% of the new retail TOD, 5% of the new office TOD, and a large medical complex have all recently opened in this corridor. Overall, this corridor has the easiest path to becoming a classic mixed-use TOD area with the West Light Rail line a central focus of accessibility.

The Southwest corridor, which has been in operation since 2000 has experienced only the sixth most square footage of new TOD of the nine transit corridors. The primary type of TOD that has been built here is retail, which is found at several of the more urban and less commuter oriented stations. However, the City Center station in Englewood (see Fig. 13) is very TOD oriented, with TOD a major piece of the recent redevelopment of the former Cinderella City Mall, the largest mall west of the Mississippi River when it opened in 1968. This City Center area now is a:

55-acre public/private project that focuses development on a central public place and connects the site with walkable streets,

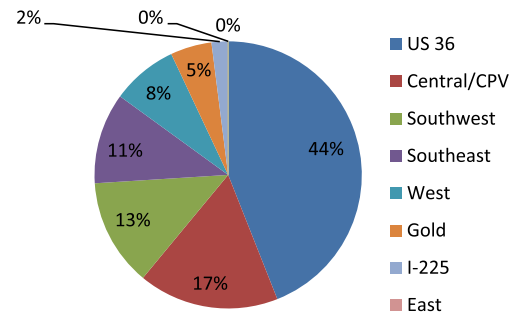


Fig. 12. Percent of retail development by corridor.

civic and cultural uses, a light rail transit station, retail and office space, residential housing, a public library, outdoor performance space, an art museum and outdoor sculpture (City of Englewood, 2011).

Development by station type

In addition to examining the development data by corridor, it was also examined by TOD station type, as defined by the City and County of Denver. In order to do this, the development data provided by DRCOG were used, and the short descriptions of individual stations from the *Status Report* were also reviewed. Tables 4 and 5 exhibit a summary of the DRCOG data. As TOD station types are only assigned for stations within the boundaries of Denver, it is only those stations that this analysis includes.

In reviewing residential development by station type, several interesting trends can be seen (see Fig. 14 and Table 4). First, apartments and condos are the only type of housing that has been developed at all station types. Major Urban Centers have experienced the most apartment development, but generally all station types have experienced some apartment development with Urban Centers significantly less than the others. Downtown stations have experienced the most condo development, followed by Main Street stations and Major Urban Center stations. As the characteristics of



Fig. 11. Residential TOD, Louisiana Pearl Street Station, Southeast Corridor.



Fig. 13. City Center, Englewood, CO.

Table 4

Residential development by station type. Source: Authors' calculations from Denver Regional Council of Governments data.

Station type	Single family	Apartments	%	Condos	%	Town-homes	%	Affordable	%	Senior	%	Student	%	Total	%
Campus	0	2203	17	111	2	5	2	0	0	0	0	316	37	2635	12
Downtown	0	2572	20	2,679	39	54	19	56	5	264	67	125	15	5750	26
Main St.	0	1881	15	1,812	26	171	60	933	76	0	0	0	0	4797	21
Major Urban Center	0	3612	28	1,459	21	44	14	60	5	0	0	0	0	5175	23
Urban Center	0	291	3	347	5	0	0	0	0	0	0	0	0	638	3
Urban Neighborhood	0	2224	17	497	7	13	5	183	14	132	33	410	48	3459	15
Total	0	12,783		6905		287		1232		396		851		22,454	
% of total units		57%		31%		1%		5%		2%		4%			

Table 5

Non-residential development by station type. Source: Authors' calculations from Denver Regional Council of Governments data.

Station type	Retail (ft ²)	%	Office (ft ²)	%	Gov (ft ²)	%	Cultural (ft ²)	%	Convention (ft ²)	%	Education (ft ²)	%	Total (ft ²)	%
Campus	400,117	14	841,194	7	0	0	0	0	0	0	197,000	100	1,438,311	7
Downtown	1,110,335	40	7,402,175	62	1,716,850	89	63,000	61	2,451,300	100	0	0	12,743,660	66
Main St.	200,600	7	0	0	0	0	40,000	39	0	0	0	0	240,600	1
Major Urban Center	812,883	29	3,365,700	28	0	0	0	0	0	0	0	0	4,178,583	21
Urban Center	169,244	6	300,000	3	216,322	11	0	0	0	0	0	0	685,566	4
Urban Neighborhood	112,000	4	45,000	0	0	0	0	0	0	0	0	0	157,000	1
Total	2,805,179		11,954,069		1,933,172		103,000		2,451,300		197,000		19,443,720	
% of total ft ²	14%		61%		10%		1%		13%		1%		100%	

Urban Centers are less residentially oriented, it is not surprising to find less apartment and condo development at these stations. With the recent gentrification efforts in the Union Station, Lower Downtown (LoDo), and Five Points areas, it is also not surprising to find the most condo development at the Downtown and Main Street stations which are located in these areas.

Townhome and affordable housing development has occurred primarily at Main Street stations, with senior housing being built at Downtown and Urban Neighborhood stations, and student housing at Campus, Downtown and Urban Neighborhood stations. As the Main Street stations are all located in the Five Points area, a lower-income area that is gentrifying, it is not surprising to find the majority of the new affordable and townhome development lo-

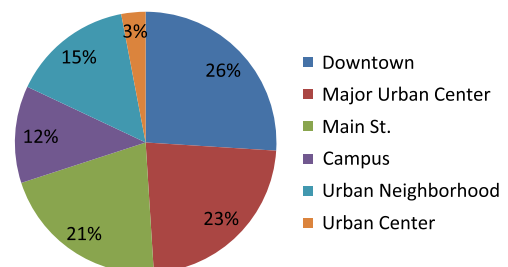


Fig. 14. Residential development by station type.

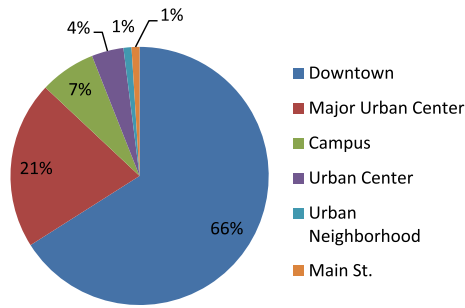


Fig. 15. Non-residential development by station type.

cated here. The total amount of development for both senior and student housing is not large, and the station areas where they are found all reflect individual projects. For example, the 410 units of student housing found in the Urban Neighborhood station type is the redevelopment of an old hotel for Regency College at the Inca Street station on the Gold line.

In reviewing non-residential development by station type, some other interesting trends can be seen (see Fig. 15 and Table 5). Foremost of these is that a majority of the non-residential development is occurring at Downtown stations, coinciding directly with the finding that most of the non-residential development is taking place in the Central/CPV corridor. Specifically, 100% of the convention development, 89% of the government development, 62% of the office development, 61% of the cultural development, and 40% of the retail development is found at the six Downtown stations. Major Urban Center stations have received the second most non-residential development, but only in the retail and office categories. Urban Center stations have also experienced some retail and office development, as well as some government development, while all of the education-oriented development has occurred at the Campus stations. Overall, all station types have experienced some retail development, with all but the Main Street stations also experiencing some office development.

Comparing TOD to overall regional development

Yearly development data from 2000 to 2010 for the entire Denver region were obtained from DRCOG. These data, though not yet fully checked for quality and accuracy, were collected from individual county assessor offices. Tables comparing the yearly total regional development data to yearly TOD data obtained from the RTD *TOD Status Reports* were built, and are exhibited below. In instances where the regional development data were questionable, they were eliminated.

Table 6 compares residential TOD to metro area residential development. Percentages range from less than 1% in 2005, to greater than 65% in 2009, with an average of 9.28%. Questionable data from 2010 were eliminated from the analysis.

Table 6

Residential TOD compared to total regional residential development. Source: RTD and DRCOG.

Building Type	2000 # of Units	2001 # of Units	2002 # of Units	2003 # of Units	2004 # of Units	2005 # of Units	2006 # of Units	2007 # of Units	2008 # of Units	2009 # of Units	Total # of Units
Apartment	6269	509	514	263	55	105	47	96	174	3497	11,529
Condo	3581	358	372	392	439	627	469	321	168	476	7203
Mixed use	755	44	22	45	35	28	29	32	35	534	1559
Mobile home	389	413	265	172	135	136	63	45	96	59	1773
Single family	18,084	16,538	15,026	14,452	15,066	15,507	13,423	7977	4702	2720	123,495
Townhome	2070	1561	1031	937	968	1162	1449	887	520	425	11,010
Total	31,148	19,423	17,230	16,261	16,698	17,565	15,480	9358	5695	7711	156,569
TOD units	965	763	910	2017	243	118	2163	1055	1232	5062	14,528
TOD %	3.10%	3.93%	5.28%	12.40%	1.46%	0.67%	13.97%	11.27%	21.63%	65.65%	9.28%

Table 7

Office TOD compared to total regional residential development. Source: RTD and DRCOG.

Year	Total office Building count	Total Office (ft ²)	TOD Office (ft ²)	TOD % Office (ft ²)
2000	189	6,322,974	40,000	0.63%
2001	184	7,286,680	449,119	6.16%
2002	81	3,893,422	4500	0.12%
2003	70	1,055,539	285,000	27.00%
2004	101	2,081,917	0	0.00%
2005	104	1,376,268	0	0.00%
2007	147	1,672,733	748,000	44.72%
2008	117	2,744,778	1,229,400	44.79%
2009	42	1,895,772	1,137,007	59.98%
Total	1116	28,694,685	4,393,026	15.31%

Table 7 compares office TOD to metro area office development. Percentages range from less than 1% in 2004 and 2005, to nearly 60% in 2009, with an average of 15.31%. Questionable data from 2006 and 2010 were eliminated from the analysis.

Table 8 compares retail TOD to metro area retail development. Percentages range from less than 1% in 2002 and 2010 to just over 33% in 2006, with an average of 10.83%.

Comparing TOD density to overall regional density

Regional and transit zone (1/2 mile station-area buffers) density data were obtained from The Center for Transit-Oriented Development. Average density for the entire Denver transit region, the aggregate of all existing rail transit station zones, and the aggregate of transit zones by station type were calculated and are exhibited in Tables 9 and 10. Household and population density figures are shown, both by population per acre and population per residential acre. A residential acre is a "land area of all blocks in which gross density (households per land acre) is greater than one." (<http://toddata.cnt.org/glossary.php>).

From Tables 9 and 10, it is seen that regardless of what density measure is used, transit zones in Denver have a greater population and household density than the entire Denver transit region. For the population and household density of all acres of land whether residential or not, the rate is from six to nine times greater. For residential population and household density, the rate is from 40% to 90% greater.

From Tables 9 and 10, the patterns of density by station type seem quite plausible. Downtown stations have the highest rates for all measures, being almost double or triple for residential densities. As downtown Denver is the densest part of the region, and demand for downtown living has increased substantially, a high residential density is to be expected. Main Street stations exhibit the second highest density for all measures. As these stations are just outside of the downtown, they also are in areas of generally high density. The station type with the third highest residential density is Campus, though the overall density in these areas is not as high. A

Table 8

Retail TOD compared to total regional residential development. Source: RTD and DRCOG.

Year	Total retail Building count	Total Office (ft ²)	TOD Office (ft ²)	TOD % Office (ft ²)
2000	259	6,365,860	350,000	5.50
2001	232	4,598,584	329,604	7.17
2002	223	5,390,506	16,000	0.30
2003	233	3,338,910	98,300	2.94
2004	243	4,439,451	670,000	15.09
2005	255	5,345,349	280,000	5.24
2006	253	5,582,172	1,854,644	33.22
2007	216	3,345,351	157,293	4.70
2008	210	2,545,325	541,709	21.28
2009	88	2,398,007	447,470	18.66
2010	20	510,247	5000	0.98
Total	2232	43,859,762	4,750,020	10.83

Table 9

Station type development. Source: Authors' calculations from Denver Regional Council of Governments data.

Area	Population density (Pop per Acre)	Population residential density (Pop per Res Acre)
Downtown Stations	13.01	43.68
Main Street Stations	16.27	22.36
Campus Stations	5.20	19.94
Urban Neighborhood Stations	8.61	17.01
Major Urban Center Stations	3.65	15.71
Commuter Town Center Stations	4.94	14.22
Urban Center Stations	6.25	11.30
All Existing Station Areas	6.43	14.45
Entire Denver Transit Region	0.97	10.26

Table 10

Household densities. Source: Center for Transit Oriented Development.

Area	Household density (households per Acre)	Household residential density (households per Res Acre)
Downtown Stations	8.46	30.17
Main Street Stations	8.05	12.19
Campus Stations	2.23	10.54
Major Urban Center Stations	2.15	9.47
Urban Neighborhood Stations	3.95	7.73
Commuter Town Center Stations	2.44	7.03
Urban Center Stations	3.16	5.92
All Existing Station Areas	3.37	7.82
Entire Denver Transit Region	0.38	4.12

high residential density near Campus stations is not surprising due to campus housing usually being concentrated in large dormitories or apartments. Not surprisingly, the Commuter Town Center and Urban Center stations exhibit the lowest densities. In the RTD TOD typology, both of these station types center on mixed-use development and thus a lower housing density is expected.

Summarizing the impact of TOD on the Denver region

When examining both the corridor development data and the station type development data, the dominant trend found is that most of the TOD activity is occurring in station areas close to the

Table 11

Percentage of TOD development type by station type. Source: Authors' calculations from Denver Regional Council of Governments data.

Development type	Main Street (%)	Major Urban Center (%)	Urban Neighborhood (%)
Residential	21	23	15
Apartments	15	28	17
Condos	26	21	7
Townhomes	60	14	5
Affordable	76	5	14
Office	0	28	0.03
Retail	7	29	4
Cultural	39	0	0

Downtown, especially in the Central/CPV corridor. This is seen especially when it comes to residential TOD, of which a majority is found at the Downtown and Main Street stations. However, it is also apparent with non-residential TOD at the Downtown stations. When specifically examining office TOD, 90% is at the Downtown and Major Urban Center stations. The tremendous change to the area around Union Station in LoDo is one of the most dramatic transformations that has and will continue to occur in Denver.

Upon examining just the station type data, it is seen that TOD seems to be generally following the typology developed by the City and County of Denver. This is especially true for stations designated Downtown as was mentioned, but is also true for a number of other station types. A Main Street station according to the typology is a "Bus and streetcar station with multi-family housing". Table 11 shows that 60% of the townhomes and 76% of the affordable units have been built at Main Street Stations. A Major Urban Center station according to the typology is a "Sub-regional destination with office, retail, residential and entertainment". Table 11 shows all of these development types at the Major Urban Center stations except entertainment. An Urban Neighborhood station according to the typology is a "neighborhood walk-up station with multi-family housing and neighborhood retail". Table 11 shows all of this type of development but at a more moderate scale.

Upon examining the corridor data, a final trend that was found is that TOD in the older but less populated Southwest corridor is significantly less than in the newer but more centrally located Southeast corridor, and the still under construction West corridor.

In the comparison of TOD to overall regional development a number of interesting patterns are exhibited. First, since 2000, over 15% of regional office development has been TOD, and in 2007 and 2008 the percentage was near 45%, with it reaching nearly 60% in 2009. With it found earlier that over 90% of office TOD has been in the downtown, the comparison statistics lead one to believe that overall office development in the Denver region is now significantly focused on the downtown, and thus serviced by rail transit.

From 2000 to 2009, it was found that just over 9% of the total regional residential development was TOD. While regionally from 2006 to 2009 new residential development declined in the Denver region, the percentage of residential TOD dramatically increased, topping out at over 65% in 2009. As most residential TOD projects are developed through a longer planning process than more traditional residential subdivision developments, the decrease seen in the Denver housing market may still occur within the residential TOD market.

From 2000 to 2010, it was found that an average of nearly 11% of the total regional retail development was TOD. The largest percentage of new retail TOD (33.22%) occurred in 2006. This percentage then dropped significantly in 2007 to 4.7%, before increasing again in 2008 to 21.28% and 2009 to 18.66%. In 2010, the percentage of retail TOD decreased to the second lowest level in the decade of 0.98%. The opening of large retail centers generally accounts for the large fluctuation in the percentage of retail TOD between 1 year and another.

Finally, upon examination of the density data, it is seen that transit zones in Denver definitely have a greater population and household density than the entire Denver transit region. In addition, the TOD densities in and near downtown are the highest, and lowest at stations more focused on mixed-use development. Even at the mixed-use oriented stations, residential densities are still higher than in the overall Denver transit region.

Summary and conclusions

Like most other US cities, Denver has been experiencing considerable suburban and exurban low-density growth since at least the 1950s, as a result of numerous factors especially the increased use of and reliance on motor vehicles and highways. In 1950, the centrally-located City and County of Denver accounted for nearly 75% of the metropolitan area population, but by 1990, it represented only 25%. The average population density for the Denver urbanized area in 1950 was 4741 people per square mile. By 1990, it had declined to 3309 (Rusk, 2004). This pattern of low-density decentralized growth and increasing reliance on motor vehicles and highways has led to increased economic, environmental, and social costs, especially growing traffic congestion, higher infrastructure costs, greater energy use per capita, higher levels of air pollution emissions, and somewhat paradoxically, reduced levels of accessibility.

In response to similar trends, many US cities have been starting or expanding rail transit systems and encouraging transit-oriented development in the station areas along the transit corridors. It is expected that new and extended rail transit will provide better access within the urbanized area to more activities, thus improving the value of land, and encouraging higher-density, mixed use development near transit stations.

In Denver, the reintroduction of rail transit in 1994 has led to successive expansions in the network, including the current FasTracks rail transit expansion program that will result in a 157-mile light and commuter rail system along six corridors throughout the metro area. A key aspect of the rail transit buildout is the potential for transit-oriented development which is being encouraged largely by the regional transit agency (RTD), the metropolitan planning organization (DRCOG), the City and County of Denver, and other jurisdictions in the region.

Early evidence indicates that the scope of transit-oriented development in Denver is considerable, resulting in nearly 18,000 residential dwelling units, 5.3 million square feet of retail space, 5.4 million square feet of office space, and 6.2 million square feet of medical space within one-half mile of existing or planned transit stations from 1997 to 2010. The largest proportion of this TOD (46% of retail, 76% of hotel rooms, 49% of office, 66% of government, and 64% of cultural) has been built along the Central Corridor at stations designated "Downtown" in the City and County of Denver station typology. Besides the Central Corridor, office and residential TOD is found on the Southeast Corridor while retail TOD is more evenly spread among all corridors, though the Flatirons Crossing Mall in the US 36 corridor still accounts for nearly 45% of the total. Medical and educational development is concentrated in the I-225 corridor due to the expansion of the Anschutz/Fitzsimons Medical Campus in Aurora.

When comparing TOD to overall development in the Denver region, TOD is becoming a larger piece of the overall picture. In 2009, 65.65% of the regional residential development, 59.98% of the regional office development, and 18.66% of the regional retail development was TOD. The residential percentage is somewhat skewed as the poor economy in 2009 had tremendously impacted the building of new housing throughout the region. Regardless, since 2006, over 20% of all regional residential development has been

TOD. The large percentage of office TOD relates directly to the large amount of office development currently occurring in downtown Denver and the fact that rail transit service in the downtown is quite extensive. Though nearly 20% of retail was TOD in 2009, retail TOD made up less than 1% in 2010. Over the past decade, whenever TOD has made up a large share of the overall regional retail development, it has been due to a very large retail complex opening near a rail transit station.

All of the development in transit-served locations is having an effect on the land use and urban form of the Denver metropolitan area. Increased density, one of the critical objectives of the regional land use and transportation plan, including the FasTracks program, is clearly evident. From 1990 to 2000, urbanized area density increased from 3309 to 3979 persons per square mile (Rusk, 2004). Density of housing increased from 1379 to 1429 units per square mile during the 2000–2006 period (Denver Regional Council of Governments, 2008). From 2000 to 2005, the number of housing units and total employment in designated urban centers that include transit stations increased (Denver Regional Council of Governments, 2008), and in the final analysis of this research, existing transit zones in Denver are now found to be significantly more dense than the overall transit region. Very dense housing is now found in and near the downtown transit zone, and even more mixed-use transit areas have higher residential densities than the overall Denver region.

While Denver still remains a relatively low density city that relies heavily on the automobile and highway transportation, there has nevertheless been a clear change in regional policy that is encouraging more transit and higher-density transit-oriented development and that change in policy is having a recognizable impact on Denver's land use and urban form. There is certainly no better example than downtown Denver where the majority of access is now by rail transit, walking and bicycles, instead of cars. Conventioneers, tourists, and others from the region enjoy the area for its pleasant atmosphere, many cultural opportunities and easy accessibility. Redevelopment of Union Station into a regional transportation hub and the coinciding mixed-use pedestrian oriented nearby development should continue this change in urban form into the future. It is too early to determine how much of a regional change in land use patterns and urban form will occur from the completion of the FasTracks program. However, it certainly appears that tying transit development to land use development is causing Denver to think and plan for the future in a way that will best utilize the transit system as an integral part of the existing and future land use pattern.

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