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Jenny Schuetz, Genevieve Giuliano, and Eun Jin Shin

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Does Zoning Help or Hinder Transit-Oriented (Re)Development?

Jenny Schuetz*

Board of Governors of the Federal Reserve System

Genevieve Giuliano

University of Southern California

Eun Jin Shin

University of Southern California

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Abstract

Despite its reputation as a car-oriented city, the Los Angeles metropolitan area has made substantial investments in developing rail transit since 1990. In cities with older “legacy” rail systems, the built environment has developed over time around fixed transit infrastructure, creating land use patterns oriented towards long-standing rail stations. By contrast, rail stations in Los Angeles were added to an already dense built environment, with auto oriented zoning and established land use patterns. In this paper we ask whether redevelopment is occurring around Los Angeles’ rail stations, and whether zoning and related public policies are facilitating or constraining transit-oriented development. We conduct case studies of six Metro rail stations in the Los Angeles region, documenting the existing built environment, key components of zoning and land use planning, and the extent and type of new development in the immediate vicinity of stations after they opened. Results illustrate that redevelopment around transit stations involves complex interactions between physical environment, economic conditions and public interventions. Incompatible zoning and related land use policies may constrain growth near stations, but TOD-friendly zoning alone is not sufficient to spur development.

Keywords: Public transportation; zoning; housing markets; land use planning; urban spatial structure; local government

JEL codes: H7, O18, R1, R3, R4, R5

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* Corresponding author. jenny.schuetz@frb.gov

Section 1) Introduction

It is difficult to imagine what the landscape of New York City would look like without the subway, or London without the Tube. These and other cities built their intra-city passenger rail systems more than 100 years ago, so their current built environments have quite literally grown up around the transit infrastructure. Successive waves of growth have added height and density around many stations, taking advantage of the accessible locations to cluster jobs and housing. Similar patterns of high-density mixed use development are still emerging (albeit unevenly) around newer rail systems built in the 1970s, including the Washington DC area Metro and the San Francisco Bay Area Rapid Transit (BART) (Arlington County 2012). More cities across the U.S. are continuing to develop new rail systems or expand existing ones, from Manhattan's Second Avenue subway to Washington DC's Silver Line extension to proposed streetcars in cities such as Cincinnati, Denver, and Charlotte. The current wave of rail expansion raises a number of questions. When rail infrastructure is added to an already dense built environment that developed around automobile travel, will new development patterns emerge around stations? What form might redevelopment near stations take, and when will it become apparent? Does zoning facilitate or impede transit-oriented development around new stations?

In this paper, we investigate these questions by documenting zoning and changes in development patterns around six Los Angeles Metro rail stations that began operating between 1993 and 2003. Despite its reputation as a car-oriented city, the Los Angeles metropolitan area has made substantial investments in rail transit. Since 1990, the Los Angeles Metropolitan Transit Authority (LA Metro) has built more than 75 stations along six separate rail lines. In most instances, the new rail stations were added to an already dense built environment, with auto oriented zoning and established land use patterns. The station areas differ widely in their basic

land use patterns, economic conditions, housing market characteristics and other signs of physical development. Anecdotal observation suggests that some stations have experienced substantial changes in physical and economic conditions after station opening while others have seen limited new development.

This research builds on several related strands of literature in urban economics and planning. Standard urban economic models predict that building new rail stations should increase the accessibility of surrounding neighborhoods, leading to higher land values and attracting higher density development (Alonso 1964, Brueckner 1987, Mills 1967, Muth 1969). The increase in accessibility may vary by types of rail systems: LA Metro and most subway systems primarily connect neighborhoods within the central city core, while commuter rail systems are intended to link outlying residential areas with the central business district. There are multiple potential barriers that can impede or prevent development near stations, especially in dense urban areas. In general, redevelopment is profitable if expected rents (prices) from the new use are high enough to warrant replacing existing low-density structures with substantially higher density buildings (for instance, replacing single-family detached homes with multifamily buildings). Redevelopment incurs higher costs than “greenfields” development, including demolition of existing structures, possible environmental remediation, and the need to assemble land parcels from multiple owners (Wheaton 1978). Thus redevelopment near newly built stations will only occur if land values around the station have substantially increased since the time at which existing structures were built.

Besides economic factors that affect land values, zoning and other forms of land use regulation may constrain higher-density redevelopment near stations. For instance, if new stations are opened in areas zoned exclusively for low-density residential land use, it is unlikely

that large volumes of new housing or employment could emerge near the station, even if firms and developers wished to locate nearby. Zoning could impede redevelopment through a variety of mechanisms, including bans on compatible land uses, density limitations, or procedural rules that add to “soft” development costs. In California, a particular obstacle is likely to be the California Environmental Quality Act (CEQA), which requires public review and comment as part of an environmental impact review for nearly all development projects (Olshansky 1996). That is, even under ostensibly friendly zoning, political and neighborhood opposition may delay or block development. Prior research has shown that land use regulations in a variety of forms can exert substantial effects on the quantity and price of housing (Glaeser et al 2005, Glaeser et al 2006, Quigley and Raphael 2004, Schuetz 2009). Conversely, if public officials and nearby residents want to facilitate change near transit stations, they can employ various political and institutional tools: increasing the allowable density, granting density bonuses or fast-tracking proposed development, and soliciting development through public-private partnerships. Coordinating zoning changes and other land use policies around the time of station opening should increase the probability of redevelopment near stations.

Combining predictions from these theories suggests that whether redevelopment occurs near new stations in urban areas will depend on the interaction between underlying property values, the pre-existing density and mix of land uses, and prevailing land use regulations. Previous empirical studies have examined the outcomes from newly built transit systems, focusing mostly on economic inputs and impacts. Research has found widely mixed results of transit investment on transit ridership, land values, housing prices, population and housing density, employment composition and population characteristics (see, for instance, Baum-Snow and Kahn 2005; Boarnet and Crane 1997; Bollinger and Ihlanfeldt 1997; Bowes and Ihlanfeldt

2001; Chatman et al 2012; Cervero and Landis 1997; Debrezion et al 2007; Duncan 2011; Handy et al 2005; Giuliano and Agarwal 2010; Hess and Almeida 2007; Kahn 2007; Kolko 2011; Lin 2002; Lund et al 2004; Mathur and Ferrell 2009; Schuetz 2015; Schuetz et al 2016; Winston and Maheshri 2007). A number of these studies have incorporated some measures of the previous built environment as explanatory variables (Bowes and Ihlanfeldt 2001; Duncan 2011; Schuetz 2015). However, no research to date has explicitly examined the extent to which local land use regulations either constrain or enhance development near stations.

This paper complements and expands upon prior quantitative research of economic change near LA Metro stations (Schuetz et al 2016) by conducting detailed case studies of six stations. We document several key features around the stations: the type and density of the existing built environment, zoning and related land use regulations, and the type and quantity of new development since the stations opened. While the cases are not necessarily representative of all stations in the Metro rail system, they illustrate the variety of physical environments, zoning and development trajectories of station areas. The case studies are not intended to prove causal relationships between zoning and development outcomes, but suggest some ways in which zoning could affect development. The analysis improves on zoning measures used in the prior literature, by examining the role of adaptive reuse regulations and additional density metrics. Further, we draw on multiple administrative data sources and use innovative metrics to identify urban redevelopment, in ways that standard datasets generally cannot capture.

The Los Angeles Metro rail system offers a particularly interesting setting to study the emergence of transit-oriented development. Because it is a relatively new system, long-term land use patterns are still emerging, and there is sufficient variation in station opening dates to observe the timing of changes. The LA region differs from older East Coast cities with legacy

transit systems is several ways that may affect the demand for rail transit: employment is polycentric and spread across a very large land area, commuters are much more likely to drive in cars than take public transit, and among those who do ride mass transit, bus ridership substantially outnumbers rail ridership. Moreover, the locations selected for Metro stations were determined more for political expediency than economic efficiency, which may diminish the potential for both ridership and nearby development (Elkind 2014, Taylor et al 2009).

Results indicate that redevelopment outcomes and zoning are quite heterogeneous across stations, and suggest that zoning has the potential to constrain redevelopment near at least some stations. Three of the six station areas – Hollywood/Vine, Pershing Square, and Del Mar – have seen substantial increases in housing stock and some new commercial space within several blocks of the stations. All three of these areas have relatively TOD-friendly zoning, moderately dense existing environments and strong real estate markets, and benefitted from active local government efforts to encourage development. The other three stations – Civic Center, Vermont/Santa Monica, and Highland Park - have had few if any changes in the building stock. In two of these cases, incompatible zoning may constrain development near stations, while two areas have had relatively soft real estate markets since the stations opened.

The remainder of this paper is organized as follows. Section 2 provides some context for rail transit in the Los Angeles region; Section 3 describes our criteria for selecting case stations, the data sources and methods of analysis. Section 4 presents results for each of the six cases, while Section 5 concludes.

Section 2) Rail transit in Los Angeles

The Los Angeles Region is the second largest metropolitan area in the US, with 2010

population of about 18 million and about 7 million jobs.¹ Although long famous for its “urban sprawl,” the central part of the metropolitan area, the Los Angeles–Orange County MSA, has the highest average density of any U.S. metropolitan area. The City of Los Angeles has an average population density of 8000 persons per square mile. The difference from older US cities such as New York or Chicago is in the distribution of population and employment. Los Angeles is distinctly polycentric, with many large employment centers located within the core MSA. The Los Angeles CBD is relatively weak; generously defined to include the CBD and entire Wilshire Corridor (Center 1 in Figure 1), it accounted for about 11 percent of regional employment in 2005 (Giuliano et al 2015). The metro area is also highway oriented; the largest employment clusters are located along major freeway corridors and interchanges.

The commitment to rail transit in Los Angeles is long-standing and substantial. Efforts to build a rail system in Los Angeles began in the 1960’s. The city was losing population and jobs to rapid suburbanization, and it was thought that a subway along the Wilshire Corridor would revitalize the central city. A new transit authority was established in 1964 with the authority to submit tax proposals to local ballots. Tax proposals to finance the subway were defeated in 1968, 1974, and 1976. However, in 1980 a new proposal for a countywide rail network (\$182 billion in 1980 dollars) was presented, and a proposal for a five cent sales tax was passed (Fulton, 1996). This was followed by additional five cent sales tax measures in 1990 and 2008. Together these taxes generate approximately \$2.3 billion annually, of which about half is available for rail capital construction.² These revenues constitute over two-thirds of LA Metro’s

¹ We define the Los Angeles metropolitan area as the US Census Consolidated Statistical Area (CSA), which includes 5 counties and 3 Metropolitan Statistical Areas (MSA).

² Source: <https://www.metro.net/about/financebudget/taxes/>; rail construction funds estimated by the authors.

annual budget (capital and operating). To date, LA Metro has invested \$9 billion (in nominal terms) in rail infrastructure, financed in part from these local sales tax measures (Nelson and Weikel). LA Metro now has by far the largest transit construction program in the US. Both city and county governments (and many voters) see rail transit investment as the key to reducing congestion, restructuring urban form, creating a livable city, and attracting economic development. However, the Los Angeles Times recently reported that LA Metro has lost 10 percent of its ridership since 2006; daily boardings were lower in 2015 than 30 years ago, before any rail transit was operational (Nelson and Weikel 2016).

Section 3) Data sources and empirical approach

To explore whether zoning and the existing built environment affect the quantity or type of redevelopment around new rail stations, we document land use patterns, zoning, and changes in physical development around six rail stations that opened in the Los Angeles metropolitan area between 1993 and 2003. The stations were chosen to provide different neighborhood environments and illustrate varying types of zoning and development outcomes.

3.1 Selection criteria for study neighborhoods and stations

We identified three types of neighborhoods that are broadly representative of station areas in Los Angeles: the Central Business District (CBD), urban density mixed-use corridors, and inner-ring suburbs.³ Most rail transit systems in U.S. cities – including LA’s Metro – run through the CBD, often connecting it with outlying residential areas or employment sub-centers.

³ We restricted the study to three Metro rail lines – Gold, Purple and Red – largely for timing and data availability. Other lines either opened too early or too late for us to have sufficient pre-opening or post-opening data on key neighborhood conditions. One line was excluded because it is located in the median of a freeway.

Downtown Los Angeles is an area with historically high employment concentration, often in high-rise office buildings with ground-floor retail and services, but with relatively little residential population. For an urban-density mixed-use corridor, we chose the Hollywood neighborhood in Central Los Angeles. It is characterized by office, retail and other commercial uses concentrated along major streets and medium-to-high density residential buildings along side streets. To examine TOD in a more suburban context, we selected the Pasadena/Arroyo Seco corridor. Pasadena is an independent city approximately 10 miles northeast of Los Angeles, a large employment sub-center within the region. The Arroyo Seco corridor is a primarily residential commuting corridor between Pasadena and Downtown Los Angeles. Including at least one station in a city other than Los Angeles also allows us to compare systematically different local government approaches to zoning and land use planning.

Within each of the three targeted neighborhoods, we then selected two study stations with contrasting patterns of development post station opening. One station where we observed substantial development consistent with TOD principles (mixed-use, higher density residential) was selected, and one more “typical” station where we observed little development was selected. Contrasting cases within the same neighborhood allows us to examine both the localized factors that affect TOD and why stations in fairly close spatial proximity and with similar underlying demographic, economic and physical characteristics might follow different trajectories. The selected stations are listed in Table 1 and mapped in Figure 1. Population and housing characteristics are fairly similar within each of the matched pairs, and differ considerably across matches. Given the variation in local conditions around stations throughout the Metro system, it is difficult to argue that any single station is truly representative, but the six stations selected for this study provide a good range of station areas across several dimensions. Three of the stations

– Civic Center, Del Mar and Highland Park – attract mostly weekday commuters, while the other three have more constant ridership throughout the week.

While we present data on many of the factors that are likely to influence neighborhood development, there are likely to be unobservable characteristics that are correlated both with development outcomes and with zoning and underlying real estate markets. Moreover, we are not formally testing relationships between redevelopment and contributing factors. Thus we are not able to draw causal links between redevelopment and any particular input (zoning, property values, existing built environment, or demographic characteristics).

3.2) Data sources

The location and opening dates of rail transit stations were assembled from the Los Angeles County Metropolitan Transportation Authority (Metro) website and supplemental documentation. The street address of stations has been geocoded and matched to latitude-longitude coordinates and census geographies.

Information on current zoning and other land use plans was obtained from the websites of Los Angeles' and Pasadena's city planning departments. For the stations in Los Angeles, the city's online Zone Information and Map Access System (ZIMAS) was used to determine the current zoning classification for all parcels within one-quarter mile of the station (Figures 2, 4 and 7). The zoning classes determine what land uses can be developed on each parcel, as well as density limits. Whereas many prior studies of zoning focus on minimum lot size as the main density constraint, in densely built urban areas where most lots are already determined by pre-existing structures, the more relevant metrics are floor-to-area ratio (FAR) for commercial structures and number of dwelling units per acre for residential buildings. Both values are reported in Table 2. Additional information on Community and Specific Land Use Plans,

including plan adoption dates, were obtained from the Los Angeles City Planning website. Zoning information around the Del Mar station was obtained from the Central District Specific Plan on the City of Pasadena's website (Figure 6). Incorporating information from land use plans provides a more comprehensive and accurate picture of the effective constraints on development than can be obtained from citywide baseline zoning, as is typical of most prior studies. In particular, we identify where allowed uses and densities in land use plans override or contradict with baseline zoning.

To track changes in physical development around stations, we rely on three data sources. Property-level data on housing sales from 1988 to 2012 were obtained from DataQuick, a private data vendor. In addition to sales volume and prices, these data include the number of housing units per structure and year they were built. Our study areas include two housing types that are poorly covered in DataQuick (or other sales datasets): multifamily rental housing and housing created through conversion of non-residential buildings. To measure development of these housing types, we use parcel-level data from the Los Angeles County Tax Assessor's website and the online building permits database of the Los Angeles Department of Building and Safety.⁴ For parcels adjacent to each rail station, we document the property type and year built, as well as number of housing units for residential buildings. For commercial buildings converted to residential use, the year housing units were created is obtained from building permits. Combining multiple data sources and investigating changes in the built environment beyond

⁴ Tax Assessor: <http://maps.assessor.lacounty.gov/>. Building permits: <http://ladbs.org/LADBSWeb/online-building-records.jsf>.

newly built structures produces a richer and more accurate description of urban redevelopment than simply focusing on counts of housing sales or new construction.

General population and housing characteristics on station areas is assembled from tract-level data from the 2005-2009 American Community Survey. Because the impacts of stations on development patterns are likely to be highly localized, study areas are defined as the quarter-mile area from the station entrance.⁵ Variables include population density, median household income, racial/ethnic composition, median home value and rent, composition and age of the housing stock. To provide some context on employment near stations, we use data from the National Establishment Time Series (NETS) database, which is based on the Dun and Bradstreet Business Register. We document employment by industry (two-digit NAICS codes) around station areas in 2013, the most recent year available. The demographic data are estimated from geographic areas larger than the immediate station vicinity, so may not accurately reflect the highly localized conditions near the station. This information is presented purely for descriptive purposes.

4) Findings from station case studies

For each station, we present information on physical development patterns and some of the underlying conditions that could have affected changes over time. First, we provide a general description of the current physical and economic environment around each station. Second, we explore the basic components of current zoning and land use planning, and determine whether these elements have changed since the stations began operation, or whether

⁵ Many stations are located at major street intersections that also serve as boundaries for census tracts, and therefore station areas often overlap multiple tracts. To match census tract characteristics to station areas, we use GIS to determine the percent of land in each study area drawn from each census tract, and created weighted averages of census variables using these percentages.

other public interventions have been employed to impact development. Third, we describe the type and quantity of physical development that has occurred in the immediate vicinity of the station, since station opening.

4.1) Civic Center Station, Downtown Los Angeles

The Civic Center station is located in the Civic Center sub-neighborhood of Downtown Los Angeles, two blocks west of City Hall (Figures 2 and 3). The Central City Community Plan (which covers both Civic Center and Pershing Square station areas) describes the neighborhood as the “governmental, financial and the industrial hub of Los Angeles”, with a relatively small albeit growing residential population. The Civic Center station area is dominated by city and county government buildings and other public facilities. Two blocks west of the station is a large performing arts complex, including the Frank Gehry-designed Disney Hall and newly opened Broad Art Museum (Finkel 2015). The residential population near the station is quite small, due to the limited housing nearby.⁶ The Civic Center station area has by far the highest employment density of the stations in this study, two-thirds of which are in public or institutional sectors. Besides the government agencies and performing arts complex, the area has some small retail and food service establishments that serve nearby office workers.

The zoning near the Civic Center station reflects the dominance of government buildings and publicly owned land (Figure 2). More than half the land in the study area is zoned exclusively for Public Facilities, with allowable uses limited to government buildings, fire and police stations, libraries, and similar public uses. On the south side of the station, parcels are

⁶ For the Civic Center station, estimating population characteristics through a weighted average of adjacent census tracts is somewhat misleading, because nearly all the residential population in those tracts are located outside the immediate station area. Moreover, neighboring tracts differ widely along basic characteristics (population density, income, and racial/ethnic composition), so the weighted average is not an appropriate measure of any area.

zoned for high-density multifamily residential and commercial (Table 2). These parcels are occupied by large apartment and office buildings that were built prior to the station opening. Civic Center falls under the Central City Community Plan, adopted in 2003, which encourages contextual development in keeping with existing historic building facades and streetscapes. Specific goals stated in the Central City Community Plan include encouraging more residential growth, supporting locally-serving businesses, inducing more pedestrian oriented development, helping industrial areas (mostly east of Civic Center), and taking advantage of unused office space. The plan calls for future projects to “maximize the development opportunities of the future rail transit system while minimizing adverse impacts”, although it does not specify what the opportunities or potential harms are.

No residential or commercial buildings have been developed around the Civic Center station since the station opening, or indeed within the last 25 years. The nearest residential properties are an affordable senior housing complex built in 1980, a high-rise condominium built in 1968, and a high-rise apartment building near the Museum of Contemporary Art built in 1988 (no current rent information was available). The government office buildings were mostly built during the 1960s and 1970s, although new buildings for the Police Department and California Transportation Department were completed in the past five years. The most notable change in the physical environment near the Civic Center was the 2012 completion of the Grand Avenue Park, which extends several blocks to the east and west of the Civic Center station, surrounding one of the station entrances. The park was developed by the City of Los Angeles and has open space and a variety of public programs, such as concert series and holiday celebrations (Karlman 2014).

4.2) Pershing Square Station, Downtown Los Angeles

The Pershing Square station is located in the Historic Core sub-neighborhood of Downtown Los Angeles, four blocks south of the Civic Center station. The station's name derives from the adjacent public plaza, which houses various special events and activities, including a weekly farmers' market, summer movies and concerts (Figures 2 and 3). In addition, non-profit organizations use the Square to provide free meals and conduct outreach to Downtown LA's sizeable homeless population. The station area is somewhat between land uses, surrounded by high-rise office buildings with ground-floor retail and restaurants, hotels, high-rise residential buildings, and surface parking lots. Most of the nearby office and residential buildings date from the 1910s and 1920s and have distinctive architectural features, such as the adjacent Millennium Biltmore Hotel, built in 1923. Pershing Square abuts two distinct and highly active retail districts: the Jewelry District to the south, and the historic Broadway theater district to the east. Although most of the theaters are long dormant, the ground floors are occupied with retail catering largely to lower-income Latinos, and an increasing number of high-end trendy retailers (Immediato 2015). The Historic Core was LA's original financial district, but the high-rise office buildings were largely unused for several decades, prior to the Adaptive Reuse Ordinance discussed below.⁷ The residential population has grown substantially since 2000, and is economically and demographically mixed, with some remaining rent-controlled apartments and Single Room Occupancy hotels, but an increasing population of affluent households living in newly converted apartments and condominiums.⁸

⁷ See Brooks and Lutz (2014) for discussion of how Downtown Los Angeles' density formed around the original streetcar lines during the early 20th century.

⁸ The only available source for small areas after 2000 comes from the five-year rolling averages of the American Community Survey, and the overlapping years inhibit comparisons over short periods of time.

Like the Civic Center station area, Pershing Square's basic zoning and land use plans are set out in the Central City Community Plan. Nearly all the parcels near the station are zoned for high-density commercial and residential activity (Table 2). However, many of the existing structures built in the early 20th century exceed the current allowable densities, some by as much as 20-30 percent, meaning if the current structures were demolished any replacement structures would be smaller. The Pershing Square station area and much of the surrounding Historic Core neighborhood have been altered by the Adaptive Reuse Ordinance (ARO), adopted in 1999. The ordinance encouraged conversion of vacant commercial buildings into housing through an expedited approval process and waivers of certain zoning and building code provisions.⁹ Initially the ARO applied only to Downtown Los Angeles, but has since been expanded to other parts of the city.

No new structures have been built within several blocks of the Pershing Square Station, but a substantial number of new housing units have been created through conversion of existing structures under the ARO. Parcel-level analysis of ZIMAS and the County Tax Assessor records indicate that at least half a dozen residential conversions have occurred within two blocks of the Pershing Square Station since 2005.¹⁰ These buildings contain roughly 500 housing units (both owner-occupied condominiums and rental apartments); the Los Angeles Department of City Planning estimates that several thousand housing units have been created in Downtown Los Angeles under the ARO. Transactions data indicate no residential sales occurred

⁹ <http://preservation.lacity.org/incentives/adaptive-reuse-ordinance>

¹⁰ Parcel-level records from the LA County Tax Assessor give "year built" dates from the 1960s through the 1980s for several buildings that were converted in the late 2000s or beyond. Moreover, because tax parcels do not correspond exactly to building structures, it is often unclear how many residential units are in the converted buildings. Conversion dates for a sample of buildings were verified through the online building permits database.

near Pershing Square station from 1988 through 2004, about 50 properties sold per year from 2005 to 2008, and about more than 100 properties sold per year from 2009 to 2012. The median condominium price in the station area ranges from \$250,000 to \$500,000 in recent years. The strong housing market and growing residential population in the Historic Core have also attracted notable restaurants and increased retail activity (Sietsema 2015, Wotapka 2013).

4.3) Hollywood/Vine Station, Hollywood neighborhood, Los Angeles

The Hollywood neighborhood of Los Angeles (as defined by the city for zoning and planning purposes) encompasses much of north-central Los Angeles, including tourist-oriented commercial areas along Hollywood Boulevard, residential neighborhoods of varying density and population characteristics, commercial and industrial zones, and the large open-space expanse of Griffith Park. The Hollywood/Vine Metro station is situated at the intersection of two major commercial thoroughfares, in a densely developed urban neighborhood with a mix of retail, entertainment, office, hotels, and multifamily buildings. The station entrance on Hollywood Boulevard is amidst the famous Hollywood Walk of Fame, with entertainment celebrities' stars embedded in the sidewalk (Figures 4 and 5). As in Pershing Square, many of the surrounding buildings date from the 1910s through 1930s and are architecturally notable. As of 2005-2009, approximately 10 years after the station opened, the population was denser than Los Angeles overall while the demographic and economic population characteristics mirrored the city fairly closely (Table 1). The station area has fairly high employment density, with about half of employment in commercial sectors and one-third in industrial sectors.

Zoning in the station area allows a diverse mixture of uses and substantial density for both residential and commercial uses. Most of the land parcels within one-quarter mile of the station allow by-right development of retail, offices, hotels, theaters, medical facilities, and both

single- and multifamily dwellings (Table 2). As in Pershing Square, some of the pre-1940 buildings exceed the currently allowable densities. In addition to baseline zoning, development in the area is regulated by the Hollywood Community Plan, adopted in 1988. The goals expressed in the Community Plan reflect the diversity of land uses throughout the broader Hollywood neighborhood: protecting low-density residential areas from “scattered intrusion of apartments”; protecting hillside areas from erosion; appropriate separation between commercial and industrial uses and housing; and “encouraging the revitalization of the motion picture industry”. The Community plan – which was adopted well into the Metro planning process but before construction of the Red Line had been completed -- also notes that “Several proposed Metro Rail stations are to be located in Hollywood. If higher intensity development is to be encouraged in the vicinity of these Metro Rail Stations, station area master plans should be prepared”. Under the guidance of the LA Department of City Planning and the Hollywood Neighborhood Council, a new Hollywood Community Plan Update was adopted in 2012. The new plan – which was highly controversial among existing neighborhood residents - would have increased allowable density and encouraged additional development along commercial corridors such as Hollywood Boulevard (Zahniser 2013). However, the new plan was challenged in court and ultimately rescinded in 2014 after a judge ruled that the Environmental Impact Report contained errors. Until 2012, the neighborhood also fell under the statewide Community Redevelopment Agency boundaries, which granted additional tax revenues for development in the area (Blount et al 2014).¹¹

¹¹ In February 2012, the State of California disbanded the Community Redevelopment Agencies.

The physical environment near Hollywood and Vine has undergone substantial redevelopment since the station opened in 1999, most notably a mixed-use TOD project on the parcel above the station. This project resulted from a Joint Development Agreement between the MTA and private developers (City of Los Angeles 2006). The MTA acquired several small lots through eminent domain, demolished the existing structures and merged the lots into a single large parcel. The redeveloped site consists of a 300-room W hotel, 145 condominiums, 350 rental apartments (of which 74 are required to be affordable to low- and moderate income households), and approximately 60,000 square feet of ground floor commercial use (Figure 5).¹² According to the building's marketing website, rents for studio apartments currently range from \$2000 to \$4600 per month, one-bedrooms rent for \$2500 to nearly \$6000, and two-bedrooms range from \$3200 to over \$7000 per month¹³ -- rents likely out of reach for many of the neighborhood's existing residents, given the median household income of \$31,000. The majority of construction was completed in 2009.

Besides the TOD project, the housing market around Hollywood and Vine has strengthened since the Great Recession. Most of the housing near the station is in small multifamily rental properties or condominiums. Residential sales near the station increased from roughly two per year from 1988-2006, to 40 per year from 2007 through 2012, nearly all condominiums, with a median price of \$660,000 per unit. Numerous restaurants and stores have also opened near the station within the past ten years.

¹² Some condo sales in the property are observed in the DataQuick housing transactions data. Information on the number of rental units and hotel rooms are taken from the CRA memo. The affordable rental housing was mandatory under the Community Reinvestment Act; the affordability restrictions will remain on the units for 55 years.

¹³ <http://www.1600vine.com/1600-vine/floorplans>. Site accessed September 2015.

4.4) Vermont/Santa Monica Station, East Hollywood neighborhood, Los Angeles

The Vermont/Santa Monica Station is also located within the Hollywood planning area, about 2.5 miles southeast of the Hollywood/Vine Station, at the intersection of two active commercial streets (Figures 4 and 5). The built environment surrounding the station is predominantly made up of low-rise, low-density commercial and industrial uses. Land uses on the blocks immediately around the station include single-story shopping centers with surface parking, fast food restaurants and parking for taco trucks, a gas station, and a medical office building. Most of these structures date from the 1950s through 1970s. One block south of the station is the Los Angeles City College campus, a public community college, which is the area's largest employer. Most other jobs in the area are retail and food service. While both Vermont Avenue and Santa Monica Boulevard are primarily commercial uses, the side streets connecting to them are almost entirely residential, with a mixture of modest single-family and small multifamily buildings, nearly all one or two stories high, built during the 1920s through 1950s. The median household income in 2005-2009 was just under \$30,000, similar to that of the Hollywood/Vine station area, and the population density was also similar (Table 1). Nearly two-thirds of the area's population was Hispanic. In addition to the Red Line station, numerous bus lines run north-south along Vermont Boulevard and connect with Metro rail at the Vermont/Santa Monica station.

Zoning near Vermont/Santa Monica reflects the area's mixture of commercial and residential uses: parcels along the two main streets are zoned medium density commercial while the side streets are zoned for medium density multifamily residential (Table 2). Like the Hollywood/Vine station area, the Vermont/Santa Monica station falls under the Hollywood Community Plan of 1988. In addition, it is governed by the Vermont/Western TOD Specific

Plan, adopted in 2001, which covers four stations along the Red Line (Hollywood/Western, Vermont/Sunset, Vermont/Santa Monica and Vermont/Beverly). The TOD Specific Plan designates the main intersecting streets as part of the “Community Center” with somewhat higher allowable densities than covered under the Hollywood Community Plan, then preserves “Neighborhood Conservation” along the residential side streets. The Specific Plan enumerates various other goals: encouraging pedestrian-oriented streetscape improvements, ensuring “a well-planned combination of commercial and residential uses with adequate open space”, as well as the “creation of a lively civic atmosphere” and less specifically defined aesthetic goals.

Despite the adoption of a new TOD specific plan, no new residential or commercial buildings have been developed within the station’s immediate vicinity since it opened. The most recent structures are some small multifamily apartments built in the late 1980s. From the mid-1990s through the housing collapse in 2007, residential sales of the small apartment buildings were modest but consistent, with about 14 sales per year near the station and average prices around \$200,000 per unit. Unlike Pershing Square and Hollywood/Vine, the housing market around Vermont/Santa Monica has not recovered from the Great Recession; sales volume has declined to fewer than ten sales per year, with prices around \$150,000 per unit. Most of the residential lots are quite small and the buildings have not been recently updated, according to building permit records.

4.5) Del Mar Station, Downtown Pasadena

The City of Pasadena is located about ten miles northeast of Downtown Los Angeles; commuting flows both directions between the two cities. The Del Mar station is located on a main traffic artery and commercial corridor, the Arroyo Parkway, about one-half mile south of Pasadena’s CBD on Colorado Boulevard (Figure 6). The above-ground station and the rail

tracks fit between two buildings of the same apartment complex, developed in 2006 around the station (Figure 8). The blocks immediately adjacent are a mixture of commercial uses, mostly retail and restaurants, segueing into single-family residential areas to the east and south. Both population and employment densities around Del Mar are substantially lower than that around the two Hollywood area stations, but higher density than Pasadena overall and comparable to Downtown Los Angeles (Table 1). The Del Mar area is the most affluent of the station areas in this study, with median household income nearly \$67,000, and more than 70 percent of the population is non-Hispanic white. More than 40 percent of nearby jobs were in public or institutional sectors – the station is near a large hospital complex – with another 35 percent in commercial sectors.

Zoning for all of Downtown Pasadena, including the Del Mar station area, is covered by the Central District Specific Plan, which was adopted in 2004, one year after the station opened, (Table 2). The Specific Plan lays out guidelines to encourage high-density mixed-use in designated corridors, including near transit stations, while maintaining the low-density residential character of streets farther from the station. The station itself lies within the Old Pasadena Transit Village (Figure 6), which allows “urban density” residential uses above ground-floor commercial, such as retail and restaurants (Table 2). The Central District Specific Plan was expressly intended to enable and encourage transit-oriented development around not only Del Mar, but all three of the rail stations in Downtown Pasadena (Fillmore and Memorial Park have nearly identical zoning). The Specific Plan also includes detailed design guidelines to ensure that new development fits with the visual context of existing buildings, matching architectural styles and streetscape elements.

Pasadena's Del Mar station has also experienced substantial new residential development, although on a more typically suburban scale than Hollywood/Vine or Pershing Square. The station is co-located with a new mixed-use TOD project: in 2006, a large national REIT built a 350-unit apartment complex on the two halves of the station parcel, with ground-floor retail (Figure 8).¹⁴ According to the building's website, current rents at the complex range from just under \$2000 per month for a studio to around \$3300 for a two-bedroom, two-bath apartment.¹⁵ Additional residential development near the station includes both rental apartments and condominiums within 3-5 blocks of the station. The commercial buildings adjacent to and across from the station were primarily built during the 1980s. Housing sales near the station (almost entirely condominiums) averaged about 56 per year from 1988 to 2012, with no significant difference in volume after station opening in 2003. However, prices of condominiums have increased significantly since the station opened: the average condo price prior to 2003 was \$260,000, but over \$480,000 from 2004 to 2012.

4.6) Highland Park Station, Northeast Los Angeles

Highland Park is an older neighborhood in Northeast Los Angeles, about halfway between Downtown Los Angeles and Pasadena. It was an independent city until the late 19th century before being annexed by the City of Los Angeles (Northeast Los Angeles Community Plan 1999). The Highland Park Station on the Gold Line is located at North Avenue 58 and Marmion Way, about one block northwest of the neighborhood's central commercial strip along North Figueroa Street (Figures 7 and 8). This area is composed mostly of one- and two-story

¹⁴ The parcels do not appear in the DataQuick data, presumably because any sale of the parcel happened under a non-residential classification and the completed property has been retained in portfolio by the REIT that developed it. Information on the unit count and year built was obtained from the Los Angeles County Tax Assessor's website.

¹⁵ <http://www.avaloncommunities.com/california/pasadena-apartments/avalon-del-mar-station/floor-plans>

buildings dating from the 1900s to 1920s, currently occupied by a mixture of retail, food service and other household services, as well as an historic movie theater from 1924 at Figueroa and North Avenue 56. As of 2005-2009, the population was 76 percent Hispanic, with a median household income around \$45,000. Many of the businesses along Figueroa cater to Latino customers with services such as specialty foods, payment remittances, and immigration-oriented legal services. Other than the commercial center, the side streets in Highland Park are mostly residential, with one- and two-story single-family and small multifamily buildings dating from the early 20th century, and a notable concentration of Craftsman buildings that are designated for historic preservation. In the past few years, the neighborhood has drawn attention – and controversy - from local and national media outlets as an example of gentrification, with a growing population of younger, more affluent college-educated non-Hispanic whites (Clark 2015, Logan 2014, Tobar 2015).

Zoning near the Highland Park station is governed by three sets of plans: the Northeast Los Angeles Community Plan (adopted 1999), the Highland Park Historic Preservation Overlay Zone (adopted 1994), and the Avenue 57 Transit Oriented Development Neighborhood Plan (adopted 2002). All three of these were in effect before the Gold Line began operations, although the Community Plan and TOD Neighborhood Plan were adopted during the planning process. Parcels along Figueroa Street are zoned for high density commercial uses, while the majority of the surrounding neighborhood is zoned for medium-density residential (Table 2). Some existing commercial and residential structures are at or above currently allowable densities. The three plans not only have different rules governing allowable uses, dimensions, procedures, and other specific components, but the language of the plans and stated goals reveals some contradictions and tensions in the expectations of development around the station. For

instance, the Community Plan largely frames development as a challenge to be controlled, rather than a desired outcome. It repeatedly mentions the need to separate commercial and residential uses – more typical of older, single-use zoning rather than the New Urbanist-inspired mixed-use zoning generally associated with TOD – and calls for creating more parking to serve commercial areas, again in conflict with the goals of TOD. According to the Community Plan, the TOD specific plan “is being prepared to regulate development near the station stop and guide development so that the mistakes of the recent past are not repeated” (Community Plan p. I-5). Throughout the document, the destruction of historic buildings and loss of neighborhood character incurred by new development are referred to as “mistakes of the past”. These motivations are also frequently referenced in the HPOZ, which establishes a number of procedural requirements to review any proposed demolition, alteration, or redevelopment of existing structures.

The language of the TOD Neighborhood Plan also reflects an attempt to balance multiple economic, physical, aesthetic and social goals. The plan outlines some incentives – reduced parking requirements, increased FAR and streamlined approval process – designed to induce reuse of existing structures and introduce residential elements in the commercial area. The plan also calls for live-work spaces for specified professional and creative occupations, and designates an “Artwalk” area that allows various artistic production activities in previously residential-only spaces. Although some density bonuses are offered in exchange for improving pedestrian amenities, the plan still stresses the need to maintain the “historic character” of the neighborhood, including “limiting the massing of parcels to maintain an appropriate scale of development”. It is unclear whether the type of land assembly and redevelopment which occurred at the Hollywood/Vine station would be allowed in Highland Park. Besides the specific

zoning changes and incentives, the TOD Neighborhood Plan outlines an ambitious set of social and economic goals:

“maintain a diverse community, where people of many different ages, incomes, family formation types, and cultural perspectives will live, work and shop in harmony...maintain a stable community that residents can invest in and live in from childhood through family formation, to retirement...retain, support and expand the traditional local population of working writers and artists in the neighborhood”

No new development has occurred immediately adjacent to the Highland Park Station or along the Figueroa Street commercial strip since the station opened, and minimal development has occurred in the adjacent residential neighborhood. Several of the media reports on gentrification in Highland Park describe increased renovation and sales activity among older residential and commercial buildings in the neighborhood, resulting in higher rents or sales prices, but it does not appear that these activities are increasing the supply of housing units or commercial space. Such outcomes would be consistent with an increase in property values in the neighborhood, but where the height or density of development is constrained by zoning, whether directly through FAR or through the procedural requirements set out in the HPOZ. Both the County Tax Assessor’s records and anecdotal media evidence suggest that property rehabilitations and demographic transitions have become noticeable since 2012, approximately nine years after the Highland Park station began operating. Unlike the TOD project at Hollywood/Vine, the type of renovations occurring in Highland Park can be completed within one or two years, unless legal problems arise.¹⁶ The residential property market around Highland Park is fairly active, with approximately 50 to 100 sales per year during the 2000s,

¹⁶ Review of a sample of building permits issued for several recently sold commercial buildings along Figueroa suggested that most physical changes have been fairly modest, such as installation of new HVAC or electrical systems and façade improvements.

including single-family and small multifamily buildings. Single-family house prices in recent years have averaged about \$300,000, while multifamily buildings sold around for \$150,000 per unit. Residential sales volume and prices decreased sharply in the Great Recession and had not recovered to pre-bust levels by 2012.

Section 5) Discussion and policy implications

Los Angeles is among a number of U.S. metropolitan areas that have invested substantial resources to build intra-city rail systems in the past 25 years. Local policymakers hope that, in addition to improving transportation flows, their investments will spur physical redevelopment around station areas. Urban economics models provide somewhat ambiguous predictions about whether redevelopment near stations will occur, depending on increases in property values and the costs of redevelopment, which in turn depend on the existing built environment and land use regulation. Our results show considerable variation in the quantity, density and type of development. Synthesizing the cases suggests that several conditions contribute to the probability of transit-oriented redevelopment: compatible zoning, strong underlying real estate markets, active engagement by local government agencies, and (in most cases) political support from neighborhood residents.

5.1 Zoning

Zoning is enormously complicated, often governed by several layers of plans, each with multiple dimensions, and sometimes conflicting terms. The Highland Park case is perhaps the best example of multi-layered, potentially conflicting zoning and land use plans, but zoning around all six station areas present non-trivial challenges for development. The complexity of both written rules and process may deter less experienced landowners or developers from

attempting even modest projects, such as small landlords adding ground floor retail or renting accessory apartments. Even for more sophisticated and well-financed development firms, the uncertainty and length of the process needed to navigate complicated rules will increase development costs, so redevelopment will only occur if developers anticipate very large profits – where land values are high and it is possible to redevelop at substantially higher density than current buildings. Higher development costs are likely to be passed on to consumers (households) through higher prices or rents. And it is notable that, even near some of the stations with ostensibly TOD-friendly zoning (Pershing Square and Highland Park), allowable densities for new buildings are lower than that of existing structures.

5.2 Local real estate market

Underlying land values and real estate markets are highly localized, so incentives for redevelopment can vary considerably even within relatively small geographic distances. The Hollywood/Vine and Vermont/Santa Monica stations are located roughly 2.5 miles apart on the same rail line and within the same Community Planning area, yet the Vermont/Santa Monica area has substantially weaker housing demand. Thus no development has occurred near the station – nor have prices of existing homes risen – despite the deliberate adoption of TOD-compatible zoning. This contrasts with predictions in some of the planning literature, which assert that TOD will emerge naturally as long as it is not constrained by zoning (Bernick and Cervero 1997, Levine 2006, Suzuki et al 2013).

5.3 Role of public sector

The public sector may behave passively or actively in a variety of ways that affect redevelopment outcomes. The City of Los Angeles used eminent domain to assemble land and acted as development facilitator near Hollywood/Vine. The City of Pasadena adopted new

zoning with increased allowable densities near the Del Mar station, which effectively increases land values even in the absence of a station. All the new housing near Pershing Square was created under Los Angeles' Adaptive Reuse Ordinance, adopted six years after the station opened. The Hollywood/Vine case illustrates both the type of non-zoning barriers to redevelopment around stations, and some ways in which public agencies can help address those barriers. Large-scale redevelopment within dense urban environments will likely face market-based frictions, such as fragmented land ownership or environmental contamination from prior uses. Although eminent domain may be an unusual form of public intervention (and not necessarily appropriate in all circumstances), public agencies can provide information on land ownership or inventories of underused parcels and act as development facilitators in public-private partnerships. In most instances, the public agency responsible for planning, financing, and developing transit infrastructure (in this case the county-wide LA Metro) does not directly have control over land use decisions, which are made by each city. At most, regional transit agencies can offer incentives for local governments to alter land use plans, as through Metro's TOD Planning Grant program.¹⁷

5.4 Public support

Beyond the involvement of public agencies and officials, political support from neighborhood residents and/or within-city governing bodies matters, at least in cities with political structure similar to Los Angeles. LA has a relatively strong city council and weak mayoral system, so support from relevant council members is critical to adopting compatible zoning. Moreover, the city's Neighborhood Councils can mobilize residents in support or

¹⁷ <https://www.metro.net/projects/tod/>

opposition of both zoning changes and specific development projects. Facilitated by CEQA, opposition groups may bring legal action that delay or end projects, as in the Hollywood Community Plan Update. The Highland Park case illustrates how ambivalent community sentiment may produce plans with conflicting goals and elements.

The case studies do not allow us to draw causal inferences about whether the stations catalyzed development in any of these areas, but suggest at most a weak link between improved accessibility created by stations and observed development outcomes. Two of the stations with redevelopment – Pershing Square and Hollywood/Vine – do have relatively high ridership, but at least in Pershing Square, the development is more closely attributable to the ARO than to the station opening. Moreover, the Del Mar station has the lowest ridership of the six stations (fewer than 1500 average daily boardings).

The intent of transportation infrastructure investments is to improve accessibility. At this point in the development of Los Angeles, transit continues to play a minor role. The transit mode share for the city is about 10 percent (NHTS 2009), far lower than cities such as Boston, Chicago, or San Francisco. Thus the rail system is not yet a critical part of the City’s transport network. Under such conditions, the station itself cannot be a significant influence on land values or development demand. The vision of county and city leaders is to promote station development in order to create the market for transit (and achieve other policy goals, such as increasing affordable housing). It is therefore reasonable that zoning, local markets, and active public leadership would all be critical factors in station area development. We expect that our findings in Los Angeles may be relevant to the many other cities in the US that are seeking to transform the built environment by investing in rail transit.

Finally, this research reveals some important measurement issues for researchers studying TOD. In the sample cases, both the outcome of interest (development) and the key independent variable (zoning) are extremely difficult to measure accurately even for a small number of data points. The complexity of zoning has long challenged empirical researchers (see Gyourko et al 2008); even basic questions of what uses are permitted and at what density may be difficult to document accurately. Most large-scale quantitative analysis of real estate markets uses data on sales prices from observed transactions, or permits issued for new buildings. These outcomes are less relevant in dense urban areas, however, where the existing building stock contains commercial buildings that transact infrequently and the housing stock is largely renter-occupied. Moreover, variable construction in administrative datasets is not always clearly documented (what does “year built” mean for adaptive reuse of buildings). And it is useful to consider smaller scale changes to the building stock – such as interior renovations and façade improvements – that may indicate rising property values in the short run but are not easy to track with existing data sources. Data limitations such as these enhance the utility of small-scale qualitative research in complement to larger quantitative studies.

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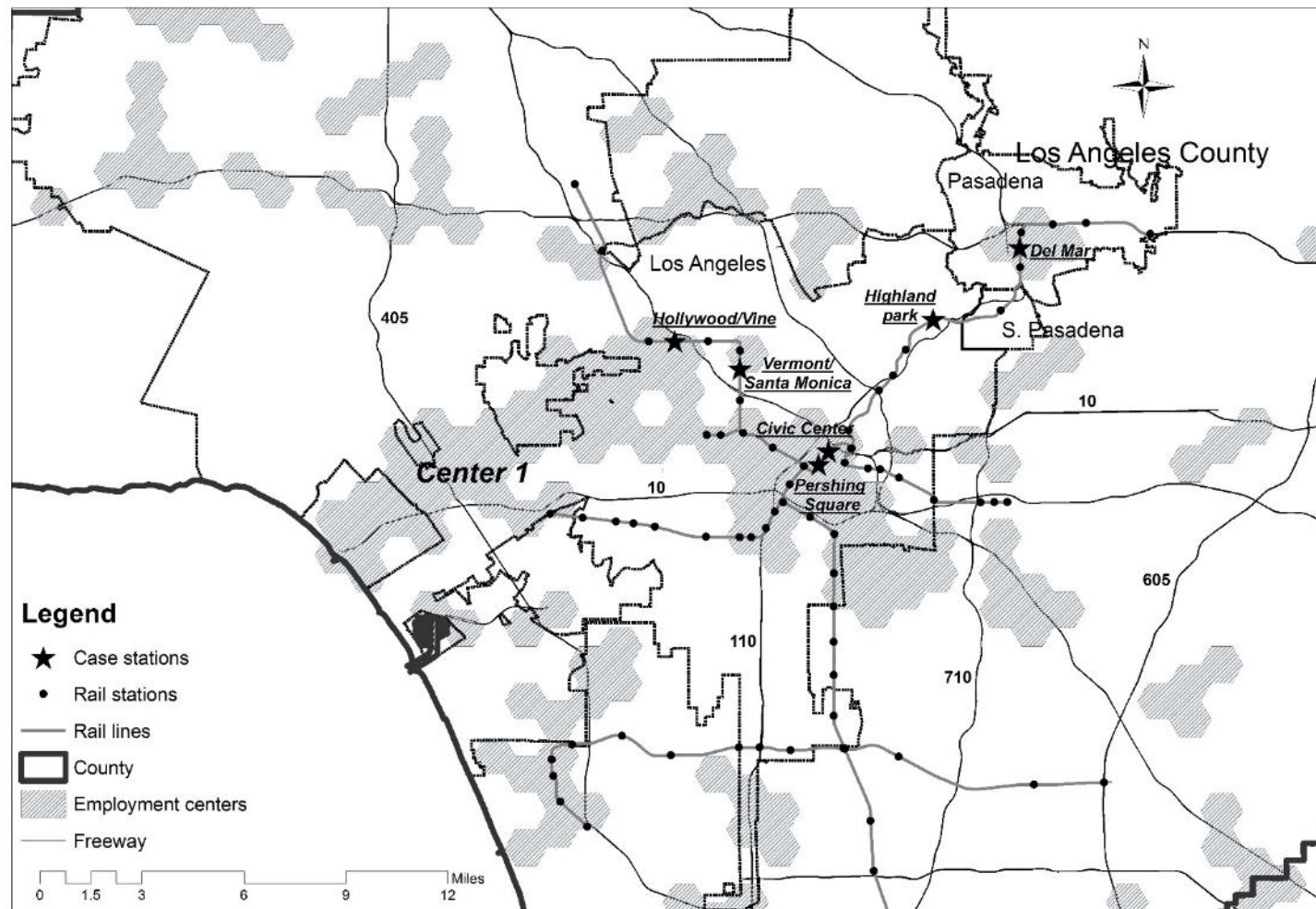
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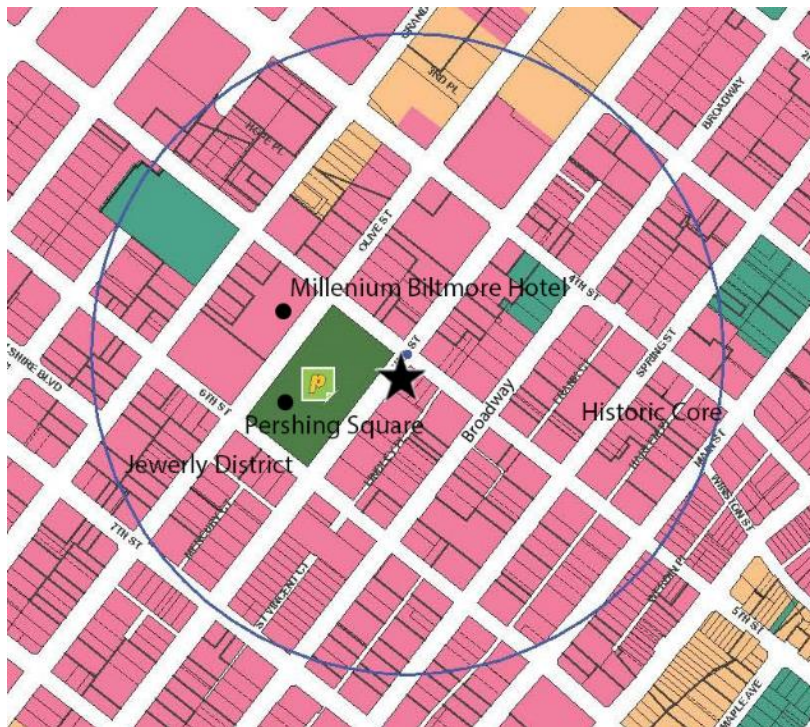
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Figure 1: Rail stations and employment centers in Los Angeles County



Note: Location of employment centers taken from Giuliano et al (2015).

Figure 2: Zoning around Downtown LA stations: Civic Center and Pershing Square



Legend

Open Space	Multi-Family Residential	Commercial
Public Facilities	Hillside	

Source: ZIMAS

Figure 3: Downtown LA rail stations: Civic Center and Pershing Square



Photos taken by authors (January 2016)

Figure 4: Zoning around Hollywood stations: Hollywood/Vine and Vermont/Santa Monica

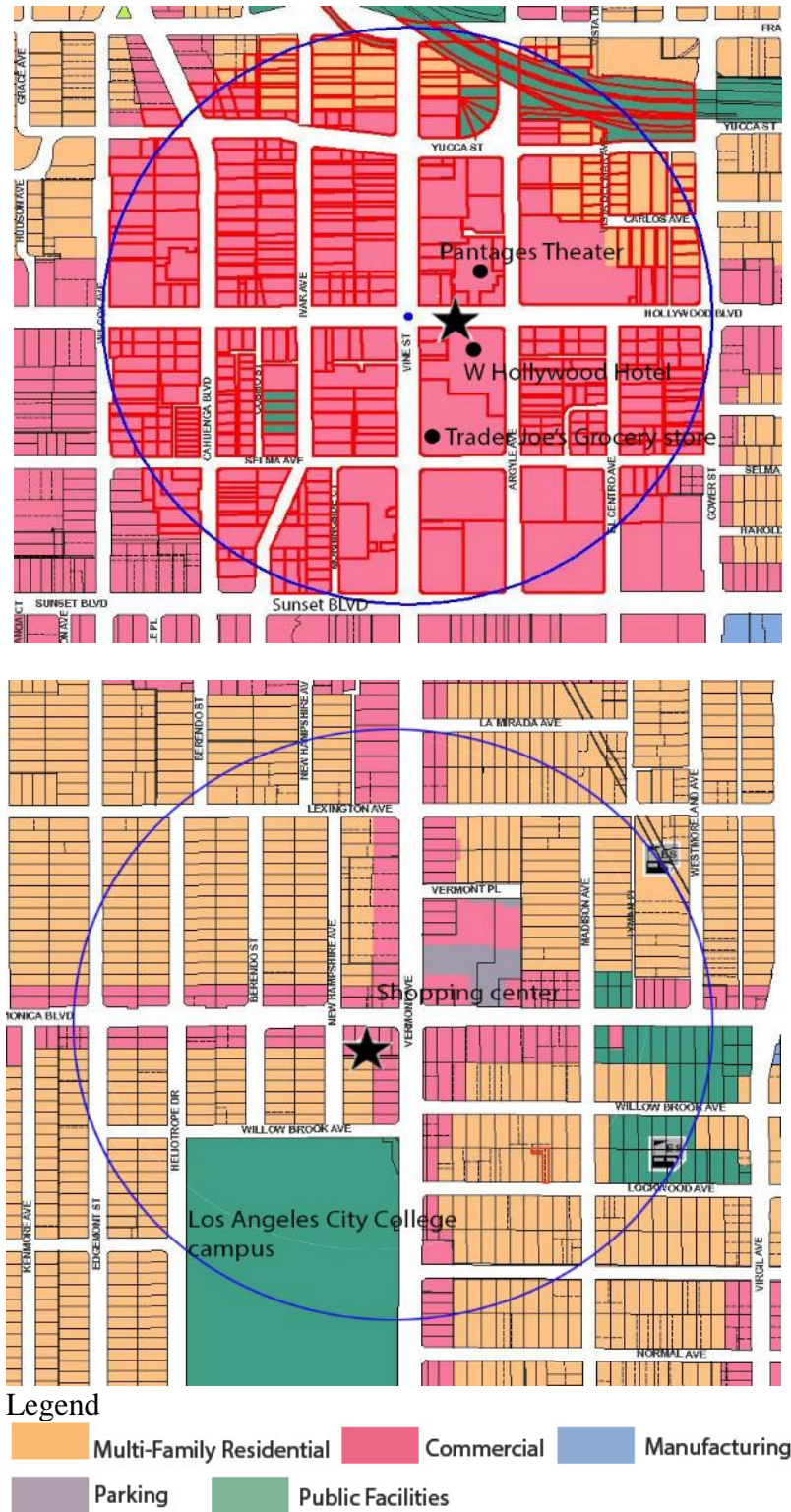


Figure 5: Hollywood rail stations: Hollywood/Vine and Vermont/Santa Monica



Photos taken by authors (January 2016)

Figure 6: Zoning around Del Mar Station Area

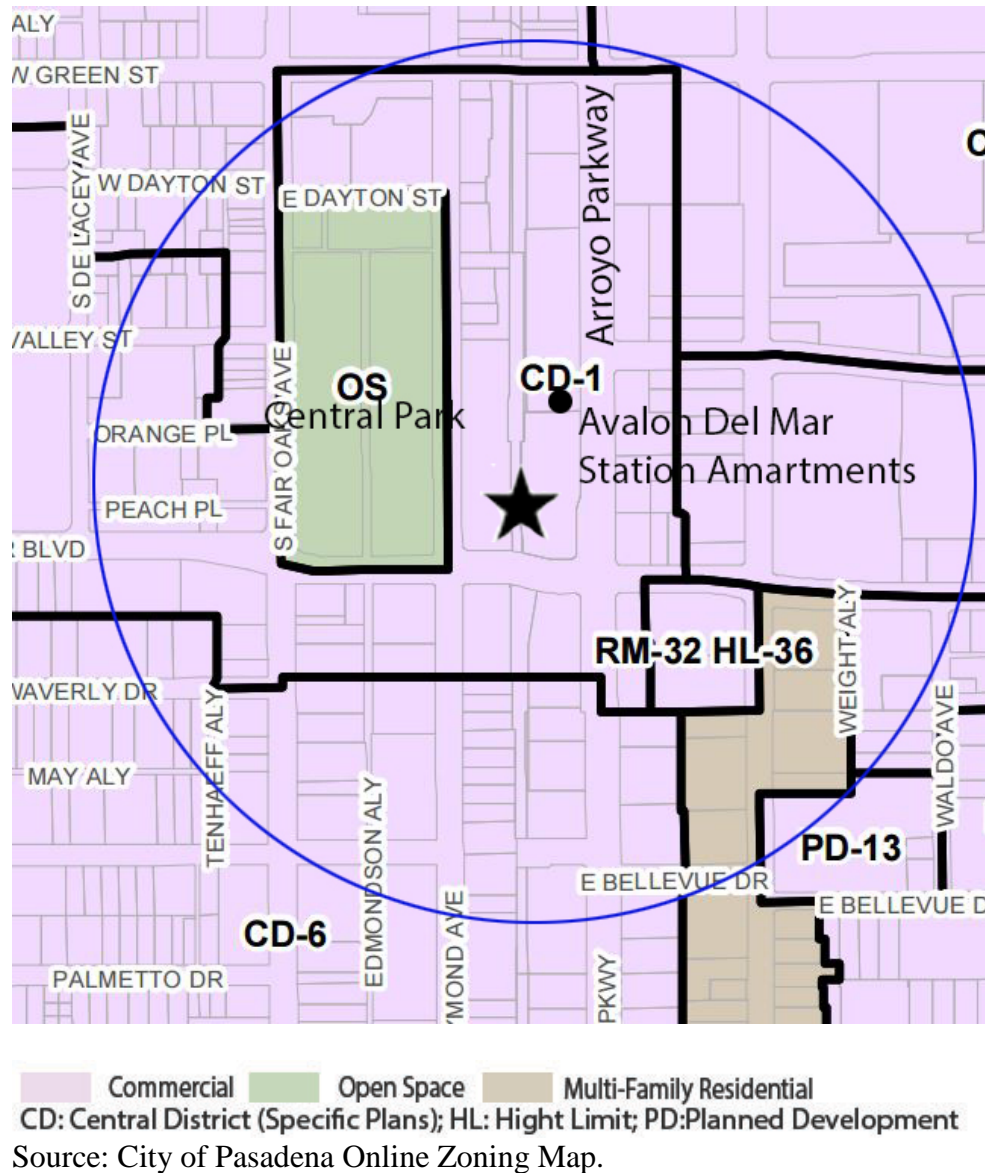
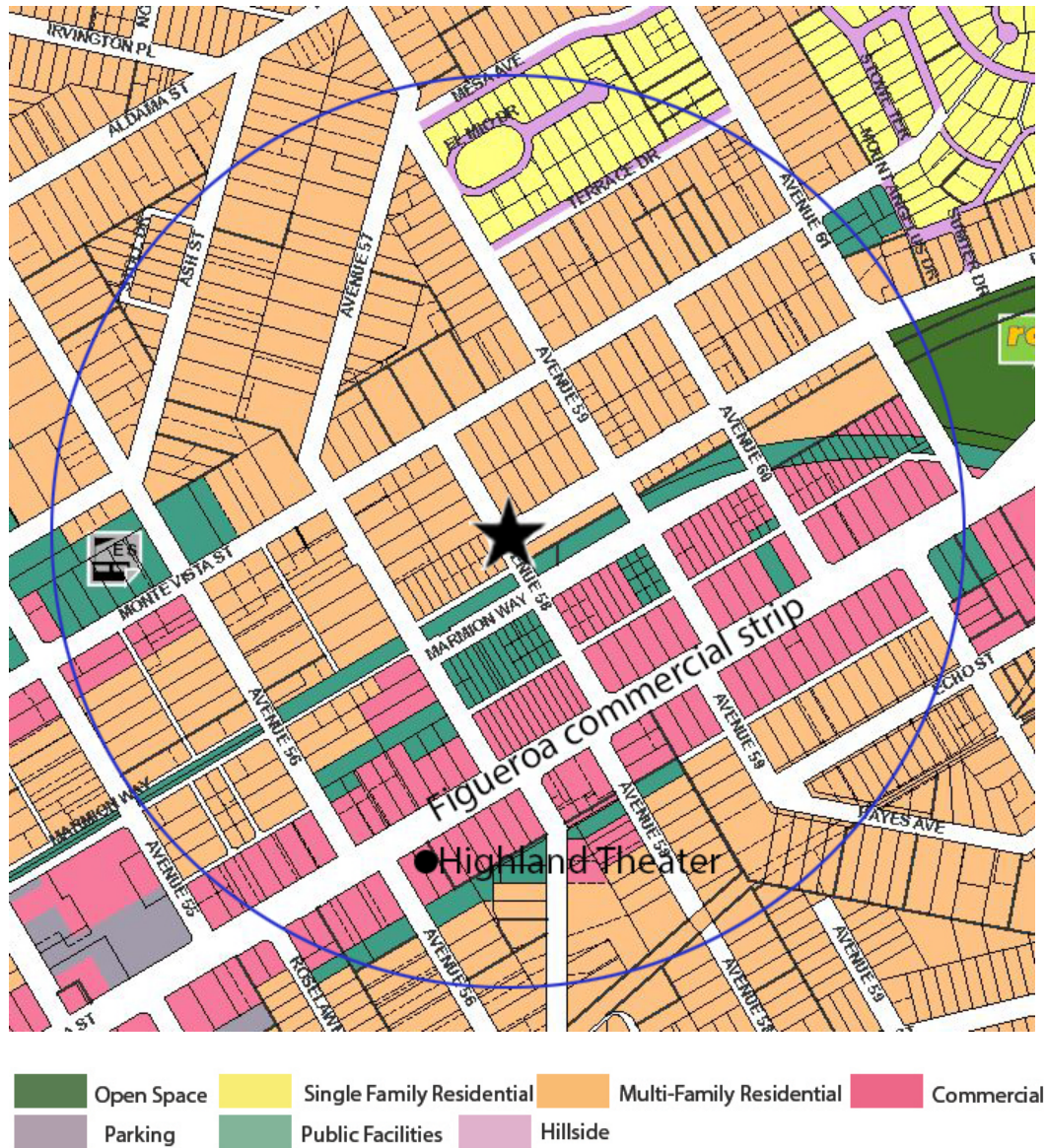
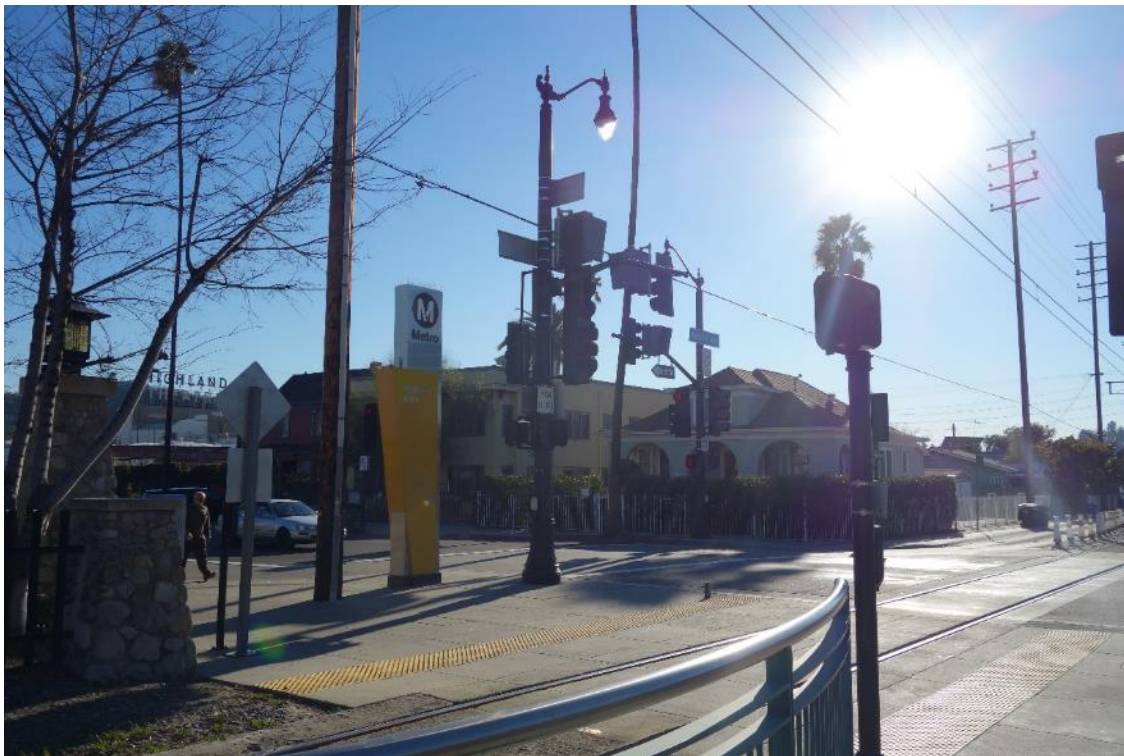


Figure 7: Zoning around Highland Park Station Area



Source: ZIMAS

Figure 8: Pasadena/Arroyo Seco stations: Del Mar and Highland Park



Photos taken by authors (January 2016)

Table 1: Station area characteristics and development outcomes

	Civic Center	Pershing Square	Hollywood/Vine	Vermont/Santa Monica	Del Mar	Highland Park
General						
Geographic area	Downtown LA	Downtown LA	Hollywood	East Hollywood	Pasadena	Arroyo Seco
Year station opened	1993	1993	1999	1999	2003	2003
Line(s) served	Purple, Red	Purple, Red	Red	Red	Gold	Gold
Avg. daily boardings (2013)	6,107	10,503	6,175	5,860	1,489	2,718
Neighborhood characteristics						
Population per acre	117	77	245	189	77	86
Employment per acre	334	264	72	24	18	4
Median household income	18,411	20,822	36,983	32,529	66,817	45,013
Black (%)	11	14	6	4	8	3
Hispanic (%)	18	21	32	67	26	76
Median rent	663	727	893	785	1,222	898
1-4 family housing (%)	2	1	10	15	28	59
Housing built pre-1940 (%)	24	39	33	26	28	31
Post-station redevelopment	Grand Avenue Park surrounding station	Housing converted from commercial buildings near station	Large mixed-use project at station	None	Small mixed-use project at station	No new structures; renovation of older residential and commercial buildings

Notes: Station opening date assembled from MTA website. Neighborhood characteristics from 2005-09 American Community Survey, calculated as weighted average of census tracts surrounding station area. Development outcomes from DataQuick housing transactions, Los Angeles County Tax Assessor, and City of Los Angeles Department of Buildings. Average daily boardings provided by the MTA.

Table 2: Zoning ordinances and plans, by station area

Station area	Plan name	Year adopted	Maximum density
Civic Center	Central City community plan	2003	Commercial: 6.0 FAR;
	Bunker Hill specific plan	2013	Residential: 108
	Adaptive Reuse Ordinance	1999	units/acre
Pershing Square	Central City community plan	2003	Commercial: 6.0 FAR;
	Adaptive Reuse Ordinance	1999	Residential: 108
	City Center CRA area	dissolved 2012	units/acre
Hollywood/Vine	Hollywood Community Plan	1988; 2012 plan rescinded 2014	Commercial: 4.5-6 FAR;
	CRA Hollywood Redevelopment Plan	1986; dissolved 2012	Residential: 60-80 units/acre
Vermont/Santa Monica	Hollywood Community Plan	1988; 2012 plan rescinded 2014	Commercial: 1.5-4.5 FAR; Residential: 29
	Vermont/Western TOD specific plan	2001	units/acre
Del Mar	Central District Specific Plan	2004	Commercial: 3.0 FAR;
	Old Pasadena Transit Village	2004	Residential: 87 units/acre
Highland Park	Northeast Los Angeles Community Plan	1999	Commercial: 6.0 FAR;
	Highland Park Historic Preservation Overlay Zone	1994	Residential: 18-29
	Avenue 57 TOD Neighborhood Plan	2002	units/acre; Height: 3 stories

Sources: Los Angeles City Planning Department, Pasadena City Planning Department.