reviewed paper

High Building Density around Subway Stations, Policies and Solutions

Abdolhossein Ardekani

(Abdolhossein Ardekani, Master Student of urban planning, Shahid Beheshti University, Faculty of Architecture & Urbanism, Tehran, Iran, abdolhosseinardekani@yahoo.com)

1 ABSTRACT

Building density is an index for controlling population density. Building at higher densities not only makes more efficient of land but can also deliver high quality. Nowadays by the reason of rapid and sprawl growth of cities and increasing urban services costs a decision should be made to decrease these costs by the means of building density. Also the efficient use of land is an important objective in making development more sustainable. It is embedded in government policy. Compact development not only uses less land, but it also has the potential to create efficiencies in the use of other resources, including energy supply and transportation. Basically public transportation stations and specially subway stations are well proper potential for urban developments because of high level of services of these places. Increasing building density around subway stations is acceptable but just when it doesn't decline the efficiency of urban equipment, facilities and services and also life quality. This paper investigates new faces, approaches and ideas of increasing building density around subway stations and offers polices and solutions to increase building density in low-building density areas around subway stations.

2 INTRODUCTION

Recent moves towards the creation of more sustainable towns and cities that offer a high quality of life whilst minimizing resource consumption (such as energy, land and water), have reawakened interest in the concept of density. The benefits of seeking higher density levels in overall terms are well-recognized-especially in the context of delivering mixed use development where a minimum housing density is required to sustain non-residential uses. Some people continue to equate higher densities with poor urban quality, such as overcrowding and reduced space standards. This misses a fundamental point. Density is only a measure. It is a product of design, not a determinant of it. The aim should therefore be not to achieve a given residential density, but to generate a critical mass of people able to support urban services such as public transport, local shops and schools.

Higher densities focused on urban centers ensure that they remain lively, with local facilities close at hand. Giving people the choice to use public transport, by sitting bus/tram stops or railway stations within walking distance also helps underpin viability by significantly increasing potential custom. This not only applies to residential uses, but to industry, commerce and shopping. The better served and connected a site or development is, the stronger the case for considering higher densities and lower car parking provision.

Building at higher densities not only makes more efficient use of land but can also deliver higher quality. Decisions on what density levels are appropriate for a location can be biased by negative perceptions. Some people imagine high density as being tall building crammed with small apartments which fail to relate to the local context but in fact high density and specially building density can help to the sustainable development. A greater understanding is required of how, with careful planning and good design, higher density schemes can create successful places with a range of housing types, good space standards and an attractive public realm. The efficient use of land is an important objective in making development more sustainable. It is embedded in government policy.

Compact development not only uses less land, but it also has the potential to create efficiencies in the use of other resources, including energy supply and transportation.

From a social perspective, studies have tested the implications of tall residential buildings for the daily functioning of their user-groups, the relationships that exist among the residents and the suitability of high-rise buildings as a living place for different population groups (for example, the studies of Appleyard and Fishman, 1977, and Dornbusch and Gelb, 1977, both of San Francisco; Yeung, 1977, in Singapore; and Ginsberg and Churchman, 1984, 1985, in Israel). The findings point to the importance of investigating the increase in high-rise building.

With respect to location, high-rise buildings in large cities such as New York, Chicago, Philadelphia, Boston, San Francisco, London, Tokyo and Hong Kong were built adjacent to the city centre or subway stations. The need to locate in proximity to partners and competitors, along with the high consumption of building areas required by the accompanying services sector, attracted economic activities to the city centre. The high price of land, high demand and the characteristics of the consumers combined to motivate developers to build tall buildings (Lim, 1988; Polledri, 1990)

In this paper we will review that how we can promote building density around sub way stations.

3 LITRATURE

3.1 Compact City

The idea of 'Compact City' refers to medieval city or XIXth century city. The Compact City strategy focuses on the form of the city and the efficiency of the distribution of human activities within it, making optimal use of the infrastructure of the city, particularly transport infrastructure, through compact, mixed-use and dense settlement structures enabling effective use of public transport and non car-based movement systems (EUEG, 2004). Benefits of the compact city are cited as: less car dependency, low emissions, reduced energy consumption, better public transportation services, increased overall accessibility, re-use of previous developed land, high quality of life, preservation of green space (Thomas, Cousins in Jenks et al., 1996). Examples of Amsterdam, the pioneer in compact city policies, Hamburg or Copenhagen provide enough evidence for compact development (Sheurer, 2007).

Some advocates of the compact city see its potential in increasing housing density in new mixed use developments. Yet density is not the only measure of a compact city. If we are to achieve the right balance of quality and quantity there must be a limit to the densities in a compact city. That capacity varies from place to place and depends on local requirements, climate conditions and the existing built environment. The aim is to generate a critical mass of people able to support urban services such as public transport, local shops and schools (Llewelyn Davies, 2003). Increasing density requires improving the quality of urban areas to attract people to live and work. Provision of urban open space is necessary for high quality urban environment and may be a source of Environmental, social and economic benefits (CABE, 2001). Especially the economic benefits seem to be interesting, since they might be better arguments than any other in the era of consumption. New tools and methodologies have been developed for better understanding of importance of urban open spaces and the activities that occur in such spaces. Nice view on green and proximity to the park may result in higher real estate prices (CABE, 2005) and in most cases that also results in higher property taxes. Good urban design can also contribute to better, more frequent use of urban open space. In conclusion urban open spaces may contribute to more compact cities for both private and public space-estate owners.

3.2 Transit Oriented Development (TOD)

Transit Oriented Developments (TODs) are higher density mixed use residential and commercial developments set within walking distance of key transit nodes such as rail or bus stations or around activity centres such as major shopping centres/offices. While higher densities are promoted closer to the transit nodes, lower density development is allowed farther away from the transit nodes. TODs aim to encourage increased ridership in public transport, to efficiently integrate land use and transport, and to create integrated liveable communities (Calthorpe and Fulton, 2001; Bernick and Cervero, 1996, Kaufman and Morris, 1995). Cervero suggests that transit oriented development requires the three dimensions of Density, Diversity and Design (3Ds) to make the concept work (Tumlin and Millard-Ball, 2003). In the context of USA, Garde comments of new urbanists projects which are very similar to TOD, pointing out that existing zoning ordinances and subdivision regulations are one of the major barriers to implementing new urbanist projects (Garde, 2004).

For example, in the case of redevelopment projects requiring land assembly, public redevelopment agencies can use the power of eminent domain to acquire the land, bearing initial development costs, to attract private developers. Tax increment funding (TIF) can be used as a tool to support infrastructure and land cost subsidies. Under this arrangement, local governments can use the future potential increases in property tax revenues in the TOD district to invest in infrastructure improvements and issue bonds against future property tax increases (Boarnet and Compin, 1999).

Also, zoning around transit nodes can be used to provide incentive for developing higher density mixed use project as a matter of right or requiring minimum review procedures.

Another form of incentive is the provision of grants to support TOD. For example, the 'Transportation for Livable Communities' program in San Francisco provides small grants to community oriented transportation projects that support walkability, transit use and compact development patterns.

The shift to a more compact form of development will be achieved through increasing the net residential density of major new urban development and on focusing higher density residential development within and around regional activity centers and public transport nodes and corridors.

3.3 Relationship between building density and public transportation

Empirical evidence and the results of a large number of studies suggest that there is strong positive correlation between population density and transit use. The higher the density, the higher the transits use. However, variables other than density – culture, household income, the design and location of transit lines, the management efficiency of transport companies, government transport policies, including subsidies – certainly also influence transit use. The correlation does not imply causality. The relationship between density and transit use in various cities of the world has been documented by Newman and Kenworthy (1989) and Kenworthy and Laube (1999).

Kenworthy established that there is a strong positive correlation between density and transit use among world cities and a strong negative correlation between auto travel per capita and density. But the correlation does not imply that in a given city an increase in density would necessarily result in an increase in transit use or that an increase in transit supply would increase density and transit use. A significant increase in average density in built-up areas is a phenomenon which has yet to be observed in large cities, looking back over the past 50 years.

The correlation between population density and transit use is often difficult to measure because the lack of comparable data across metropolitan areas for density and for transit use and because factors others than density that might influence transit use might be difficult to measure. We compare density in the built-up areas with two types of variable: transit trips per capita and passengers per mile of metro line. These variables are somewhat more abstract than the percentage of transit trips over all trips, but they have the merit of being more accurate.

If we compare population density in the built-up area and transit trips per capita per year globally, we find that low density cities (below 30 people per hectare) have a very low demand for transit (below 70 trips per year or about 7 percent of all trips). Atlanta with about 40 trips per year per capita shows a relatively high demand given its very low density. This would suggest that transit trips in Atlanta are unlikely to increase much in the future as the transit system seems to have already attracted the maximum number of transit passenger compatible with its current densities. The under-utilization of the existing transit network in low density cities suggests that low density might be associated with low demand. In other words, there may be a density below which transit becomes impractical for most travelers compared to alternative means of transportation. Cities with low average densities (below 30 people per hectare [p/ha]) have low transit use, i.e. in these cities transit trip represents less than 10% of all trips. By contrast, cities with densities above 30 people per hectare tend to have higher transit use. For example, a very high density city like Hong Kong (370 p/ha) has a very high transit use: 85% of all trips are made by transit. It is no accident that one of the densest cities in the world is the only one to have been able to develop and operate its metro without subsidies.

While empirical evidence shows a strong correlation between density and transit use, it is important to know whether causality exists and why there might be a density threshold below which transit is ineffective. If a city's density is below this threshold, it could not hope to increase the share of transit trips significantly without first increasing its density.

Population density is not the only factor affecting transit operation; the spatial concentration of jobs and people is certainly as important in determining the viability of transit. The city centre of traditional European and Asian cities is usually the place where the major number of jobs, retail space and cultural amenities are found. The steep density gradients of European and Asian cities point to the primacy of the city centre as a focal point for the majority of transit trips. It is easier for transit operators to operate transit lines with multiple origins (the suburbs) and one destination (the city centre). It is much more difficult to operate transit routes linking multiple origins to multiple destinations, as recognized by Cervero (1998), one of the strongest advocates of transit. In most “transit cities” the trips toward the centre are mainly by transit while suburb to suburb trips are by car. While rail mass transit, commuter trains, metro, and light rail are well adapted to monocentric cities, buses are the only transit mode which makes sense in a polycentric city where jobs are dispersed throughout the metropolitan area. The more dispersed the jobs, the fewer the passengers per route, the smaller the capacity of the required buses. A related issue is whether transit investments might promote more compact urban development. Most, but not all, of the new rail transit developments are radial systems that either terminate or pass through the CBD. Some argue that this might help to promote downtown or inner-city development around rail stations, and thereby increasing densities. This might happen on a micro scale, e.g. moderate-size infill development.

In Tokyo, we find the combination of a cluster of high-rise buildings and individual high-rise buildings across the entire urban landscape as a result of the absence of clear zoning policies (Bognar, 1997). It is perhaps Singapore, the city-state where 90 per cent of its 3 million populations live in private or public high-rise buildings, that has succeeded best in creating community life in a high-rise environment by implementing a new pattern of high-rise neighborhoods in the Housing and Development Boards new towns. This was achieved by a high level of pedestrianisation and the use of outside space, along with easy walking distances from each building to the neighborhood centre and other facilities (Beng-Huat, 1997, pp. 111–123).

High density presents both opportunities and challenges in the transport arena. It is opportunities that have often been emphasized in the compact city literature. For example, high density offers the opportunity for average trip lengths to be short and to foster successful, economically viable public transport (Puckered and Zupan, 1977). Such high densities also promote a high level of accessibility for non-motorized modes of transport and enable cities to have low levels of energy use per person in transport (Newman and Kenworthy, 1989). The opportunity that high urban density presents to public transport is exemplified by the case of Hong Kong, where in 1990 public transport carried 82 percent of all motorized passenger kilometers. A number of mechanisms explain the potential for high levels of public transport in dense cities but there is not space to go into them here. Figure 4 makes clear that a very high role for public transport is possible in high density cities, even in those with high incomes. However, the examples of Bangkok and Surabaya suggest that high density does not necessarily guarantee the success of public transport. Another opportunity of high densities is the possibility that many trips can be short and therefore easily made on foot or by non-motorized vehicles However, Fig. 5 also shows that although high density provides an opportunity for non-motorised transport to play an important role, it does not guarantee it. For example, Bangkok seems to have remarkably little walking or cycling to work despite its relatively high density. In fact, the graph shows that the levels of non-motorised transport for work trips in the high and very high-density Asian cities in this sample are no higher than levels found in most middle-density cities. This probably reflects the hostility of the street environments for people on foot or on bicycles in most of these cities.

High urban densities also present formidable transport-related challenges, especially for cities where rising incomes have begun to unleash the potential for higher private vehicle ownership and usage. For example, traffic congestion tends to emerge rapidly as dense cities motorize, even if vehicle use per capita remains relatively low. This is not simply a result of poorly developed road systems, since in dense cities’ road capacities per capita are inherently and inevitably low. It is physically impossible for dense cities to match the road provision levels of low-density cities. Furthermore, air pollution and other local impacts of traffic can become severe problems for dense cities even at low levels of motorisation. The most successful transport policies in dense cities are those that are compatible with the spatial realities of such urban areas. The voracious demand for space by cars has been understood for many years. An influx of cars therefore creates great difficulties for established dense urban areas and generates substantial pressure for activities to spread out to make way for access by cars. Research on transport space consumption using the product of the space occupied by the time that it is occupied, shows enormous differences (up to 90 times) in space consumption between cars and public transport for a trip to work in a central business district. This approach emphasises the importance of the space consumed for car parking, especially that which is occupied for the entire day in expensive central areas. Unfortunately, the recognition of the inefficiencies of private transport from a spatial perspective has often not penetrated to a policy level. Exploring how developing cities can retain or reinforce transit-oriented urban land-use patterns, even as incomes rise, is an important area for study (Gakenheimer, 1995). The experiences of some of the Asian cities show that, even with their high-density land-use patterns, there is still potential and a need in dense cities for land use policies to explicitly favour public transport and non-motorised transport. This involves attention to the details of transit-oriented urban form. Unfortunately, there is not space to go into this in detail here. Suffice to say that explicit policies in Singapore, Hong Kong and Seoul are encouraging land-use patterns to become increasingly transit-oriented. In Tokyo, the land-use control system is relatively weak but nevertheless much new development is transit-oriented in its location and design (Hook, 1994), providing evidence that, in conditions of public transport dominance, transit-oriented land-use patterns can naturally develop as a market response. In the other cities in the Asian group, there is a trend for the design details of much new development to be oriented to access by private vehicles, even though densities remain high overall. In Bangkok, Kuala Lumpur, Jakarta and Manila, many new housing, office or shopping complexes built in the recent boom decade (1986 to 1997), and targeted at the newly prosperous middle class, have designs predicated upon private vehicle access. These developing Asian cities run a risk of building traffic disasters into their urban fabrics. This is because densities are still too high to cope effectively with many private cars but the pro-car design features tend to encourage private transport and make the provision of public and non-motorised transport facilities somewhat difficult.

4 HIGH BUILDING DENSITY AROUND SUBWAY STATION

Development densities are “as great as possible” within the context of a particular station and surrounding community. Minimum residential densities around rail stations are high enough to support higher frequency transit service and to foster lively, walkable communities. Housing forms include townhouse, walk-up apartment and high-rise buildings. Minimum employment densities are established in station areas to create a destination which generates transit trips. Below are some examples of minimum densities being used in LRT station areas by other jurisdictions?

The highest densities are ideally located closest to the station, to optimize transit rider convenience. This includes high-density housing and offices. Intensity of development can taper off away from the station, to create an appropriate transition and interface with the surrounding community.

Plans for areas around LRT stations should address the ability to increase density over time. Vacant lots, surface parking lots and existing low intensity uses present opportunities for future infill development. A phasing plan that demonstrates how the station area can intensify over time offers flexibility to meet changing community needs and provides a vision for this transition.

Within the higher density levels which sustain urban life, variations in the net density of built form profiles will occur naturally. This can be enhanced by building up the mass around centers, public transport access points, parks and riverfronts, for example. Shape the mass of built form to frame positive Public spaces.

There is currently a proposal for high-density housing at Yonge Street and Eglington Avenue. This area already contains mixed high and low density housing as well as stores, schools, public buildings, office buildings and restaurants. There is significant controversy surrounding this proposal as many studies have suggested that increasing density will increase traffic in the area thereby lowering the property values in the area.4 However, one could argue that the project is located directly on public transit lines, and would therefore encourage the use of public transit as well as attract residents who are already use public transit. Moreover, the increase in population could stimulate upgrades to the area’s transportation infrastructure. According to a recent issue of Realty Times, high-density housing that generates the need for upgrades to public transportation systems increases the area’s employment, household incomes and property values.

Taking public transport into account in urban planning decisions is an effective way to stop the increase in private car traffic and daily traffic congestion. One of the best incentives for leaving the car at home is a short walk to an attractive public transport station.

5 HIGH BUILDING DENSITY AROUND SUBWAY STATION

5.1 Mixed-land use

High-density, mixed-use development and high levels of transit service are often present together at sites exhibiting a high transit commute mode share and a high midday non-motorized mode share. Unknowns involving causality make it difficult to separate the contribution of each site element to the resulting transit and pedestrian activity (Douglas and Evans, 1997). commercial uses are encouraged to locate at subway station nodes and development should be more residential in nature adjacent to designated stable residential areas. nature of development along the Sheppard East Subway Corridor should reflect the nature and character of the communities around the subway stations. The mix and range of uses encouraged by this Secondary Plan and the level of development potential are influenced by these characteristics. The key development areas are shown on Map 9-2 and their development will be governed by the following policies. The key development areas are primarily designated Mixed Use Areas and are focused within walking distance of the subway stations.

Development of lands designated Mixed Use Areas will be in accordance with the Official Plan and the fol owing policies:

- Mixed Use Areas may be permitted to be developed primarily for residential uses, however, mixed use developments with non-residential uses such as retail or small offices at grade with multiple residential or offices located above grade are encouraged along the Sheppard Avenue frontage;
- In predominately residential areas within Mixed Use Areas designations, non-residential retail and office uses will be located on properties with frontage or flankage on Sheppard Avenue, Bayview Avenue or Leslie Street. Access to such non-residential uses will be primarily via the arterial road and such development wil not depend upon obtaining vehicular access through local roads serving multiple residential development;
- Within the interior of Mixed Use Areas, a mix and variety of residential buildings, uses complementary and accessory to a multiple residential use and public and private open space areas will be encouraged;
- On lands designated Mixed Use Areas which abut properties designated Neighbourhoods, only residential uses which can be designed to be compatible with the low density character of the stable low density residential properties they impact will be permitted;
- It is intended that as densities are distributed within a comprehensive development area, the highest densities will generally be located closest to the subway nodes, and along the frontages of arterial roads and abutting Highway 401. Densities will be lowered toward stable residential areas where no change in land use policy is introduced by this Secondary Plan.

5.2 Job-housing balance

Jobs-housing balance is a planning tool that local governments can use to achieve a roughly equal number of jobs and housing units (or households) in a jurisdiction. The notion of balancing jobs and housing goes well beyond trying to attain numerical equality. Ideally, the jobs available in a community should match the labor force skills, and housing should be available at prices, sizes, and locations suited to workers who wish to live in the area. Jobs-housing balance is a planning technique rather than a regulatory tool. Nonetheless, various ways exist that the concept of jobs-housing balance can be applied in local land-use regulations and large-scale development reviews.

Any policy that seeks to balance jobs and housing has multiple objectives, but almost all of these objectives will promote smart growth. The leading scholar on the concept of jobs-housing balance, Robert Cervero (1989; 1991), suggests that jobs-housing balance policies can help to reduce urban sprawl and lower energy consumption. The most important objectives of jobs-housing balance policies, in the eyes of those who have implemented them, have been the reduction of VMT and other traffic impacts. Reduced congestion and lower VMT. There is evidence that intensifying housing in downtown areas can reduce peak-hour commute trips into those areas. David M. Nowlan and Greg Stewart (1991), for example, studied commuting to Toronto's central downtown and concluded that inbound trips had been reduced due to the increase in residential population there. The authors estimate that "for each 100 additional dwelling units in the Central Area there has been a reduction of approximately 120 inbound trips during the morning three-hour rush period" (Nowlan and Stewart 1991, 165). In a study of the Greater Seattle-Tacoma region, Lawrence Frank and Gary Pivo (1994) found that travel distances tend to be shorter for commutes to balanced areas (see also Cervero 1996). The San Diego Association of Government's Regional Growth Management Strategy (1991) found that commute trip lengths in sectors with balanced jobs and housing were 8.8 miles, two miles less than the regional average (Ewing 1996, 46, n. 17). The Southern California Association of Government

(SCAG) provides additional evidence of VMT reduction from implementing jobs-housing balancing policies. This policy can be effective with mixed-land use.

Generally, job-hosing balance is a policy that can be effective anywhere to promote building density, because the people who work somewhere, live near their houses. Otherwise accessibility for public transportation will increase.

5.3 Pedestrian design

The quality of walk connections has been shown to influence the distance people are willing to walk. A short walk made difficult or unpleasant by adverse environmental conditions such as high-speed traffic or lack of shade can seem longer while a long but pleasant or interesting walk can seem shorter. It follows logically that quality of the pedestrian connections between the transit stop and the front door of the development should be important to transit usage. In many subway stations, special attention has been given to the pedestrian environment, including streetscape improvements. It is generally held that the placement of parking lots, green spaces, and the buildings themselves can impact the pedestrian and transit friendliness and attractiveness of travel by transit or walking (Arrington et al., 2002). Results from development of an advanced travel demand model set for San Francisco County lend support to the concept that the quality of walk connections to transit is positively related to transit use. Neighborhood vitality at the destination was found to have a strong positive relationship to the choice of all non-auto modes examined (walk, bike, and transit) for most types of trips. Adverse topology (steep gradients and barriers) was nearly as important. Connectivity at the destination was also, for work trips, significantly and positively related to walk and transit choice (Cambridge Systematics et al., 2002). The lesser importance in the San Francisco travel models of connectivity, and the lack of significance of conditions at the trip origin, are likely artifacts of model calibration with travel data from a city with limited pedestrian-friendliness contrasts. Few city/county of San Francisco non-industrial areas have poor pedestrian connections and most neighborhoods are basically pedestrian-friendly.soe strategies that can help to the pedestrian design are:

- Station Area block lengths should range between 400 and 660 feet to facilitate connectivity and pedestrian accessibility.
- Develop primary and secondary bike and pedestrian paths connecting to the Station Area.
- (a) Primary paths attract high pedestrian and bike volumes, associated pedestrian and bike oriented services, and act as the major connections to the station. Primary routes should provide direct access between the station and major pedestrian and bike destinations in the surrounding community. Primary paths should be designed as continuous, convenient, safe and barrier-free routes.

  (b) Secondary paths do not provide direct links to the station, but feed into the primary routes.
- Utilize sidewalk widths adequate for social use (six to twelve feet depending on location and use).
- Provide pedestrian plazas to create social places and to tie buildings and uses together.
- Install direct, continuous, buffered sidewalks across any large parking areas.
- Utilize canopies, awnings, and arcades to provide pedestrian shelter.

5.4 Infrastructure and Facilites

While there is probably no “right” definition of infrastructure, much depending on the context, there is some advantage in reserving the term for structures and facilities that are the result of human intervention, creating something physical that was not there before. This definition can still embrace the movement of soil to create embankments or cuttings as well as the erection of buildings and the laying of lines. The difference between infrastructure and other potentiality factors, such as the location of the region or its natural resource endowment, is that the service bundles inherent in infrastructure have been ‘artificially’ created through investment, whereas location and natural resources are ‘naturally’ given. There are various ways in which infrastructure so defined can be categorized. The simplest is descriptive: Buildings, roads and related items, utilities, etc. However, this is not particularly helpful from an analytical point of view. A more economic approach is to consider supply characteristics, particularly economies of scale, and demand characteristics, particularly the “publicness” of the goods or services provided, and to develop a categorization on this basis. For present purposes, however, we adopt a categorization based on just two characteristics, which highlight access to the service. We see much of the man-made urban infrastructure as belonging to one or other of two broad types:

• Area Type: Provides services within a defined area (e.g. utilities, transport systems). In such cases, getting the service to users involves distribution costs;

• Point Type: Provides services at a specific point (e.g. hospitals, schools, offices, shops, museums, theatres, etc). In such cases, the equivalent consideration is the cost to users of accessing the facility.

In the urban economics literature, the provision of infrastructure services tends to be viewed as naturally monopolistic because of scale economies. It seems self-evident that setting up rival systems to compete with each other to supply a community would mean duplication and waste. And the more people who can be connected to a system, the lower average costs must be. However, this view overlooks the effect of distribution or access costs.

Higher densities focused on urban centers ensure that they remain lively, with local facilities close at hand giving people the choice to use public transport, by sitting bus/tram stops or railway stations within walking distance also helps underpin viability by significantly increasing potential custom. This not only applies to residential uses, but to industry, commerce and shopping. The better served and connected a site or development is, the stronger the case for considering higher densities and lower car parking provision. If we want to promote density around subway stations, Infrastructure and facilities should be forecast, otherwise building density will not rise by the reason of lack of Infrastructure and facilities.

The policy should be Focus public infrastructure investments where development is most desirable to correct existing deficiencies and ensure capacity for high-intensity around subway stations and also Maximize smart growth planning techniques and opportunities as a mechanism to promote the practical preservation of the floodplain/floodway and to reduce potential runoff into Clear Creek.

There are some strategies for this polices:

- Ensure that adequate public facilities, including streets, drainage, pedestrian and bicycle amenities, are in place in advance of or can be completed concurrent with development in Station Areas.
- Relocate or reconstruct existing facilities that are incompatible with desired Station Area development, such as utility sub-stations, abandoned freight rail spurs, overhead utility lines, or oversized streets or street layouts.
- Coordinate capital improvement plans by the County, Metropolitan Districts and private developers to facilitate TOD development.
- Document baseline infrastructure conditions.
- Ensure that developers and agencies comply with County requirements for road and intersection improvements.
- Implement the findings and recommendation of the Clear Creek Master Drainage Study and other floodplain and drainage studies done by the County or the Urban Drainage and Flood Control District.
- Comply with federal, state and local storm water programs by using ‘Best Management Practices’ (BMPs) to manage storm water runoff over the life of development and redevelopment projects within the overlay district.

6 CONCLUSION

High building density around subway stations can have to positive effect on using public transportation ,first high building density increase accessibility to public transportation for more persons and the result is that passengers benefit public transportation will increase and VMT will reduce. Second high density cause reducing operational costs of transportation networks that are in the high density areas author to decreasing the time of journey. High rise building without investment can have bad effects on environment sustainability. However in this paper we reviewed some polices and solution to increase building density around subway stations that are mixed-land use, pedestrian design, Infrastructure and facilities and job-housing balance. These police and solutions can not promote building alone. Development intensity and density should be significantly higher in station areas to provide a base for a variety of housing, employment, local services and amenities that promote transit usage, encourage pedestrian activity and support a vibrant station area community.

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