

Evidence Based Principles for Transit Oriented Development

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Abstract

This paper discusses the theory of transit oriented development and attempts to create an effectually structured set of best practices through the study and modification of the documentation that currently exist. To identify the core elements or “principles” that go into constructing a transit oriented development plan. To do this a [deconstructive] qualitative survey of more than 30 projects or municipal planning documents that self-identified as transit oriented was conducted. The result was six goals that were deemed essential to the creation of “good” transit oriented development. The six goals were then combined with empirical research from academic and practicing professionals in the field to form recommendations for new best practices.

Introduction

Transit oriented development is a new and potentially controversial way that public planning officials have begun to reimagine our cities. The original concept of transit oriented development has been around since the depression era, but was revived by Peter Calthorpe in the late 1980's with his work *The Next American Metropolis: Ecology, Community, and the American Dream* (Carlton). In contemporary terms, transit oriented development is moderate to higher density development, located within an easy walk of a major transit stop, generally with a mix of residential, employment, and shopping opportunities designed for pedestrians. TOD can be new construction or redevelopment of one or more buildings whose design and orientation facilitate transit use. The concept has subsequently gained traction in both established and quickly emerging cities. Public planning officials recognize transit oriented development as a potential long term solution for many urban issues and are eager to adapt TOD philosophies within their jurisdictions. The problem that quickly arises for these cities is the insufficient amount of formal evidence based guidance for these municipalities to utilize in their development of transit oriented projects. Without proper guidelines, cities are wasting valuable time, resources, and taxpayer money rather than creating economically successful, environmentally sustainable developments that create more economically stable and welcoming communities.

Several prominent planning organizations including The Urban Land Institute, The American Planning Association, and The Institute for Transportation and Development

Policy have all tried to develop guidelines in an attempt to codify Calthorpe's original concept and while they all cover the same basic ideas, the lack of a universally accepted working definition of "Transit Oriented Development" and, more importantly, how it would be effectively utilized in community development has resulted in a broad spectrum of interpretation, none of which carry the clout to apply across the diverse jurisdictions eager to apply them.

The purpose of this research is to discuss the theory of transit oriented development and attempt to create an effectually structured set of best practices through the study and modification of the documentation that currently exist.

Transit Oriented History

The history of transit oriented development can be traced back to several important social and design precedents. Ebenezer Howard's garden cities took their name from the tree lined, in town suburbs of pre 1871 fire Chicago. Howard's vision was to create multiple mid-density circular towns ringed by green space and connected to one another via intercity railway (Creese).

Using Howard's principles, Raymond Unwin created the town of Letchworth. Letchworth also had a main commercial street, mixed income groups and limited to the size of land available to heavy industry (Creese).

Hamstead, Unwin's subsequent development utilized pro-pedestrian, anti-auto philosophies that later transit oriented developments aimed to recreate. Unwin created

roads of differing widths and materials to indicate what they were to be used for and said “Streets are not a virtue in themselves. In fact, the less area given over to streets, the more chance one has of planning a nice town. To be obsessed with the idea of planning for traffic is a mistake” (Carlton).

By the mid-1930s, garden cities had become an antiquated ideal giving way to the dream of the private automobile. Railways gave way to parkways and the garden cities eventually gave way to auto-oriented suburbs. It wasn't until the late 1970s that a shift away from suburban development began, discussed by Robert Stern in “Subway Suburbs.” The influence of garden cities begin to reappear with his proposal to redevelop underused inner city tracts to create suburban scale housing that was to be served by subway mass transit and surrounded by green space. It was also during the 1970s that Leon Krier, an English urban theorist, began theorizing that development should be created at the human scale and that neighborhoods should be defined by quarter mile walking distance. Both of these theories would become cornerstones in transit oriented development practices.

Krier's ideas became reality in Andres Duany and Elizabeth Plater-Zyberk's development known as Seaside in Florida. Seaside took the concepts from the garden city movement by borrowing Unwin's idea; limiting the roads available to automobiles and supplementing them with walking and bike trails. Seaside's density benefited tremendously when the couple allowed multiple architects the ability to design buildings for the community instead of relying on one uniform concept for its entirety.

In 1989 Peter Calthorpe and Mark Mack began to work on a new concept called “Pedestrian Pocket” that would become the precursor to Transit Oriented Development. Pedestrian Pocket was defined as a “simple cluster of housing, retail space and offices within a quarter-mile walking radius of a transit system” and was different from TOD in that it focused more on offering choice of transit mode including automobile and was not meant to slow sprawl. The concept of contemporary transit oriented development arose in 1993 during the first meeting of the Congress of New Urbanism (Carlton). The concept was intended to be more in line with characteristics of traditional neighborhood design that the group hoped would become widely adopted.

Definitions

The term "Transit Oriented Development" is most often defined by the context in which it is being used. For example, the Atlanta Regional Commission defines it as “a pedestrian-friendly, mixed-use community that provides relief from totally automobile-dependent lifestyles by increasing access to transit for residents and workers, enabling them to drive their cars less and ride transit more. TODs provide people with options so they can choose where to live, work, play and mingle. In the most successful TODs, transit stations integrate seamlessly into the community”. The Metropolitan Transit Authority of Portland defines Transit Oriented Development as “multiple-unit housing and mixed use projects that support the public investment in light rail and fixed route transit (bus) service because they preserve, enhance, or contribute to creating active

pedestrian districts within walking distance of transit. A TOD may be a single building, a group of buildings, or a multiple block district.”

The lack of a concrete definition has led to many planning departments selecting the aspects that they feel are the best and, more often than not, what they can get the most money and support for. While commonalities could be found in TOD definitions across the breadth of projects surveyed during this research, it has been determined that no universal definition of Transit Oriented Development exists.

Transit

The goal of transit is to provide a variety of multimodal options to people in order to reduce automobile dependence and encourage alternatives that are beneficial and healthy for citizens, the economy and the environment. There are currently four main alternatives that have been attempted in order to achieve this goal. They include light rail transit or LTR, street cars, conventional buses, and the increasingly popular bus rapid transit or BRT.

Light rail trains are medium sized trains that typically carry approximately 250 people and travel from 45 – 65 miles per hour on their own dedicated right-of-way tracks. Several LRT systems have seen success in larger metro areas such as San Francisco's BART and Atlanta's MARTA systems, which carry suburbanites into center cities for work, commerce or entertainment while cutting down unnecessary automobile traffic (Groenewegen).

Streetcars are smaller and slower than light rail transit options; they carry approximately 150 people and travel at 25 – 34 miles per hour. Streetcar systems have recently become the transit option of choice for medium to large sized cities looking to revitalize their downtown districts, and have been met with varying degrees of success. Aside from the size and speed, the major difference between the two is the fact that streetcars operate on the same roads as cars and often have tracks ingrained into the same lanes (Golem).

Bus rapid transit is different from a conventional bus system in that it offers high quality, higher capacity buses that travel along their own grade separated lanes to achieve higher speeds and reduced time spent in traffic (Kittleson). Bus rapid transit systems are slowly gaining support due to their ability to carry up to 200 people, providing a slightly less expensive competitor to light rail transit. Conventional buses, on the other hand, have a maximum capacity of 50 people at standing room and mostly operate within traffic. Conventional buses also have the unfortunate and unseemly reputation as inferior goods; one which will be avoided if a person has the economic means to do so, leaving only the poor and destitute to take advantage of this transit mode (Kittleson).

There are several more, less successful transit alternatives that have not been widely adopted due to contributing factors such as the size and sprawl of area or demand needed to support them. Heavy rail transit, which includes larger, faster trains akin to New York's subway system, as well as demand response paratransit systems such as vans, taxis or small buses that move door to door are examples of this. One needs a much larger, denser population to be successful; the other is used for more infrequent

needs in rural places and both are relatively expensive to for both the operator and consumer.

The two largest factors contributing to which mode of alternative transit would be best implemented in a given city are population density and cost of implementation (APTA). Population density is used to determine if there will be an adequate number of people to support a given transit mode and to insure that it does not fail immediately due to lack of patronage. Pushkarev and Zupan found in their book “Public Transportation and Land Use Policy” that bus rapid transit and light rail transit both need between nine and twelve housing units per acre within a quarter mile radius of stations to be successful.

These numbers can be reduced for several reasons, including a large supporting employment density, if the surrounding area allows for easy access to stations (commonly referred to as high walkability) or if there is a large population of low income families, students or senior citizens within the quarter mile catchment area (Tumlin).

There will always be some drawbacks to and criticism of mass transit. Critics often argue that transit alternatives are a waste of taxpayer money that could be better spent widening and improving existing streets for automobiles, but it has been proven time and again that endlessly stalling the latent demand in this fashion will create only a sea of asphalt and leave external issues unsolved. More often than not, alternative transit systems need to be highly subsidized during their first years in order to operate at costs affordable enough to attract the necessary customer base. While issues like these do exist, if alternate transit systems are supported with proper adjoining land uses and a

reduction in auto favorable policies during critical planning phases, all alternatives have proven to be at least moderately successful (Lyndon).

Density

The largest goal of the majority of transit oriented projects is to increase housing and employment density. Density in this context refers to the number of residences and jobs located in a given area, usually measured in acres. The concept of density is particularly important because it pertains not only to transit oriented development concepts but relates to other commonly implemented development initiatives as well, including mixed use and infill development practices. Urban development researchers Frank and Pivo found that increasing urban residential populations to forty people per acre increased transit use by almost five percent (Pivo). The same study found that increasing densities in commercial centers to one hundred employees per acre resulted in an increase of alternative transit modes to eleven percent of the total. Combining cluster or mixed use development with increased density has also been found to reduce costs of public infrastructure and policing by reducing physical and occasional need. Several other studies have shown that doubling an area's population density leads to increases in economic productivity which, in turn, helps drive economic development and increases the median standard of living (Coffey).

In spite of this evidence, there are still critics that support suburban development and argue that there is not a market for higher density. They are convinced that consumers prefer low density suburban developments that allow higher instances of automobile use. To this end, developers are often hesitant to create these types of high density areas due to perceived financial risk and difficulty securing the necessary capital (Burchell). Current transportation planning policy for most cities does nothing to alleviate the initial burden, but instead often favors auto-centric land uses that are not conducive to creating higher density mixed use development (Burchell).

Accessibility/Connectivity

Accessibility and connectivity are placed together because one essentially fuels the other. Accessibility is measured by people's ability to easily reach goods, services, and destinations with the primary goal of providing easy access to all of the resources that provide a person with what is considered a high quality of life (Litman). In association, connectivity is concerned with how many options are provided to a person to achieve that goal, be it by walking, cycling, taking mass transit, or, more conventionally, driving (Handy). Therefore, as connectivity increases, so does accessibility.

Accessibility is affected by three main factors; mobility, transportation system connectivity and land use (Litman). Mobility pertains to how much physical movement a person has within the given space. Transportation system connectivity is the directness

of links such as roads and paths, and further, the density of those connections. Finally, land use refers to the distribution of activities and the distance between them.

The U.S. Environmental Protection Agency found that increasing street connectivity created a more equitable, pedestrian friendly environment and led to a possible decrease in vehicle miles traveled. A similar study that was conducted by the Canadian Mortgage and Housing Corporation found that areas which have more direct and safe routes to destinations have an eighteen percent increase in foot traffic over those that do not.

The majority of criticisms against increasing accessibility and connectivity stem from those who favor auto dominant policies. Creating traffic barriers or attempting to reroute traffic to improve these aspects has been shown to be extremely difficult and unpopular so it is incredibly important that areas dedicate a lot of time early on in the development process to perfect these things. There is often less resistance from local residents and business owners if they truly understand how good accessibility and connectivity benefit them.

Walkability

Walkability is characterized by an area's overall walking conditions, potential foot traffic connectivity and usefulness (Lo). According to John Lavey and Jennifer Hill of Community Builders, walkability can be broken into three key focuses; physical access, places and proximity.

The concept of physical access relates to determining if an area is safe and comfortable with adequate opportunities to travel and interact with one's environment. There are many things that are considered when determining an area's physical access including whether people have access to sidewalks or walking paths and the role and relative importance given to the private automobile. It is also very important to consider the prevalence and condition of the supporting infrastructures that are in place such as lights, shades, and vegetation (Brown). Physical accessibility is only as important as destination, however, which can range from grocery stores to schools to places of employment. Using walkability in conjunction with mixed use development can actually play a large part in this by creating destinations that members of the community can walk to in order to serve multiple needs. This saves both time and money while also reducing vehicle usage.

The last focus is on proximity to housing. It is a generally held belief that anything inside a fifteen minute or half mile walk is considered accessible by foot as this is the distance that the average person is willing to walk to get to goods and services they need. This metric plays a key role in determining where businesses and transit stops should be located in relation to housing in developments.

There are currently two regularly used systems to classify and create walkable areas: the STEPP system and the 5 "D"s. STEPP which stands for Safety, Track, Environment, Population and Purpose was developed by Dr. Steven Gehrke at Portland State University and has seen use mainly within developments with Portland. The 5 "D"s or Design, Diversity, Density, Distance and Destination is a popular method that has seen

widespread use, most notably in (city) and (city). There are, however, challenges similar to those faced by other aspects of transit oriented development. Since the end of World War II, development has primarily been suburban and automobile driven and has resulted in many cities preferring this rather than changing focus.

Clustering/Mixed Use

Cluster or Mixed Use development is a development strategy that combines multiple residential, commercial, cultural, institutional, and, where appropriate, industrial uses. By creating effective combinations, municipalities can create areas where people are attracted to live, work and play while cutting down on infrastructure and utility costs.

There are three types of mixed use developments currently being employed in transit oriented projects. First type is vertical mixed use buildings, where ground level floors are dedicated strictly to commercial purposes with residential units built on the upper levels. The second type is horizontal or corridor mixed use sites, where buildings retain their individual specific uses, but are planned within a certain area to encourage easy access to the range of available activities. The third type of mixed use development is mixed use walkable areas which consist of a cluster of vertical mixed use buildings within a horizontal mixed use site, ensuring that multiple uses are within a ten minute walk. By creating cluster development areas, developers and planners are able to

dedicate more land to open space and environmental protection, promote a diverse economy and create a sense of place which welcomes both the residential occupants and patrons of the commercial spaces.

Mixed use development has many barriers to wide scale implementation. Traditional municipal zoning regulations in most have strict rules forbidding the combining of different land uses. This type of code has created a lot of municipal red tape and slow review process which often plagues public sector planning efforts and can kill what could potentially be a viable and lively mixed use development.

Parking Management

Parking management is a highly contentious topic in transit oriented development planning. Developers and planners seek to limit the number of parking spaces in order to encourage successful transit and pedestrian alternatives while helping to keep down building costs. There are a number of different strategies being experimented with to help reach these goals. For example, the city of New York has begun to lower the minimum requirements for total parking spaces for developers that are willing to lower rent prices in exchange for the ability to charge separately for parking (McDonnell). Other cities such as Portland, Seattle and San Antonio have enacted maximums to the number of parking spots that can be located within certain areas, in effect preventing an oversupply of parking that squanders valuable land which could be more densely developed (Daisa). San Francisco has gotten rid of parking

minimums for individual buildings and instead encourages builders to work together to combine resources to make shared parking structures with rentable spaces (Litman).

The most popular strategy is the one that Donald Shoup outlines in his book “The High Cost of Free Parking” - parking benefit districts. In parking benefit districts, all revenue generated from existing parking related infrastructure ie; meters, tickets, rentable spaces are used to finance improvements to mass transit alternatives, sidewalks or even to build better parking. Changes to parking management are extremely slow. The current thinking is that creating the maximum number of spaces is the best approach so that consumers always have a place to park should they want to.

Affordability

An increasingly important goal of newer transit oriented developments is to insure that housing in proximity to transit remains financially accessible to a wide range of income levels

It is also important to recognize the effects to rent prices gentrification can have on lower income tenants who have lived in areas which are experiencing redevelopment (Belzer). Studies from (name) have shown that creating and maintaining affordable housing creates a stable and diverse population base for transit systems and employers to pull from.

There are several tools in effect to help achieve these goals. Inclusivity zoning is a method in which cities can leverage public/private partnerships to insure that a certain

percentage of new construction is dedicated to the low income or section eight housing. Another tool that is popular and has seen wide historical use is rent control, maximum rent prices communities can help stabilize rental markets and keep people from being priced out. Unfortunately, providing affordable housing is often difficult. Whether it's the lack of federal subsidies or lack of financing from banking institutions, increasing affordability is very difficult.

Methodology

One of the objectives of this paper was to identify the core elements or “principles” that go into constructing a transit oriented development plan. To do this a [deconstructive] qualitative survey of more than 30 projects or municipal planning documents that self-identified as transit oriented was conducted. Deconstructive research entails analyzing data and breaking it down into core concepts or themes (Stake). Over the course of several pieces of data a set of common themes will appear in the data (Stake). The themes can be used to draw conclusions based upon their common relation to the topic at hand (Stake). For the current research, each of the thirty plans were scrutinized for their proposed goals, definitions and metrics and from there broken into key words and phrases. Of these words a hierarchical ranking was created, listing those that were found in nearly every document to those that were the least common (Stake). Those that were found least were further examined to see if they possibly fit into another larger category or were just a specific objective of a particular project. To achieve the end product of a set of solid guiding principles, a list was

created from the highest ranking of those words. The result was six goals that were deemed essential to the creation of “good” transit oriented development. These six goals were then combined with empirical research from academic and practicing professionals in the field to form recommendations for new best practices. In the cases of conflicting research such as bus rapid transit versus light rail transit the most current data was used.

Principal One: Encourage human scale development

while increasing density

The debate over whether or not increasing an area’s density is beneficial to the community should be over. Studies have shown time and again that compact dense development leads to reduced vehicle miles traveled, energy use, and co2 emissions overall (Driving the Built Environment). There have been studies that show that these types of developments also make economic sense by helping to increase workers’ wages and productivity (Glaeser). A study conducted by Edward L. Glaeser for the National Bureau of Economic Research found that higher urban population densities have a positive correlation to rising wages and increased productivity. The study compared the gross metropolitan product with a city’s population density and found that “per capita productivity increased by 4% as population density [rose] by 50%” (Glaeser). The benefits of urban density have been proven, however, the argument still remains that there needs to be more comprehensive design guidelines to encourage human scale development.

The challenge faced now is creating dense urban spaces that follow good, context driven design. University of Toronto Professor Richard Florida argues that simply building the tallest buildings crammed with the highest number of people is detrimental (Florida). The emphasis must be on creating a place for those people to interact. Research from The Preservation Green Lab lends credence to this; “fine grained urban fabric is more likely to foster local entrepreneurship and the creative economy than monolithic office blocks and apartment towers.” Perhaps the most compelling evidence that good urban design is beneficial is from a study by Andrew Burleson, Principal at Fourth Environment LLC. In his work “How Urban Design Affects Property Values,” Burleson finds that design guidelines such as those used in Portland increase the value of the space and incite more interest which leads to increased population density. Design requirements like building lines, parking not allowed at ground level, and building height limits increase property values and create a more desirable environment to attract new and diverse population base.

The goal of encouraging human scale development within our transit oriented development is to create a vibrant place where a person feels safe to interact with their surroundings and the people within them. By instituting environmental and contextual design within these places, we have the potential to create great urban spaces that are sensitive to both the person and the natural environment.

Principal Two: Creating lively functional streets

Streets- how they function as both interactive and transportation space are of the utmost importance to the vitality of urban developments. In the study “Walkable Route Perceptions and Physical Features: Converging Evidence for Enroute Walking Experiences,” Barbara Brown et. al. found that creating environmentally pleasing and safe streets leads to a marked increase in foot traffic in those areas. Participants of the study were given a survey and instructed to traverse varying routes throughout the urban fabric. As they walked, they rated the areas based on things such as temperature, shade, vegetation, lighting, and the condition of the sidewalks. The data from this study found that areas with higher numbers of vegetation, shade, lights, and with good sidewalks were considered to have a higher walkability route score than those that did not and were more likely to generate foot traffic. These findings were further supported in The Center for Disease Control and Prevention’s “Recommended Community Strategies and Measurements to Prevent Obesity in the United States”, which found that more aesthetically and environmentally pleasing streets encourage people to walk more which, in turn, lead to a host of health benefits including decreased rates of heart disease, obesity, and diabetes.

Encouraging people to walk doesn’t solely benefit individual health and environment; it also supports the economic growth of the community. A 2007 study in the United Kingdom found that good street design also leads to increases in local economies with increased retail profits and housing rental prices. The study came to these conclusions by performing market regression analysis for ten London streets combined with stated

preference surveys from local residents. They found that design quality “can add an average of 5.2% to residential rents...and an average of 4.9% to retail prices” (CABE).

Enriching the pedestrian experience is not the only way to create better streets. In order to make a better experience for users we must also reduce the prevalence of automobile traffic onsite and instead replace it with non-motorized and alternative mass transit options such as bus rapid transit. The Victoria Transport Policy Institute found in their study of active transit modes, such as riding a bicycle or walking, that limiting automobile accessibility onsite lead to a slew of benefits including increased street safety and reduced congestion for all modes. They also found that an increase in active modes created greater community cohesion, fostered more positive interactions between neighbors, and increased local security (Litman). In Garret and Castelazo’s “Light Rail Transit in America: Policy Issues and Prospects for Economic Development,” the authors found that providing above grade light rail lines created less traffic congestion and helped spur economic development along planned routes.

Principal Three: Invest in mixed uses

Creating active and varied mixed uses is important for the success of any transit oriented development project. An Arizona Department of Transportation study found that mixed use development led to a reduction of daily vehicle miles traveled and reduced overall traffic congestion. By including a mix of retail and service businesses within a compact neighborhood, residents are able to complete more daily tasks without the use of automobiles (Kuzmyak). According the LD Frank et. al., integrating

mixed uses into walkable environment also leads to an increase in physical activity and aids in further stabilization of climate changes by reducing the dependence on automobiles.

Developments that make use of commercial and residential mixes also see the added benefit of safety. By profiling a mix of eight high crime areas in Los Angeles, researchers at the University of Pennsylvania were able to determine that increased activity in mixed use areas lead to what Jane Jacobs termed “eyes on the street” meaning that the more people active in an area the less chance criminal types would have to perpetrate crime (Anderson).

Finally, mixed use developments can also be substantial drivers for economic development. By comparing tax income and employment rates of typical big box retailers to mixed use developments, Joseph Minveozzi principle at Urban3 found that mixed used developments outperformed their counterparts leading to increased taxes for municipalities and lower employments while using only a fraction of the acreage.

Principle Four: Encourage Mixed Income neighborhoods to stabilize development

Planning agencies must ensure a range of equitable housing options in order to create more permanently productive transit oriented projects. Creating a blend of income strata reduces class segregation which will alleviate some of the negative effects of gentrification and reduce crime rates, improve educational outcomes, and increase social tolerance (Jargowsky). Mixed income neighborhoods also increase the likelihood

of success for nearby mass transit. In the United States people earning less than \$37,000 a year make up approximately 59% of transit riders (Pucher). Increasing the ability of those people to reside near transit stations increases their ability to utilize and support that transit.

Principle Five: Recognize the value of Light Rail Transit

When designing a transit system for transit oriented development, light rail transit is the best option to encourage economic development while providing the most benefit for the surrounding population.

Often cities look to save money when evaluating transit possibilities and a popular option is bus rapid transit. The perception of bus rapid transit is that it can deliver the same level of service to a community as rail, but at a fraction of what it costs. A study by Lyndon Henry and Dave Dobbs of the American Public Transportation Association that compared new light rail and bus rapid transit projects found that is a common misconception. The study found that “BRT averaged 35% above [projected] budget” while “LRT only exceeded by 2% on average” (Henry). The same study found that operating and maintenance fees for bus rapid transit are on average 24% higher when compared to those of light rail. Additionally, bus rapid transit’s inability to meet ridership targets by 20% on average means that tax payers are not going to get the most for their transportation money (Bruun).

Creating light rail plans for an area surrounding a commercial property increases in value by 23%, up to 120% on average if that property is already within an existing business district (Knaap). A positive correlation has also been found between impending rail systems and increased likelihood of development of higher density housing (Cervero).

Light rail transit systems also provide the most benefit for the populations which they serve. Studies have shown residents near transit stations save approximately \$500 dollars on per capita auto related expenses (McCann)

Principle Six: Discourage auto-dominance by removing parking minimums to allow more profitable land uses

The private automobile is a major source of contention for many transit oriented development projects. The dedicated amount of physical space automobile related infrastructure inhabits can be better utilized in several capacities. Zoning code mandated parking space minimums have been shown to increase the cost of housing by occupying land that may have otherwise become housing, therefore restricting the supply (McDonnell). This often generates an oversupply of parking space which, following the concept of latent demand, leads to increased car ownership and increased driving ultimately negatively impacting the environment (Shin). Parking minimums also damage economic development, as concluded in a study released by the American Institute of Architects, many planned projects had to be canceled because minimums

made them economically unfeasible. Instead of needlessly swallowing valuable land in asphalt, planners and developers need to work together to create less expansive automobile related infrastructure while still addressing the needs their owners.

Discussion

There are three distinct problems with transit oriented development as it currently stands. The first is that there is no solid, universal definition. When each group or project creates their own definition to fit their specific objectives, it corrupts and weakens the overall picture of transit oriented development creating misinformation for other professionals as well as the public.

The absence of a definition creates further confusion in that professionals are forced to define and measure the commonly found aspects of TOD such as density or walkability that projects often discuss, but this does nothing to help TOD as a whole. You are forced to piece together the best case scenarios without the ability to discern the impact the individual parts may be having on the development as a whole.

The lack of a firmly defined foundation makes attempting to codify what exactly makes great TOD extremely difficult, and near impossible to measure empirically. There is also a great deal of conflict and problems within the research of those individual concepts as well. For example walkability measurements are highly contextual and can differ greatly from project to project. What may be necessary in one area, may be consider

impractical in another and often the research that is done will not take the differing factors into account. There are also instances of institutional bias in the research of some planning organizations and journals which skews research data to further their own agendas. Whether this is intentional or not, it creates many conflicting reports as to what the best course of action may be for certain things like parking requirements or how mixed use affects economic stability and also hurts public perception of planning institutions. Finally, municipalities are often picking apart the concepts of TOD and selecting those that are easiest to sell to their constituents. While not a horrible practice, there is some evidence found by the research conducted here that many aspects of TOD are actually very closely entwined. The success of transit may be connected to walkability and both may be joined to density. By selecting only what is deemed to be the “good” or popular values, cities that adopt these modified TOD plans may be harming themselves without even realizing it. Transit oriented development cannot function correctly or cannot truly be called transit oriented without a systemic approach to its implementation.

Future Research

Moving forward, the principles created in this document could be used to create baseline metrics for future transit oriented development projects. After a period of review, the effectiveness of the principles will be determined and adapted. Further, planning agencies from different regions can submit additions or addendums which can

be applied to their region to allow for effective place based planning while ensuring the continued use of a comprehensive set of best use practices.

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