



Density and Efficiency



**MICHIGAN ECONOMIC
DEVELOPMENT CORPORATION**

What you will learn:

How denser development saves a municipality and its tax payers money

The variety of ways that density and infill development are efficient

The difference between Asset Management and Capital Improvement Programming

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In microeconomics, economies of scale are the cost advantages that are realized due to their magnitude of operation (typically measured by the amount of output produced), with cost per unit of output decreasing, which causes scale increasing.

Likewise, communities (cities, villages, townships) experience efficiencies through density. Throughout most of human history, communities were limited in size by how far a human being could walk. In this regard, they were very efficient. But many factors led to a separation of uses and buildings, and people moving further out from city centers, including our understanding of waterborne and airborne pathogens and disease spread; increased negative health impacts of industrial pollution and noise; the advent of the automobile; and a desire for more open space and nature. Ultimately this led to a spread out development pattern known as urban sprawl, and we now understand that sprawl drains local environmental resources, shifts the economic burden of development to longtime residents, increases transportation and energy costs, and diminishes overall community character.

Today, we recognize that some of the most charming and liveable neighborhoods and cities have not only certain design characteristics, but a certain density level that establishes that sense of place. There is much talk of a “Goldilocks” density and what the ideal number is (see Resources to read more on this topic). But regardless of the number, both planners and engineers agree that density provides a number of efficiencies to a community.

Pipes in the Ground

Denser development requires less infrastructure to be built. In a traditional small downtown a single block consisting of many

State laws that may also apply:

Michigan Planning Enabling Act, Public Act 33 of 2008

Michigan Zoning Enabling Act, Public Act 110 of 2006

Uniform Budget and Accounting Act, Public Act 2 of 1968

Revised Municipal Finance Act, Public Act 34 of 2001

Brownfield Redevelopment Financing Act, Public Act 381 of 1996

Recodified Tax Increment Financing Act, Public Act 57 of 2018

businesses with upstairs residential uses will utilize the same water and sewer systems for that block. The buildings are close to the street so the individual sewer and water leads are shorter.

In a suburban setting, development is spread out. Businesses with a larger building footprint - - to accommodate larger parking lots, water retention areas, building massing, and setbacks consistent with traditional suburban model development - - decrease the number of businesses within that same block or along a corridor. In this setting, fewer users share the water and sewer mains. The buildings are set off from the street so the individual water and sewer leads are much longer.

Developers are often required to not only install the water and sewer utilities within their developments,

but also to connect to the existing systems, no matter the distance. However, the legacy costs of major water and sewer infrastructure projects are often not considered. The systems require regular maintenance; in about 50 years, they will need to be replaced.

Upfront capital costs (the installation of the water and sewer systems), long-term operations and maintenance costs, and, presumably, cost for eventual replacement are all lower in a denser setting. Infill development often can tap into existing pipes, lowering upfront capital costs even more.

During master planning, if the future land use map identifies a particular area at a certain density, and intends that utilities be constructed to serve the proposed density, the municipality would be obligated to allow development of that area, at the allowable

TERMS:

Density is the amount of development per acre permitted on a parcel under the applicable zoning, commonly measured as dwelling units per acre (du/ac).

Goldilocks is term that refers to the most desirable or advantageous part of a range of values or conditions (typically the center). For example: “the planet is in the middle of what astronomers call the Goldilocks zone : a place that’s not too hot and not too cold”

Infill development is the process of developing vacant or under-used parcels within existing urban areas that are already largely developed.

LEED (Leadership in Energy and Environmental Design) is the most widely used green building rating system in the world. Applicable for all building types and phases. LEED also recognizes location and planning, sustainable site development, water savings, energy efficiency, materials selection, waste reduction, indoor environmental quality, innovative strategies and regional issues.

Resources:

- “Want to reduce the energy used by buildings? Make cities denser.” David Roberts. *Vox*. November 26, 2017
- “The costs and benefits of density in cities.” Gabriel M Ahlfeldt. *The Planner*. June 13, 2019.
- “Building Better Budgets” *Smart Growth America*. May 2013.
- “Growing Up and Not Out: The Fiscal Benefits of Higher Density Development Share.” by Brad Broberg. *On Common Ground*. National Association of Realtors. November 20, 2014
- “Researchers Calculate the Healthiest City Density.” by Kelsey E. Thomas. *Next City*. October 11, 2017.
- “Building Water-Efficient Cities: A Comparative Analysis of How the Built Environment Influences Water Use in Four Western U.S. Cities.” Philip Stoker, Heejun Chang, Elizabeth Wentz, Britt Crow-Miller, Gabrielle Jehl, and Matthew Bonnette. *Journal of the American Planning Association*. Volume 85/ Issue 4. 2019.
- “Efficiency.” by Charles Marohn. *Strong Towns*. March 31, 2015.
- “Quantifying the Cost of Sprawl In infrastructure, service delivery and tax receipts.” Emily Badger. *CityLab*. May 21, 2013.
- “New Studies Measure the True Cost of Sprawl, and It’s More Than You Think.” Lloyd Alter. *Treehugger*. October 11, 2018
- “Many Cities Have Transit. How Many Have Good Transit?” *Urban Edge*. November 14, 2018.
- “Rome Reborn” by Andrew Curry. *Smithsonian Magazine*. June 30, 2007.
- “Designing Cities for Water Efficiency.” *Fluence*. October 3, 2019.

MAP offers workshops on Capital Improvement Planning and mini workshops on many topics including housing, utilities, and asset management.

density. However, that new development might not be adjacent to the areas already built. The new development would leapfrog over a farm, field or wooded lot, possibly creating a large separation of between developed areas and open space or farmland. Even though the developer will pay for extending utilities, the municipality will have possibly miles of sewer and water lines that it is responsible for in between.

Electricity, Gas, and Water Use

Utilities like electricity and gas are often outside of the local government’s purview, but energy efficiencies reduce costs and carbon footprints. While LEED-certification demonstrates that renovations or new construction are energy efficient, studies show that urban density is about as effective as efficiency improvements for energy savings in building heating and cooling.

In addition, experts have found that water consumption is affected by vegetated land cover, housing density, and lot size.

Pavement

Roads in Michigan are free to use, but they are expensive to build and maintain. Just as denser development allows more users to share the cost of pipes in the ground, these same property owners are also able to share the cost of road construction and maintenance.

While abutting property owners are often directly assessed for sidewalk or public parking lot construction and maintenance, public local street construction and maintenance are more often paid for through bonds or mileages. Denser development means more property owners in an area. The more property owners there are to share costs, the less each one will need to pay.

A Short History of Density

Walking was the first means of transport available, and the urban spaces in the first cities were structured accordingly. Walking speed is 3 miles per hour, so the area a city dweller can cover is limited. As a consequence, the surface of ancient cities was restricted to several acres and population density was high, approximately 80 inhabitants per acre. Total population of ancient cities was limited; in 200 AD, ancient Rome is estimated to have had 1.2 million inhabitants living within 16 square miles.

The public transport city emerged with the arrival of the bicycle, the tramway and urban railways in industrialized countries around 1860. Cities spread out and were star-shaped around public transport lines. Population density diminished to around 40 inhabitants per acre. Centers of activity appeared when they were accessible from the city center. The heart of the city was still very dense and journeys were short. There were frequent pedestrian pockets of medium density around railway stations.

The automobile city emerged after the Second World War. Massive investment in road infrastructure enabled spatial spread over a 30 mile radius, with population density at about 8 inhabitants per acre.

Federal, state and county roads are largely paid through fuel taxes and license fees. These don't begin to cover the costs for construction and maintenance. As a result, some road commissions no longer accept new neighborhood roads, and the responsibility to maintain them. New development would then have private, rather than public roads, meaning that a homeowners' association would be responsible for the maintenance and eventual replacement of those roads. However, many homeowners' associations do not have the capacity to maintain neighborhood roads effectively and efficiently, nor do they collect enough money in association fees to cover the long term costs. In addition to property taxes, these residents may experience prohibitively expensive and ever increasing association fees to pay for their private roads. Private roads are rarely the cost saving mechanism they are expected to be, and municipalities should carefully consider allowing them. Often, when the homeowner association can no longer afford to maintain the streets, they ask the municipality to take over, and ultimately taxpayers (including the property owners in that development) pay the maintenance costs anyway.

Other Modes of Transportation

Public transportation is incompatible with low density development. Various surveys show that people prefer to walk less than 10 minutes with walking speeds generally being about 3 miles per hour. These parameters mean that bus or transit stops must be easily accessible from homes or workplaces. Investment in public transport infrastructure is only economical if housing and employment density

is sufficient within the service area of the agency. Research shows that for places with a density of 3,000 people per square mile, it makes sense to operate some level of infrequent local bus service. However, while an hourly bus will get ridership, transit will never be the most convenient mode--most people who can choose will still choose to drive. When density reaches about 10,000 people per square mile, transit reaches a tipping point: the number of people are enough to justify frequent service. Walking and biking become useful for short trips, which makes it easier for people to live without cars and makes transit more desirable. As densities further increase, more and more transit is justified.

Fiscal Impacts

As infrastructure and population grows, the need for service grows, too. Larger, more populated municipalities require larger departments of public works, including the administrative staff that accompany that. An expansion to city hall may be necessary to provide additional services and to accommodate greater service demand. Police and fire protection may need to be increased. Additional polling locations to facilitate more voters might be necessary.

Every community has at least one major revenue source, and in some cases several, upon which it is reliant. In Michigan, local units of government rely on local property taxes; state shared revenue and fees; and some cities charge income tax for residents and workers. An important component of revenue

WHAT COMMUNITIES ARE DOING THIS?

Mt. Pleasant, MI: Stable funding from a diverse tax base is one of nine vision statements. Eliminated minimum vehicular parking requirements citywide; and reduced or eliminated minimum lot size and setback requirements to encourage infill and permit denser development patterns.

Ann Arbor, MI: Transit corridor and mixed use zoning. Buildings must be at least 2 stories tall.

Midland, MI: Plan for and encourage infill development

Austin, TX: Residential Infill and Neighborhood Urban Center Special Uses Zoning Code

Portland, OR: Alternative Development Options - Duplexes on corner lots

structure is the distribution/collection formulas for various sources. Other states, and the local units of government in those states, have more revenue sources available to them.

A fiscal impact analysis can reveal if your community's current land use plan is fiscally sustainable. While Michigan requires most local units of government to develop and adopt a Capital Improvements Program (CIP), the projects included in a CIP account for only about 15 to 25% of the entire budget. The operating costs (especially over time) are the majority of municipal expenses.

Capital Improvement Programs and Asset Management are Essential

An asset management plan is an engineering evaluation of how to provide a desired level of service in a cost effective way and reduce the risk of infrastructure failing. A CIP takes this further by prioritizing infrastructure investments across the municipality, and determining when and how the infrastructure will be funded.

A comprehensive CIP allows policymakers to take a close look at their municipal master plan, and how to implement that plan's vision through infrastructure investments. Considering the lifecycle costs of infrastructure, whether proposed or existing, will help

to keep operation and maintenance costs in check. An asset management program is used to track the life of a community's infrastructure, and is a critical tool when maintaining municipal infrastructure. If policymakers can understand the condition of different elements of their municipality's infrastructure, they can charge the appropriate user fees and taxes, saving for necessary maintenance or replacement in the future. They can also save money by coordinating projects. For example, if a road and a water line will both require an upgrade, both projects can be done at the same time. Asset management tools are often reactionary in that they manage assets which already exist, as opposed to evaluating the cost before they are installed. But the same technology used in asset management can be applied during the planning process before infrastructure is built.

Modeling can determine the infrastructure needs for particular uses. The cost of maintaining those proposed systems can be estimated, allowing a community to understand the true long-term cost implications of adding new infrastructure. Sophisticated tools and data can demonstrate the true cost of development not only in terms of finances, but ultimately on the character of the community, allowing policy makers to consider how plans, policies and infrastructure may affect the community.

This tear sheet was developed by the Michigan Association of Planning (MAP) for the Michigan Economic Development Corporation (MEDC). The Michigan Association of Planning is a 501 c 3 organization, dedicated to promoting sound community planning that benefits the residents of Michigan. MAP was established in 1945 to achieve a desired quality of life through comprehensive community planning that includes opportunities for a variety of lifestyles and housing, employment, commercial activities, and cultural and recreational amenities.

