Chapter V: Transportation

Introduction

The original NORRA study showed that the large majority of municipalities in Northeastern Ohio were oversaturated with retail space. In addition, the most recent findings show that in spite of this result the amount of retail space has continued to grow. Clearly there is a need to start thinking about the impacts that continued retail growth will have on the environment, economy, and overall quality of life for residents.

To serve the ever-growing supply of retail space in Northeast Ohio, transportation systems must be built. Current state and federal policies have funneled nearly all available funding into automobile-oriented construction, which has led to a proliferation of highways, roads and parking lots. The following section will examine the impacts of this auto-centric development pattern on the economy, public health and the environment. It will also recommend policies that mitigate these impacts.

Sustainability

Retail Development and Land Use

By developing additional land and replacing natural areas with buildings, roads, and parking lots there is a cost to the environment and in turn the quality of life for future residents of Northeast Ohio. One question that residents should ask is how much consideration is given to the future impacts of big box retail developments, shopping malls, and other forms of sprawl. While it may seem that the leasing and sale of property to retail establishments will generate tax revenue and jobs to the community, it is highly unlikely that these benefits will be sustainable over the long-term.

The most obvious impact that results from retail development is the degradation of natural ecosystems such as wetlands, meadows, forests, and fertile farmland. The sprawl development that is taking place in the area either fragments or completely destroys these natural habitats. While it is true that the majority of the study area in Northeast Ohio has already lost these sensitive lands, there is still the opportunity to preserve natural places on the urban fringe. Restoration practices are also an option for communities that are able to fund such projects and find experienced persons to manage the development of these sites.

By clearing or fragmenting land, the wildlife that is dependent upon these very specific niches is also threatened. Oftentimes the land that is cleared is regarded solely for its monetary value. This can be problematic, because without giving value to wildlife there is no incentive to investigate the numbers or species inhabiting the land. In addition, there is pressure stemming from competition between neighboring municipalities. A town that has the opportunity to preserve these lands cannot make a strong enough argument when an adjacent town is booming with development – making it seem progressive. What results is an overall loss of habitat and precious resources, which could be in demand in the future.

In terms of human impact, there can be damage to one's psychological, physiological, and spiritual health. The fact that humans have evolved over hundreds of years within natural areas should not be underestimated. It is hard to say how the current disconnect with nature

impacts our overall health. In another portion of this report the physiological impacts will be examined. There are also fundamental psychological and spiritual connections that humans should maintain in order to achieve optimum health. The field of ecopsychology seeks to determine the relationship between humans and nature. Ecopsychologists argue that the connection between humans and nature is beneficial for both. When this relationship is fostered, damage to the environment (ecological devastation) and to humans (grief, despair, and alienation) can be avoided.[285]

One other cost to the community, in the long-term, is a decreased opportunity for developing alternative land uses. After land has been cleared and paved, the option of maintaining the space as a preserve or recreation area becomes far out of reach. Restoration is an option, but this can be expensive and it is hard for humans to recreate an ecosystem that had naturally developed over a long period of time. One may think that it would be easy to convert the space for other uses if the retail store does not succeed. However, this is not always the case, especially when many chain retail stores have a specific and recognizable design for their buildings.

Strategies to Prevent Future Degradation of Land

What options do cities have to preserve natural lands given the seemingly insurmountable pressure of increased development? It seems as though for Northeastern Ohio the primary objective should be to not only preserve what land is left, but to do so through collaboration on a regional scale to diminish the pressure of continued growth that the less developed communities have. Moreover, partnership between the public and private landowners is essential in order to find the optimum strategy for managing land use.

Preservation Strategies

Conservation Easements and Working with Land Trusts

According to the Land Trust Alliance (LTA) there are currently more than 1,600 non-profit land trusts.[286] Through arduous efforts they have protected more than 37 million acres of land combined.[287] Land trusts operate to help individual land owners sell, donate, or set up conservation easements on their property. A conservation easement is a legally binding agreement between a landowner and municipality that spells out the ways in which a particular piece of land is to be managed. Currently there are four LTA member land trusts operating within the seven county study area. They are the Gates Mills Land Conservancy, Western Reserve Land Conservancy, Grand River Partners Inc. and Waite Hill Land Conservancy.

The Cleveland Museum of Natural History has also made efforts to preserve habitat through their Natural Areas Program. The overall mission of the program is to acquire a system of nature preserves that represent the biodiversity that can be found in Northern Ohio. Currently three of their preserves are open to the public: Mentor Marsh, Scheele Preserve and North Kingsville Sand Barrens.

[285] John Davis. "What is Ecopsychology?" http://www.johndavis.com/ep/epdef.com (April 2007)
[286] Land Trust Alliance. "2005 Land Trust Census Report." http://www.lta.org/aboutlt/census.shtml (April 2007)
[287] Ibid.

Volunteerism and Civic Involvement

Here it is appropriate to quote the famous line proclaimed by Margaret Mead: "Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has." One essential piece of land conservation is citizen demand and involvement. By showing interest and getting involved in an effort to protect remaining parcels of land, residents can show that their need for open spaces is greater than their need for another big box or strip mall development.

The other option would be for residents to become involved in restoration efforts. However, communities should not overdevelop the land in their neighborhoods thinking that restoration would be feasible in the future. A workshop conducted by Building the Livable Urban Edge (BLUE) asked the question, "If ecological restoration were a primary goal for Cleveland's lakefront, what should we do?" The study concluded that Cleveland might not be ready for such a task due to operational, funding and land use issues.[288] This conclusion emphasizes the reality that once an area has been developed it is hard to go back.

Public Land Acquisition and Preservation

Government entities can make a huge impact on conservation efforts because they have the power to acquire land on a larger scale. One example is the "Land Acquisition Program" established by the Northwest Florida Water Management District." Thus far, more than 179,000 acres of wetlands and recharge areas have been acquired since 1984.[289] The primary funding sources for the program are a statewide documentary stamp tax on real estate and through the sale of bonds.

Increase Density and Encourage Infill

Local municipalities can encourage infill development by targeting and restructuring the obstacles that make these sites undesirable. This would include improving infrastructure, shortening the permit process, making it easier to assemble parcels, and updating zoning provisions.

Reasons for Saving Land

Why is it important to save land? Would it be fair to ask the counties that have not been completely developed (areas of Portage, Lorain, Medina, and Geauga) to set aside land considering the other counties have relentlessly gobbled up all of their available land? It seems necessary to develop a regional consortium which would create specific strategies to provide revenues to municipalities making a conscious decision to preserve land for all of the residents in the seven county area. After this has been accomplished we can begin to think in terms of the benefits that would be realized through preservation of existing spaces: educational value, aesthetics, spiritual reasons, ethical considerations, human need for natural areas, ecosystem services and goods and economic benefit.

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[288] Ecocity Cleveland and the Cleveland Waterfront Coalition, Building the Livable Urban Edge (BLUE). "Ecological Restoration Opportunities for Cleveland's Lakefront." http://www.ecocitycleveland.org/ecologicaldesign/blue/eco-restoration.html (April 2007)

[289] Northwest Florida Water Management District. "Land Acquisition Program." http://www.nwfwmd.state.fl.us/lands/lands.htm#funding (April 2007)

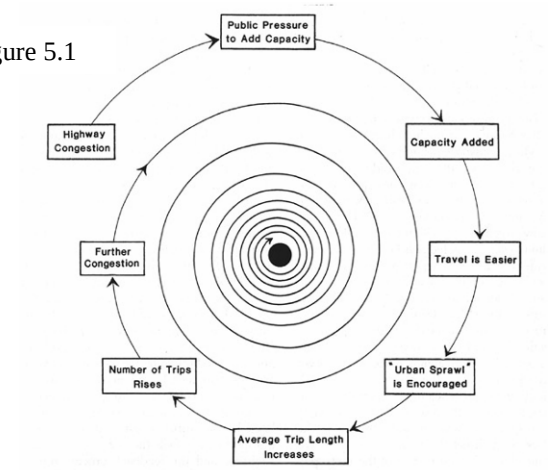
ODOT Policies and Retail Sprawl

Retail and office space are among the most transportation-intensive land uses. Euclidean zoning – which separates residential, industrial, retail and office uses – means that few people in communities developed after the 1920s can walk to shopping areas or to work. Instead, they must drive or take public transit. As will be discussed in detail below, current federal and state policies heavily favor automobile-centric development over transit-oriented development. This leads to an ever-growing need for highways, roads and parking lots to serve shopping centers.

An amendment to the Ohio Constitution, dating to 1947, requires the Ohio Department of Transportation (ODOT) to spend all passenger vehicle license fees and gas tax revenue exclusively on highways – construction, reconstruction, maintenance and repair. In 2006, that translated to $3.04 billion, or 49 percent of the department's budget, spent directly on highways. By comparison, ODOT spent just $92 million on transit – or 1.5% of its budget. (The remainder of the department's funding goes to research and planning, railroads and airports, rest area upgrades and other projects.)[290]

Much of Ohio's spending on public transit comes from federal sources. The amount of state money spent on transit has fallen precipitously in recent years due to rising opposition to transit projects in the state legislature, which has been controlled by suburban and rural Republican interests. Only $16.3 million in state money goes to mass-transit trains and buses, down from $43 million in 2001. This translates to $1.58 per capita, far lower than nearby states with comparable populations. For example, Michigan spends $20.73 per person, while Pennsylvania spends $63.29 and Illinois spends $61.25.[291]

Figure 5.1



This pattern of funding highways over transit by a 33:1 ratio has played a major role in promoting residential and retail sprawl. It has led to what some planners have termed "The Black Hole Theory of Highway Investment," in which congestion leads to new construction, which in turn leads to additional land consumption and eventually more congestion.[292] (See to left).

The department's coffers are growing, but there has been little push for additional transit funding. ODOT raised the state gas tax 6 cents (27%) in 2003. Most of the new money was earmarked to help fund a 10-year, $5 billion highway construction program. Because the hike was heavily supported by the Ohio Contractors Association and construction industry allies, critics have accused ODOT of being unduly influenced by campaign contributions and by the clout of asphalt and construction contractors.[293]

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[290] Kellogg, Wendy. "The State Role in Guiding Land Use Change in the Ohio Lake Erie Basin." Prepared for EcoCity Cleveland (March 26, 2007).

[291] Tuscano, Mark. "Laketran may seek dedicated funding." *News-Herald* (Willoughby, Ohio), 19 October 2006.

[292] Hanson, Susan, ed. *The Geography of Urban Transportation.* (New York: Guilford Press, 1986).

[293] Wendling, Ted and T.C. Brown. "Gas-tax increase fuels ODOT building boom." *Plain Dealer*, 31 December 2006, sec. A, p. 1.

The outcome of these automobile-centric policies is readily apparent in Northeast Ohio. Cleveland, once confined to a dense core of 77 square miles served entirely by streetcars and buses, now sprawls across five counties and more than 70 suburbs, even as the metropolitan area has seen minimal population growth for decades. Many communities in this sprawling metropolis – particularly those in outlying counties – have little or no access to public transportation. New retail in these areas is similarly ill-served by public transit, making it difficult for residents of the city and older suburbs to shop there without a private automobile.

This continued dependence on automobile-oriented development forces people to spend an ever-greater share of their income on gasoline, motor oil, car insurance and maintenance. In 2003, the average Cleveland-area household spent just over 20 percent of its income on transportation – the second-highest proportion among the nation's 28 largest metropolitan areas, after Houston. This fuel dependency puts a heavy financial burden on households – particularly low-income households – and diverts money out of the local economy.[294] The more Ohio invests in highways, the more it discourages population density. Correspondingly, it has become increasingly impractical to build effective mass transit systems because public transit requires relatively high densities to be well-used.[295]

Even in the area of road improvements – ODOT's bread and butter – older areas and inner cities tend to take a back seat to projects on the fringes. This can be attributed to a scoring system ODOT has used since 1997 to determine which highway projects it will fund. A group called the Transportation Review Advisory Council (TRAC) evaluates proposed projects, usually submitted by a regional transportation organization (such as NOACA in Northeast Ohio). It grades each project on several criteria, each weighted differently. The criterion weighted most heavily is "increased capacity," which automatically puts urban projects at a disadvantage because many built-out cities have no room to widen roads or add new ones. Thus, projects in suburban and rural areas win out. In fact, ODOT's "Access Ohio" program aims to place "94 percent of Ohio's population … within a 15-minute commuting distance of an efficient corridor which can attract economic development."[296] These policies push people – and thus stores – ever farther from the center.

ODOT Policy Outlook

Gov. Ted Strickland, Ohio's first Democratic governor in 16 years, has taken aim at some of ODOT's current policies and initiated major staff changes. Since his election, all the department's district directors – who coordinate transportation plans in different sections of the state – have either stepped down or been fired. In February 2007, Strickland said the pace of road construction projects would slow because ODOT had overcommitted itself by some $1.2 billion.[297]

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[294] Bernstein, Scott et al. "Driven to Spend: Pumping Dollars Out of Our Households and Communities." Center for Neighborhood Technology and Surface Transportation Policy Project (June 2005).

[295] Kellogg, Wendy. "The State Role in Guiding Land Use Change in the Ohio Lake Erie Basin." Prepared for EcoCity Cleveland (March 26, 2007).

[296] Ibid.

[297] Nash, James. "Project slowdown; Governor: Road Work Too Costly." *Columbus Dispatch* 16 February 2007, sec. A, p. 1.

Strickland also named a new director, James Beasley. Beasley has given mixed signals about his transportation philosophies. On the one hand, he has accused the TRAC system of favoring urban areas over rural ones because it considers accident rates, congestion and average daily traffic in deciding which projects to fund.[298] This could be read as an endorsement of new road-building in rural areas, which could promote sprawl. Yet during budget hearings in April 2007, he said Ohio's transportation policies must embrace more than just the private automobile. "A multi-modal approach targets the headache of all motorists: congestion and roadway wear-and-tear. By putting more people in buses and more freight on trains, we ease traffic congestion and preserve our highway conditions," Beasley said.[299] He and Strickland have also proposed a modest increase in transit spending. Time will tell whether these steps lead to substantive change in state transportation policy.

Meanwhile, Northeast Ohio's own transportation planning agency, NOACA, has adopted a set of transportation priorities that take a slightly tougher stance against sprawl than ODOT's TRAC system. Its nine criteria for scoring projects include relieving congestion and improving safety – like ODOT – but also include urban core reinvestment, multimodal and intermodal considerations and planning. If ODOT's policies were revised to include some of these criteria, the pace of sprawl throughout the state might slow.

The tension between ODOT and NOACA policies reached a potential tipping point in the debate over a proposed new interchange off Interstate 90 in Lorain County. Officials in the city of Avon, the growing exurb where the new exit would be located, want the interchange to relieve traffic congestion and spur new development. Hoping for higher property values, private developers and landowners have offered to pay for as much as 70% of the $15 million project. NOACA must approve the project in order for it to proceed. In February 2007, the agency announced that its decision would be based in part on an economic impact study that would explore whether the interchange would siphon business and people away from older suburbs in western Cuyahoga County. The study would be the first of its kind to consider impacts beyond a new interchange's immediate community. It was viewed by some as a sign of Northeast Ohio's growing interest in stemming sprawl.[300]

Parking Lot Design

Parking lots are level areas paved with permeable or non-permeable materials intended for parking vehicles. The largest examples of parking lots are found surrounding large shopping centers such as regional malls. City ordinances and retailer preferences have driven parking lots size to reach epic proportions. Everything from small, grocery-anchored centers to regional malls commonly contain six spaces per 1,000 square feet of gross leasable area (GLA). Assuming shopping centers have between 150,000 and 2.5 million square feet of GLA, they could contain 900 to 15,000 spaces.

[298] Ibid.
[299] Gongwer News Service, "Transit Systems Seek Study of Dedicated Funding Source to Avert 'Crisis in Public Transportation.'" Vol. 76, no. 67 (April 5, 2007).
[300] Hollander, Sarah. "Agency plans first regional impact study." *Plain Dealer* 10 February 2007, sec. B, p. 1.

Paving Materials and Environmental Impacts

Traditional retail surface parking lots are paved in asphalt or concrete, which are impermeable. They tend to deflect water instead of allowing it to absorb into the ground. How a parking lot handles water from rain or snow varies greatly. Like roads, they might have extensive sewer systems capable of handling large amounts of water. However, parking lots often do not have their own drainage systems. Consequently, each time it rains almost all of the water, excluding evaporation, becomes runoff. Traditionally, runoff ends up in city storm sewers which in turn feed into rivers and lakes. Yet this leads to frequent overflows. Today, many communities require builders to construct detention basins in their parking lots to help slow runoff, thereby mitigating stress to the sewer system during peak flows.

Parking lots can also affect water systems in other ways. When cars and trucks park on lots they often drip motor oil, radiator fluid, brake dust and rust. In small amounts, drips from cars have minimal impacts. But the problem is multiplied by the number of cars and the overall size of the parking lot. Detention ponds, again, can allow sediment to settle out. Effectively the sediment remains in the basin without allowing the oil and other particles to trickle into the streams and waterways.

Parking lots constructed of brick and paving blocks are friendlier to the environment. These materials allow water to absorb into the ground after being filtered by the paving block. This also reduces the total amount of water which would otherwise flow into the system.

Parking Management

The typical response to parking problems is simply to create more parking. This is not a viable long-term solution. The growing supply of parking dilutes proximity among businesses, leading to increased automobile use and other problems such as traffic pollution, congestion and sprawl. [301]

Strategies to encourage businesses to share parking aim to increase efficiency and lessen environmental impacts. Under a district parking plan, for example, parking could be shared among businesses that have different operating hours. [302]. Patrons visiting a jazz club or bar would use the parking lot at night; the same lot could be used by patrons of a breakfast restaurant in the morning. Since the two businesses have different operating schedules, each business would have ample parking available during their respective peek hours of operation. Often times, there is sufficient parking in an area but it is so poorly allocated between buildings that some spaces on individual lots can go empty while drivers compete for spaces at other lots.

Another approach to effective and efficient parking management is called “fee in lieu of parking” [303] which allows cities to plan district parking while the developers pay for the cost – essentially an impact fee for development. The city uses the fees, which would be paid by all

[301] Krieger, Alex. “Rules for Designing Cities.” In *The Mayors’ Institute: Excellence in City Design*, pp. 105-111. Washington: Princeton Architectural Press, 2002.
[302] Litman, Todd. “Parking Management Best Practices.” *Planning*, October 2006, 40-45.
[303] Mukhija, Vinit and Donald Shoup. “Quantity Versus Quality in Off-Street Parking Requirements.” *Journal of the American Planning Association* (Summer 2006): 296-308.

buildings in a district, to construct shared parking. This approach would make it easier and more affordable to redevelop buildings where on-site parking is not feasible or available.

Overview: Health Issues and Policies

The effects on human health due to transport and land-use strategies are increasingly recognized. While injuries and annoyance from traffic have long been identified as important consequences of certain patterns of transport activities, evidence of the effect of air pollutants on health – including respiratory and cardiovascular diseases – has emerged only in the last few years. Global warming, thought to be caused in part by carbon dioxide emissions from private automobiles, will also likely have devastating public health impacts.

Further, sedentary lifestyle is associated with the use of motor vehicles. Half the adult population in developed countries is sedentary or does minimal physical activity. The contribution of sedentary lifestyle to heart disease is similar to that of tobacco. Obesity can also result from non-active lifestyles, which can in turn cause diabetes and other diseases. Strategies to address sedentary lifestyle include physical activity to accomplish daily chores, notably through walking and cycling for transport.

Each of these transport-related risks imposes a considerable burden on public health. Most human exposure from air pollutants comes from traffic, and evidence is emerging of a direct link between respiratory problems and residence near busy roads, or roads with very heavy-vehicle traffic. (Air pollution will be discussed in further detail below.) Noise pollution can also affect people's health, through sleep disturbance, speech interference and general annoyance.[304] "Road rage," meanwhile, has become an increasingly common stressor as roads become more congested with traffic. Traffic congestion, long commutes, chauffeuring children and others to sports practices, events, appointments – all add to the stress of daily living[305].

In sum:

- More driving means more automobile crashes
- Driving spawns road rage
- Poor road design can be lethal for pedestrians and cyclists
- Older neighborhood designs encourage walking and newer urban forms discourage walking

Strategies for Change

In designing new transport policies, a holistic approach is crucial. Some strategies may be beneficial for one health element but not others, for health as a whole but not for the environment, or for the short but not the long term. For example, higher speeds over certain ranges reduce pollution but increase accident risks. New desulfurized fuels improve the particulate situation but generate more environmentally damaging carbon dioxide.

Governments should adopt two important related strategies to address these issues. They must internalize health externalities, which involves establishing policies to regulate or encourage more optimal use of existing transport systems; and make decisions concerning

[304] Sandberg, U., ed. The effects of regulations on road vehicle noise. *Noise news international*, 6: 85–113 (1995).
[305] Transportation Research Board Paper on Transportation and Health Issues

transport infrastructure and urban development that take appropriate account of the health implications.[306]

Making such decisions means establishing systems that routinely, accurately and comprehensively identify the health consequences of transport and land-use strategies. It also means developing and applying methods to measure the economic impact of these health consequences. Governments should pay special attention to groups at greater risk of transport-related health effects. This includes women, elderly people, children, the ill or disabled, the poor and people living in areas with greater traffic exposure, and those using vulnerable transport modes (e.g., bicycling).

Finally, local, state and federal cooperation and coordination are needed to fill the gaps in knowledge on the health effects of transport.

Impacts

In Focus: Transportation-Related Air Pollution

Despite the United States' abundant resources, air quality is an issue even here. The six most common air pollutants in the United States are classified by the EPA as *criteria air pollutants*: Carbon Monoxide (CO); Lead; Nitrous Oxides (NO_x); Volatile Organic Compounds (VOC's) , also known as hydrocarbons, (which interact with NO_x to form ground-level Ozone (O_3) also known as smog); Particulate Matter (PM); and Sulfur Dioxide (SO_2). These pollutants can cause health issues, environmental problems, and property damage. The EPA sets National Ambient Air Quality Standards (NAAQS) for each criteria pollutant. These standards set the maximum concentration allowed in the air. If the NAAQS for a pollutant is exceeded, human health can be impacted. These pollutants are monitored, and areas that routinely exceed the NAAQS are classified as non-attainment areas.

Of the six criteria pollutants, four are directly related to transportation issues: CO, NO_x, VOC's, and PM. In addition, there is another air emission relevant to transportation and the environment, this being the greenhouse gas Carbon Dioxide (CO_2). According to 2006 U.S. Environmental Protection Agency data, 158 million people live in areas of non-attainment for eight hour O_3; over 29 million people live in areas of non-attainment for PM_{10}; 15 million people live in non-attainment areas for CO.[307] Ohio is not immune from the air pollution issue, and Northeast Ohio is especially not without problems. The seven counties covered in this retail study are almost always found among the top twenty-five counties in Ohio for mobile emissions of criteria air pollutants.[308] It is no coincidence that these counties are also the ones currently included in Ohio's Vehicle Emissions Testing Program (ECheck). The area is in non-attainment for both eight hour ozone and PM.

Hydrocarbons, or Volatile Organic Compounds, are gases emitted by certain solids and liquids. VOC's come from a variety of sources, including transportation emissions. VOC's react with NO_x to form ground-level ozone, otherwise known as smog. Because of the number

[306] Center for Sustainability (2004) www.c4s.info, Transportation Research Laboratory, www.trl.co.uk.
[307] U.S. Environmental Protection Agency, "Nonattainment Areas for Criteria Pollutants." December 6, 2006. http://www.epa.gov/air/oaqps/greenbk/ (accessed April 10, 2007).
[308] Scorecard, "Pollution in Your Community." 2005. http://www.scorecard.org/index.tcl (accessed April 10, 2007).

of compounds that qualify as VOC's, their environmental and health impacts from eye and throat irritation, to organ damage, to cancer in some animals.[309] This area is a non-attainment area for ground-level ozone. NOACA currently has a variety of programs that address the ground-level ozone problem, such as Ozone Action Days. In addition, the EPA's 8 Hour Ozone NAAQS addressing the issue is currently being litigated.

Carbon Monoxide is a nearly odorless, colorless gas created by the incomplete oxidation of carbon in combustion. The largest source of CO emissions is vehicle emissions, 77% of national CO emissions are a result of transportation sources.[310] At low concentrations, CO may cause fatigue in healthy people and exacerbate heart conditions.[311] At higher concentrations it will cause flu-like symptoms, impaired vision and coordination, and it may be fatal in certain concentrations.[312]

Nitrous Oxide refers to a variety of compounds made up of nitrogen and oxygen in varying amounts. While normally colorless and odorless, one form, NO_2 can combine with air particles in urban areas to form a reddish-brown substance.[313] Motor vehicles accounted for 55% of NO_x emissions in 2003.[314] The NO_x compounds contribute to a variety of environmental problems. NO_x reacts with VOC's to form ground level ozone; in other forms it also contributes to acid rain, while in another form (N_20) it's a greenhouse gas, and it can react to form toxic materials as well.[315]

Initially, Carbon Dioxide was not considered a pollutant by the EPA; however, a recent Supreme Court decision has held that CO_2 is an air pollutant under the Clean Air Act.[316] While it does not directly impact human health, it is a primary greenhouse gas. Greenhouse gases trap heat close to the earth and contribute to global warming. Carbon dioxide is another component of automobile emissions that need to be addressed. Given the recent Supreme Court decision holding that the EPA can, in fact, regulate heat trapping emissions under its Clean Air Act authority perhaps a change may be coming to CO_2 regulation in the United States.

When it comes to sources of air pollution, retail is not the first thought that springs to mind, that distinction is reserved for factories and power plants. However, retail is almost exclusively reliant on mobile sources (automobiles) to deliver its customers. The automobile emissions generated by trips to retail destinations are a significant source of air pollutant emissions.

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[309] U.S. Environmental Protection Agency, "Organic Gases (Volatile Organic Compounds – VOCs)." September 27, 2006. http://www.epa.gov/iaq/voc.html (accessed April 17, 2007).
[310] Scorecard, "Pollution in Your Community." 2005. http://www.scorecard.org/env-releases/cap/pollutant-desc.tcl (accessed April 10, 2007).
[311] U.S. Environmental Protection Agency, "Basic Information Carbon Monoxide." April 17, 2007. http://www.epa.gov/iaq/co.html (accessed April 17, 2007).
[312] Ibid.
[313] U.S. Environmental Protection Agency, "NOx: What is it? Where does it come from?" March 6, 2007. http://www.epa.gov/iaq/co.html (accessed April 17, 2007).
[314] Ibid.
[315] U.S. Environmental Protection Agency, "Health and Environmental Impacts of NOx" March 6, 2007. http://www.epa.gov/air/urbanair/nox/hlth.html (accessed April 17, 2007).
[316] See *Massachusetts v. EPA*, 127 S. Ct. 1438, (2007).

Tables 5.1 and 5.2 detail the amount of emissions of VOC's, CO, NO_x, and CO_2 generated annually by passenger cars and light trucks traveling to retail establishments.

Passenger Cars

Type of Shopping Center	**Cumulative Annual Vehicle Miles Generated**	**Annual VOC Emissions (lbs)**	**Annual CO Emissions (lbs)**	**Annual NO_x Emissions (lbs)**	**Annual CO_2 Emissions (lbs)**
Large Super Regional Center	70,638,750	435,657.49	3,251,871.97	216,272.82	64,705,095.00
Small Super Regional Center	51,358,499	316,748.45	2,364,300.95	157,242.98	47,044,385.08
Regional Center	22,042,231	135,943.27	1,014,719.44	67,486.13	20,190,683.60
Community Center	8,404,578	51,834.40	386,906.78	25,732.08	7,698,593.45
Neighborhood Center	1,426,511	8,797.87	65,669.78	4,367.51	1,306,684.08
Convenience Center	472,410	2,913.54	21,747.51	1,446.37	432,727.56
Power Center	28,846,272	177,906.52	1,327,945.12	88,317.88	26,423,185.15
Big Box Retailer	10,024,065	61,822.43	461,460.26	30,690.42	9,182,043.54
Large Drug Store	115,525	712.49	5,318.22	353.70	105,820.90

Table 5.1

Sources: Urban Land Institute, *Dollars and Cents of Shopping Centers*, 1998; Institute of Traffic Engineers, *Trip Generation*, 6th Ed. 1997; U.S. Environmental Protection Agency National Vehicle and Fuel Emission Laboratory, 2000.

Light Trucks

Type of Shopping Center	**Cumulative Annual Vehicle Miles Generated**	**Annual VOC Emissions (lbs)**	**Annual CO Emissions (lbs)**	**Annual NO_x Emissions (lbs)**	**Annual CO_2 Emissions (lbs)**
Large Super Regional Center	70,638,750	546,127.78	4,309,897.30	281,621.45	81,234,562.50
Small Super	51,358,499				59,062,273.85

Regional Center		397,066.81	3,133,547.19	204,755.25	
Regional Center	22,042,231	170,414.61	1,344,867.40	87,877.62	25,348,565.65
Community Center	8,404,578	64,978.13	512,790.33	33,507.24	9,665,264.70
Neighborhood Center	1,426,511	11,028.75	87,036.02	5,687.19	1,640,487.65
Convenience Center	472,410	3,652.33	28,823.25	1,883.40	543,271.50
Power Center	28,846,272	223,018.53	1,760,003.82	115,003.86	33,173,212.80
Big Box Retailer	10,024,065	77,498.83	611,600.44	39,963.78	11,527,674.75
Large Drug Store	115,525	893.16	7,048.55	460.57	132,853.75
Table 5.2					
Sources: Urban Land Institute, *Dollars and Cents of Shopping Centers*, 1998; Institute of Traffic Engineers, *Trip Generation*, 6th Ed. 1997; U.S. Environmental Protection Agency National Vehicle and Fuel Emission Laboratory, 2000.					

Since the 1960's automobile emissions have improved a good deal. However, both the number of automobiles on the road, and the number of miles driven, continues to increase often off-setting gains made through emission improvements. According to 2004 data obtained from the Bureau of Transportation Statistics, there were 243,023,485 registered passenger vehicles in the United States. Passenger cars accounted for 56% of the 243 million, while trucks accounted for another 38%.[317] Comparing the emissions figures with the number of vehicles on the road and the drawing power of larger retail centers creates the picture of unpleasant air quality consequences. Being a non-attainment area is not without consequences. Without an improvement in our situation, the area will face consequences such as the loss of federal transportation funding or stigmatism from business and industry looking to relocate or expand operations.

Since the initial study many additional retail projects have been built and proposed. As retail continues to move outward in the region, it only increases the miles driven and the emissions generated. Furthermore, larger retail developments draw from larger markets areas – also creating more miles driven and subsequent emissions. Two examples of new developments can illustrate the impact. Avon Commons is an 800,000 square foot retail center in Lorain County that came online in 2001. This qualifies as a Large Super Regional Center under the original study. In addition, there is also a proposed retail center in North Royalton that will consist of 400,000 to 500,000 square feet of new retail – which qualifies as a Small Super Regional Center under the original study criteria. Referring back to the tables above, that is an

[317] Bureau of Transportation Statics, "Table 1-11: Number of U.S. Aircraft, Vehicles, Vessels, and Other Conveyances." September 2006.
http://www.bts.gov/publications/national_transportation_statistics/html/table_01_11.html (accessed April 16, 2007).

additional 71 million in annual vehicle miles generated by Avon Commons and another potential 51 million miles that could be generated in North Royalton.

There are several possible solutions that could be adopted in Northeast Ohio to curb the air pollution problem. A 2004 study by Mark Southerland suggests several options for mitigating environmental impacts of development.[318] Among Southerland's suggestions are: development impact fees; development of concentrated activity nodes to center projects around; permitting mixed land uses; use of transportation management areas; and incentives for location-efficient development.[319] Each of these solutions requires participation of all stakeholders in order to implement, fund, or enable. Changes are being to occur, for example, in 2006 the San Joaquin Valley Air Pollution Control District instituted an assessment fee to curb their air pollution problem. The District's Indirect Source Review Program targets the developers and assesses fees for projects that will generate more traffic.[320] The money generated from the fees will be used to purchase cleaner school buses and city vehicles as well as pave roads. Impact fees are not a popular option, but they are beginning to receive consideration in other areas of the country. While perhaps not the likely in Northeast Ohio's situation, something must be done. The consequences of continuing in non-attainment could be worse on the local economy.

Policy Recommendations

Transit Oriented Development

A Transit Oriented Development (TOD) project is mixed use, dense development in close proximity to a transit stop. A core commercial area, such as a commercial main street, office, and a dense residential area should be within a short (5 minute) walk of the transit stop. The development should be pedestrian friendly, and there should be a diversity of residents (encompassing various incomes, ages, races and cultures) and housing types. Mass transit options should exist around the clock, and riders should not have to wait more than 15 minutes for a bus or train.[321]

A TOD incorporates many sustainable ideas. It promotes healthy behavior and helps to lessen the impacts of sprawl and the automobile. Denser neighborhoods lead to more easily maintained infrastructure and a tax base that is not spread thin. Diverse neighborhoods allow people to remain in the neighborhood throughout their lifetime, as they age, or as their income fluctuates. Less infrastructure is needed and the automobile is a luxury more than a necessity.

By being more pedestrian and transit friendly, a TOD encourages a healthier lifestyle through activities such as walking and bicycling. Decreased (and slower) driving leads to less air pollution, fewer (and less severe) accidents and less time wasted idling in traffic. The increased density and walkability makes a TOD neighborhood a good place for people to get to know each

[318] Southerland, Mark T. "Environmental Impacts of Dispersed Development from Federal Infrastructure Projects." *Environmental Monitoring and Assessment* 94, no. (2004): 163-178.
[319] Ibid.
[320] San Joaquin Valley Air Pollution Control District, "Indirect Source Review Program." February 12, 2007. http://www.valleyair.org/General_Info/ISRLoader.htm (accessed April 1, 2007).
[321] Tumlin, J. and A. Millard-Ball. How to Make Transit Oriented Development Work. 2003. *Planning*. May: 14-17.

other, as neighbors sit on their porches, walk in the neighborhood, commute together, and grow old in the same neighborhood.

Financially, the developer should see increased returns, as more people buy denser living space. The project is also more financially sustainable to the municipality, which can support more people on a smaller amount of infrastructure. This could lead to less maintenance, better maintained infrastructure and possibly lower taxes or increased services. Retail opportunities will exist at transit nodes. As TODs become more common, a real opportunity also exists for car sharing and bike stations. Increased density brings down the cost of housing.[322]

Rail transit ridership increases with coordinated land use policies near stations. (Boarnet 1999) Those who live in a TOD are also up to five times more likely to choose rail for their commute when compared to people in the surrounding community. This will improve financial conditions for public transit departments, reduce the impact of transportation on the environment and slow sprawl (preserving forest and farmland). TOD should lead to less air pollution per capita as fewer automobile trips are made. The decreased demand for parking could lead to improved drainage and less surface runoff and flooding.

The impact on community health should also be positive, as people spend more time walking and bicycling, and less time sitting in their cars. People will have more incentive to get outside, where there are other people and places to eat and shop within walking distance of their home. This will likely lead to increased interaction with neighbors and a strengthened community identity. The diversity of housing types may keep the elderly from becoming isolated, as they will live in the same neighborhood as young people, couples, families, and empty nesters.[323]

The following policy shifts at the federal, state and local levels could help support TODs:

1. Put a moratorium on new road construction and expansion, or at least fund improvements to existing infrastructure before creating new infrastructure.[324]
2. Increase funding for Amtrak, local transit organizations, and specific transit projects, including development projects along transit corridors. For example, in California, a percentage of highway funds are used on rail projects in San Diego County.[325]
3. Create reliable, fast, high speed train service (>75 mph) between urban areas in multi-city regions (i.e. Cleveland, Akron).
4. Create a national network of high speed trains. This can be accompanied with a moratorium on new airports and expansions of airports.[326]
5. Use form-based zoning, pedestrian overlay districts, re-zoning opportunities and other tools to increase density and decrease parking (especially within a five to 10 minute walk) near transit stops. Peter Calthorpe recommends average residential densities of 10

[322] Ibid
[323] Ibid
[324] www.transitorienteddevelopment.org
[325] Boarnet, and N.S. Compin. 1999. Transit Oriented Development in San Diego County: The Incremental Implementation of a Planning Idea. *Journal of the American Planning Association*. 65(1).
[326] www.transitorienteddevelopment.org

housing units per acre (15 in more urban developments).[327] Density should be highest closest to the transit stop.

6. Eliminate (or at least decrease) minimum parking requirements. In Alma Place in Palo Alto, California, a TOD where parking is free, peak hour demand is at four tenths of a space per housing unit.[328]
7. Encourage wider sidewalks, bike lanes, calmer traffic, and street trees.
8. Incorporate local smart growth initiatives into publicly funded plans and projects.
9. Use tax (or other) incentives to encourage TOD.
10. Increase the cost of parking.
11. Create and expand partnerships between public transportation departments and employers and schools to provide discounts and free ridership.
12. Provide public art opportunities in the pedestrian space.
13. Hide parking garages, so they do not dominate the landscape.

Fuel Cells

Beside TODs, alternative fuels can lessen the transportation-related environmental impacts of retail development. There are several types of alternative fuels. Some examples are: Diesel, ethanol, hydrogen, electric and biogas. However, the alternative fuel of focus here is fuel cells because of its assuredness in production, cleanliness and automobile manufacturers' interest in its use.

In March 2007, Ohio Lt. Governor Lee Fisher announced that more than $9 million in grants would be awarded to 13 entities for the advancement of fuel cell research and production in Ohio.[329] Nine companies and research collaborations received awards to assist in the research, development and commercialization projects of fuel cell technologies.

A fuel cell is an electrochemical energy conversion device. It produces electricity from external supplies of fuel and oxidant. These react in the presence of an electrolyte. Generally, the reactants flow in and reaction products flow out while the electrolyte remains in the cell. Fuel cells can operate as long as the necessary flows are maintained. The materials used in fuel cells differ in type.

[327] Boarnet, and N.S. Compin. 1999. Transit Oriented Development in San Diego County: The Incremental Implementation of a Planning Idea. *Journal of the American Planning Association*. 65(1).
[328] Tumlin, J. and A. Millard-Ball. How to Make Transit Oriented Development Work. 2003. *Planning*. May: 14-17.
[329] US State News, Columbus, OH, "State Awards $9 million for Fuel Cell Development", March 28, 2007. http://www.ulib.csuohio.edu/research/databases/index.html.

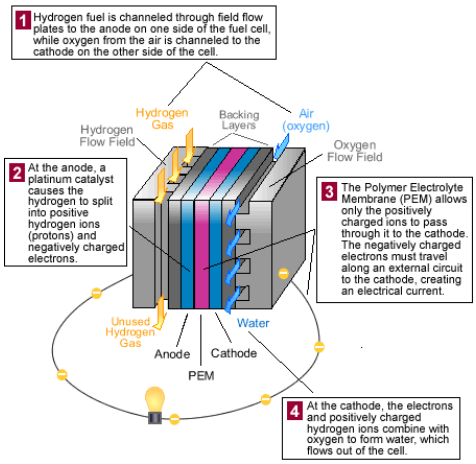

Figure 5.2

Cleveland's role in fuel cells is bringing companies in to produce and distribute the product. As the country moves from demonstrations to a commercially viable fuel cell product for the automotive sector, there are three key challenges to overcome in development: reducing the cost of production, increasing the durability of fuel cell use and ensuring reliable startup of the automobiles in freezing temperatures (there's no better place for testing that than Cleveland). In other words, one of the concepts for fueling Cleveland's economy is through research, development and distribution of fuel cells which will provide a local, national and international sustainable energy future. It is significant to mention that the funds from the $9 million grants mentioned above will result in the creation of 617 jobs.

In 2002, typical fuel cells had a catalyst content of $1,000 per kilowatt of electric power output. However, it is pertinent to remember that the high cost of fuel cell development is not unlike the development in the computer industry. In 1956, a gigabyte of memory cost $10 million. By 1980, the cost had been reduced to $193,000 per gigabyte. Today the cost is approximately $1.15.

Methods to manage the challenges in fuel cells are being developed by companies like Wellman Products Group (Solon), Contained Energy, Inc. (Shaker Heights) and in academic research labs like Case Western Reserve University, the University of Akron and even Cuyahoga Community College. The intolerance of carbon monoxide emissions is one of the greatest challenges to fuel cell production. (Vehicle emissions of carbon monoxide are greater when the weather is cold.) Ohio's inclement weather could help position the state as a national leader in the growing fuel cell industry.

The fuel cell initiative is an integral part of the Third Frontier Project, a $1.6 billion high-tech research program designed to create jobs and bring new products to market. To date, more than $62 million in funds have been awarded to fuel cell projects across the state. Cleveland is very capable of receiving a piece of the pie with its ability to accommodate alternative fuel/fuel cell companies with suitable facilities for research and development and affordable housing for the researchers, chemists and developers.

Silicon Valley achieved its title by the high concentration of semiconductor and computer-related industries in the area. Cleveland could transform itself from a blue collar town to a research and development central city—working toward a greener ecosystem.

More and more automobile manufacturers are coming out with models that run on greener fuels like fuel cell energy—Ford, Honda, Toyota, and Volkswagen. A company out of Connecticut called UTC Power (a United Technologies Company) is the sole supplier of fuel cells to NASA for use in space vehicles. The company is also developing fuel cells for automobiles and buses. It has been the first company to demonstrate automotive fuel cell start-up under freezing conditions. Companies like UTC could be persuaded to locate/relocate to Cleveland receiving the benefits of a city that is adept in production and manufacturing.

The impact of more automobiles on the roads results in residential streets becoming alternate routes as drivers attempt to avoid main road congestion. In turn, residents experience increased traffic noise and emissions pollution.[330] Alternative fuel vehicles are less noisy and emit fewer fumes than traditional vehicles, therefore making them less of a nuisance in residential areas.

If alternative fuels were used, fuel would cost less and the polluting emissions and noise would decrease. Jobs would be created and people would have more money to spend in the shopping malls of Cleveland and the surrounding suburbs. Most important, Cleveland would achieve a positive reputation of contributing to the improvement of a greener atmosphere.

[330] Northeast Ohio Regional Retail Analysis, "General Retail Development Impacts", Chapter 7, pages 156-159, August 2000