Cool Planning:

A Handbook on Local Strategies to Slow Climate Change

Oregon Transportation and Growth Management Program

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Oregon's Transportation and Growth Management Program supports community efforts to expand transportation choices for people. By linking land use and transportation planning, TGM works in partnership with local governments to create vibrant, livable places in which people can walk, bike, take transit or drive where they want to go.

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Part I Introduction

Images: Otak

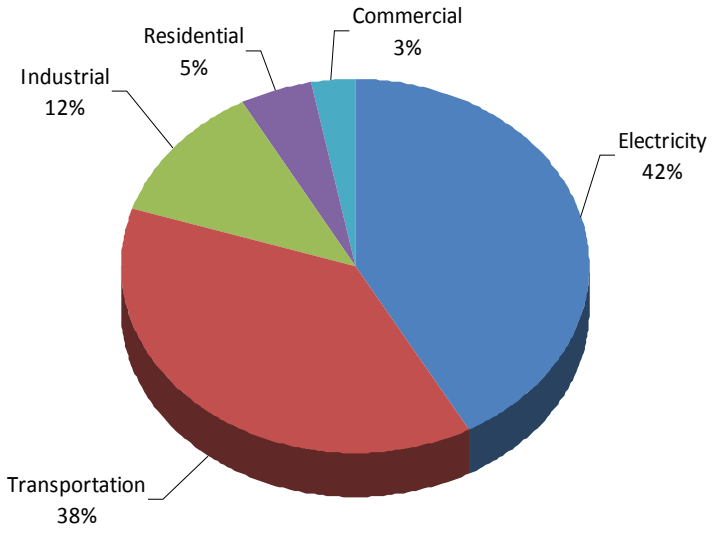
1 What's This Handbook About?

Ask people what their community is doing about climate change, and they may look puzzled. "My community? How can my community do anything about something global? It will take national or international action to fix that problem."

Granted, it will take national and international efforts to solve the problem of climate change. But that doesn't mean that all the important work will be done by presidents and prime ministers in far-away places like Kyoto and Copenhagen. Much of the work can be done here at home. In fact, much of the work must be done here at home. And one of the most important local tools to help reduce climate change is community design.

The reason is simple: the way our communities are designed and laid out has a dramatic effect on our travel, and our travel affects our climate. Transportation generates about 38% of Oregon's carbon dioxide (CO_2) emissions, mostly through tailpipe emissions from cars and trucks. CO_2 accounts for some 84 percent of the state's greenhouse gas (GHG) emissions. [1]

Oregon's CO2 Emissions From Fossil Fuels by Sector



Source: Oregon Strategy for Greenhouse Gas Reductions: Governor's Advisory Group on Global Warming

New Oregon Laws

House Bill 2186, passed by the Oregon legislature in 2009, requires providers of transportation fuels to reduce the carbon intensity of their fuel mix by at least ten percent by 2020.

Senate Bill 1059, enacted in early 2010, directs the Oregon Department of Transportation and the Oregon Department of Land Conservation and Development to work with local governments in metropolitan areas on ways to reduce greenhouse gas emissions (GHGs) through land use and transportation planning. In addition, ODOT and DLCD are directed to:

- Educate Oregonians about the need to reduce GHG emissions – and the benefits of doing so;
- Develop scenario planning guidelines aimed at helping local governments and metropolitan planning agencies to reduce such emissions;
- Prepare a toolkit to help local governments carry out programs aimed at reducing transportation-related GHG emissions.

Senate Bill 1059 also directs DLCD to set targets for GHG reductions in GHG emissions caused by cars and light trucks in five metropolitan planning organizations in Oregon. Finally, the legislation directs the Oregon Transportation Commission to adopt a statewide transportation strategy aimed at meeting the state's GHG reduction goals.

Land-use policies, development decisions, street design, road networks, transportation plans – these and other community-shaping factors greatly influence the frequency and distance of our travel and the mode of transportation we use. When local policies enable us to travel less and travel cleaner, we can reduce our carbon emissions and help our planet be a cooler place. That's what this handbook is all about.

The three-legged stool

Policy efforts to reduce carbon emissions from transportation fall into three main areas: vehicle efficiency, fuel content, and vehicle miles traveled (VMT), or the amount of driving we do. Some experts refer to these factors as the "three-legged stool."[2]

Vehicle efficiency is mainly about gas mileage. Each gallon of gasoline consumed by a vehicle produces about 20 pounds of CO_2. Thus, if we double a vehicle's efficiency – get it to travel the same distance on half as much gas – we cut its rate of carbon emission roughly in half. Public policy on vehicle efficiency has been largely the domain of the federal government and, more recently, some states. For example, Congress in 2007 passed the Energy Independence and Security Act, which calls for corporate average fuel economy (CAFE) standards for new passenger vehicles to rise to 35 miles per gallon by 2020. Thanks to a recent court decision, Oregon now has the authority to regulate vehicle efficiency and plans to implement a fuel economy standard of 43 mpg by 2020.[3]

Likewise, policy on fuel content (dealing with alternative fuels such as ethanol and biodiesel) has been set largely by federal agencies. For example, the federal Energy Policy Act of 2005 established a renewable fuel standard requiring use of at least 7.5 billion gallons of renewable fuel by 2012. The Energy Independence and Security Act of 2007 expanded this standard to require the use of 36 billion gallons of renewable fuel by 2022.

The third leg of the stool, VMT, is different, for two reasons. First, no federal or state agencies regulate VMT directly. VMT policy has fallen largely to state and local governments. Second, policies on fuel efficiency and fuel content can be negated by growth in VMT. For example, if cars become more fuel-efficient but people drive even more, the climate benefits of increased efficiency are overtaken by the climate costs of higher VMT. And that's exactly what's happening now. [4]

The bottom line? The stool falls over if the third leg fails. We can't reach our greenhouse gas (GHG) reduction goals without reducing VMT. [5] But a lack of national policy or federal law on VMT reduction leaves that problem to state and local governments. The sidebar at right shows how two local governments in Oregon, the City of Portland and Multnomah County, are meeting that challenge.

Reducing VMT has two distinct advantages as a way to deal with climate change. First, it's an approach that's available now, unlike certain technological advances that, however promising, may not bring results for years to come. Second, it's a tool available to local governments. It doesn't depend on international organizations, the federal government, or multi-national corporations.

Given the strong correlation between VMT and GHG emissions – and between VMT and community design – we need to act now. Among the most important things we can do here in Oregon is to use good community design to build more transportation choices, especially ones with low carbon footprints, into our cities, towns, and suburbs. Likewise, we need to preserve downtowns, main streets, and other compact centers where good transportation choices already exist.

Handbook's purpose and audience

We wrote this handbook to help local governments and communities throughout Oregon understand how specific community development, land-use, and transportation planning techniques can enable us to reduce our carbon footprints. The desired outcomes of such planning often are described as "smart growth" or "sustainable development."

The handbook is aimed at local elected officials, planning commissioners, planners, community organizations, and developers. It describes planning tools currently available as well as new climate action plans that can advance local efforts to reduce transportation-related GHG emissions.

In describing the focus of this handbook, it may be useful to mention a few things this handbook is not about:

First, it deals only with mitigation of climate change, not adaptation. Mitigation consists of actions taken to slow or stop climate change – to keep the problem from occurring. Reduction of greenhouse gases is the prime example. Adaptation refers to measures to deal with the effects of climate

Portland and Multnomah County's GHG-Reduction Goal

The City of Portland and Multnomah County adopted a joint Climate Action Plan 2009. Reducing per capita VMT is one of the plan's key strategies. The plan's goal is to "Reduce per capita daily vehicle-miles traveled (VMT) by 30 percent from 2008 levels."

The plan describes the effort that will be needed to achieve that goal in these words:

"As of 2005, the per capita daily passenger vehicle-miles traveled (VMT) in the Portland region are about eight percent above 1990 levels. . . . To be on target for the 2050 goals, per capita daily passenger VMT must decline by about 30 percent from today's by 2030. This reduction must occur in addition to vehicle fuel efficiency improvements and the development of cleaner fuels. Reducing per capita VMT while maintaining the mobility of and access to services for, Portland and Multnomah County residents will require significant growth in walking, bicycling and transit."

City of Portland and Multnomah County Climate Action Plan 2009 (p. 42) at http://www.portlandonline.com/bps/index.cfm?c=49989&a=268612

change – amending floodplain ordinances to address higher water levels, for example.

Second, this handbook is limited to land use, community design, and transportation planning strategies that can be applied by local governments. Such strategies constitute one set of tools among many for fighting climate change. Other measures, some involving new technologies and new ideas, will play a large role in the campaign against climate change, but they lie beyond the scope of this handbook. They include fuel-efficient cars, biofuels, electric vehicle fleets, renewable power sources, waste prevention, recycling, and emissions trading ("cap and trade").[6]

Finally, this handbook presents suggestions, not requirements. It does not say that each Oregon community must develop a climate action plan. Rather, it provides useful ideas and information for the many Oregon communities that already are developing such plans and for others interested in doing so.

But before we get to specific climate-friendly community design strategies, let's consider what climate change is, what scientists have to say about it, and why Oregonians should care about it.

Now is not too soon to act

The longer we wait to act on global warming, the longer it will take to reduce it. Some scientists even believe that if significant reductions in GHG emissions are not achieved soon, global warming will become irreversible. In the words of Paul Brown, author of Global Warming: Last Chance for Change: "Man-made global warming has a short history and a long future."

Consider this: At the request of our President, the National Research Council investigated the issue of global warming and came to this conclusion: "If carbon dioxide continues to increase, the study group finds no reason to doubt that climate changes will result and no reason to believe that these changes will be negligible. . . . A wait-and-see policy may mean waiting until it is too late."*

The President who made that request was Jimmy Carter. The year was 1978.

*Carbon Dioxide and Climate: A Scientific Assessment. Report of an Ad Hoc Study Group on Carbon Dioxide and Climate to the Climate Research Board of the National Research Council, July 1979. Available on-line in PDF at http://www.atmos.ucla.edu/~brianpm/download/charney_report.pdf

[1] Oregon Strategy for Greenhouse Gas Reductions: Governor's Advisory Group on Global Warming (December 2004), p. 29-30, at http://www.oregon.gov/ENERGY/GBLWRM/docs/GWReport-FInal.pdf. Transportation's share of all greenhouse gas emissions in Oregon, which include methane, nitrous oxide, and other substances, came to 34 percent in 2005, according to the Oregon Department of Energy. March 25, 2010 e-mail communication from Bill Drumheller, Oregon Energy Department, to Constance Beaumont, Department of Land Conservation and Development.

[2] Some experts see vehicle and system operations as a "fourth leg" of the stool. See Moving Cooler by Cambridge Systematics, Inc. Washington, D.C.: Urban Land Institute, 2009, p. 1 & 4.

[3] This is the so-called Pavley Standard for fuel efficiency, initiated in California but now adopted by Oregon. See http://www.arb.ca.gov/cc/ccms/ccms.htm

[4] "The increase in transportation emissions from 1990 to 2003 reflects continued growth in passenger and freight travel, which has substantially exceeded improvements in the energy efficiency of most major transport modes." U.S. Environmental Protection Agency, Greenhouse Gas Emissions from the U.S. Transportation Sector, 1990–2003 http://www.epa.gov/oms/climate/420r06003.pdf

[5] Reid Ewing et al, Growing Cooler: The Evidence on Urban Development and Climate Change. Washington, D.C.: Urban Land Institute, 2008, p. 1 and 17.

[6] You can learn more about these measures by exploring documents and websites listed in our "Publications and Resources" at the end of each chapter.

2 What Does Climate Change Mean for Oregon?

The world's atmosphere has a natural supply of greenhouse gases such as carbon dioxide and methane. These gases capture heat and keep the surface of the Earth warm enough for people to live. Without this greenhouse effect, the planet would be a frozen, uninhabitable wasteland. [7]

Before the Industrial Revolution, the amount of CO_2 and other greenhouse gases released into the atmosphere was in a rough balance with what the Earth could store. Natural emissions of heat-trapping gases could be absorbed in "carbon sinks" such as forests, grasslands, and oceans. Plants, for example, take in CO_2 when they grow.

Following the Industrial Revolution, cities, factories, and machines began to emit large amounts of greenhouse gases. Over time, people used fossil fuels increasingly to power cars, trucks, planes, and factories, thereby increasing the world's supply of greenhouse gases. The gases, which can stay in the atmosphere for 50 years or more, are now building up beyond the Earth's capacity to absorb them. In effect, they are creating an extra-thick heat blanket around the Earth.

Climate change predicted to bring floods, fire, rain

STORY BY JIM REDDEN

Source: A headline on climate change impacts in the February 16, 2007 Portland Tribune

The earth's atmosphere heated up by about one degree Fahrenheit during the past century, and scientists now expect global warming to accelerate. Even if future temperature changes turn out to be at the low end of scientific predictions, climate alterations are expected to be serious: stronger storms, more pronounced droughts, and increased erosion in coastal areas due to rising sea levels. If the high-end predictions come to pass, the world could face abrupt, catastrophic, and irreversible consequences.

Climate change impacts in Oregon

Likely impacts of climate change on the Pacific Northwest were described by some 50 Ph.D. scientists who convened at Oregon State University in 2004 to discuss climate change. In a public statement, the scientists stated that they were "very certain that the Pacific Northwest is warming and that since 1975 the warming is best explained by human-caused changes in greenhouse gases."[8] Climate change consequences likely to occur in this region, according to these scientists, include the following:

- more summer droughts
- more frequent and longer forest fires
- greater vulnerability of forests to insects and disease
- water resource conflicts
- longer and more intense allergy seasons
- decreased water quality
- more stress on fish, including salmon
- higher sea levels and more erosion in coastal areas
- more frequent and harmful floods. [9]

Such consequences not only would affect our state's natural environment but also would have a significant impact on Oregon's economy. That impact was described by a group of 52 economists who wrote Governor Ted Kulongoski and the Oregon legislature in 2005 to urge "prompt action" to reduce GHG emissions for the sake

Big, wet storms may become new 'normal'

Global warming | Faster-than-expected tropical expansion could bring more tempests to the Northwest

By MICHAEL WILSTEIN
THE OREGONIAN

The steamy tropical belt around Earth's midsection, birthplace of the powerful storm that pounded the Northwest this week, is expanding much faster than scientists studying global warming expected.

It's now as wide as climate models suggested it would be at the end of this century, new research shows. The rapid growth is another sign that bigger storms carrying more rain may become the new "normal" in the Northwest, especially i fall and early winter.

Because the tropics drive much of the world's weather, the new re search suggests that its growth could cause major shifts that further dr out arid regions such as the Southwest United States and direct more in tense storms toward the Pacific Northwest.

"If it continues at this pace, it will be a very big deal," said Qiang Fu, professor of atmospheric sciences at the University of Washington and a author of the research published this week in the scientific journal Natur Geoscience.

Government and business leaders in the Northwest say the region mus

Please see WARMING, Page A8

Weather in a warmer world
The tropical belt is growing, pushing storms north, feeding the Northwest with moisture.
Jetty damage
Flooding
Erosion
Expanding tropical belt

1 Ocean heats up
Most greenhouse warming has been soaked up by the ocean, raising temperatures.

2 Storms grow larger
Warmer air holds more moisture, feeding storms. The more moisture, the more potential for storms to expand and last longer.

3 Wind, waves escalate
More intense storms drive higher winds that blow farther across the ocean, building larger waves.

4 Coast takes pounding
Higher waves reach farther on shore, accelerating erosion, flooding and other damage.

Sources: Nature Geoscience; National Oceanographic Data Center; National Climatic Data Center; Oregon State University; Oregon Department of Geology and Mineral Industries

STEVE CONDON/THE OREGONIAN

An article on possible climate change impacts in the December 6, 2007 The Oregonian

of the economy. The economists based their recommendations in part on a 2005 report, "The Economic Impacts of Climate Change in Oregon: A Preliminary Assessment." It declares that climate change is "likely to impose significant economic costs on key sectors of the state's economy." [10]

For example, if droughts occur more frequently due to climate change, farmers could find water supply constraints the norm rather than an occasional challenge. Wildfire management could become more costly; salmon recovery programs, more difficult.

Under some climate scenarios, ski areas could become snowless by the end of the 21st century: glaciers on Mt. Hood already have shrunk by more than one third. [11] Accelerated beach erosion could affect private properties and shorelines and diminish the attractiveness of coastal areas to tourists. Higher waves and larger storms could affect bridges, port facilities, and other public infrastructure.

Given the financial risks associated with climate change, the 52 economists emphasized the importance of moving forward quickly: "Now is the time to act, to prepare, and to invest. Oregon's future is at stake."

Warmer winters may melt ski spots

Weather model | Even a small temperature gain could spell doom for many Northwest ski resorts

By RICHARD L. HILL
THE OREGONIAN

CORVALLIS — This winter's deep snow in the Cascades is a snowboarder's dream, but a new study suggests that ski areas may have fewer such bonanza seasons if Northwest temperatures continue to rise as they have for decades.

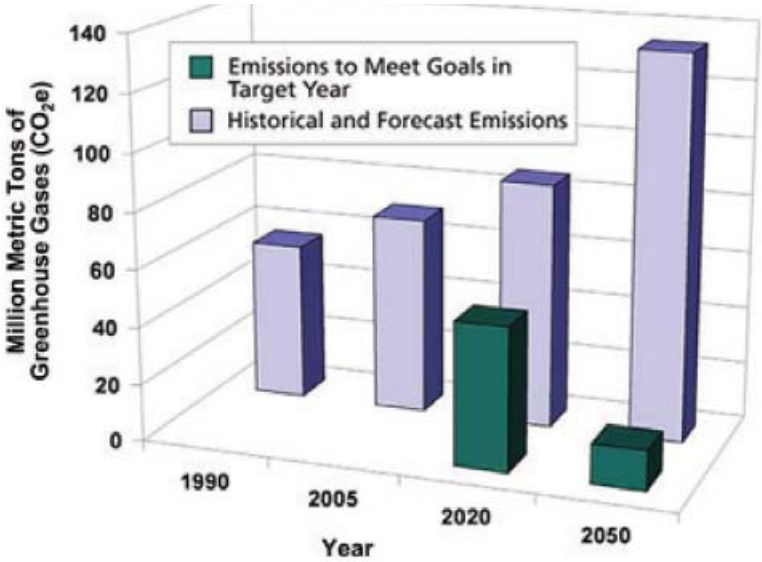
An article on the effects of warmer winters on Oregon's ski industry from the March 8, 2006 Oregonian.

Our state legislature listened to the Oregon economists, scientists, and other concerned citizens, and in 2007 enacted House Bill 3543. This measure sets these ambitious targets for reducing the state's greenhouse gas emissions:

(a) By 2010, arrest the growth of Oregon's greenhouse gas emissions and begin to reduce greenhouse gas emissions;

(b) By 2020, achieve greenhouse gas levels that are 10 percent below 1990 levels; and

(c) By 2050, achieve greenhouse gas levels that are at least 75 percent below 1990 levels.



Source: http://www.keeporegoncool.org/content/goals-getting-there

Is the problem too big to fix?

Any problem that involves the entire planet must be considered formidable. Only a Pollyanna would predict with absolute certainty that we can resolve such a thing quickly or easily. But it should be remembered that we have tackled planet-wide challenges before and met with success. Indeed, the global network of weather stations around the world that enables us to monitor climate change today is a good example of international cooperation toward a planet-wide goal.

Another success story is the international effort to reduce the size of the hole in the ozone layer over Antarctica that was first observed in 1970s. The National Academy of Sciences describes it this way:

> "Governments have proven they can work together to reduce or reverse negative human impacts on nature. A classic example is the successful international effort to phase out use of chlorofluorocarbons (CFCs) in aerosol sprays and refrigerants, which were destroying the Earth's protective ozone layer." [12]

Likewise, worldwide efforts have dealt effectively with worldwide problems before in matters such as whaling, use of dangerous chemicals such as DDT, and national claims to Antarctica. Success stories like these give us reason to believe that the problem of global warming, too, can be resolved – if we take meaningful action soon.

The Oregon Way

Oregon has a long history of taking bold action to meet daunting challenges. Our beach bill, bottle bill, and land use planning system are evidence of that. And we can address the challenge of climate change. In fact, we already are seeing some signs of success locally. For example, in 2008, the Portland region managed to reduce its carbon emissions to one percent below 1990 levels, despite rapid population growth. Over the same period, emissions in the U.S. as a whole increased 13 percent. [13]

How Portland Region Held VMT and GHG Emissions Down

In a July 14, 2009, statement to the U.S. Senate Committee on Environment and Public Works David Bragdon, president of the Portland Metro Council, explained how the Portland region has managed to stabilize greenhouse gas emissions. Among Bradgon's points:

- The Portland region has invested in more than 60 miles of light rail, an extensive bus network, and bike trails and lanes for bicycle commuters.
- Rather than spending tax dollars to extend new roads, water and sewer lines, and other services farther out, the region has focused its investments on development (and redevelopment) inside the Urban Growth Boundary.
- The region concentrates new development around transit lines and encourages mixed-use neighborhoods.
- Although most people get around the Portland area by car, they are not forced to do so. Thanks to a good transit network as well as bicycle and pedestrian facilities, many residents take advantage of other transportation choices.
- Transit ridership grew at twice the rate of population growth between 1990 and 2000.
- The average trip length in the Portland region is shrinking, and the population drives 20 percent less per day than people in other large metro areas. This means about $1.1 billion a year in savings on fuel, auto maintenance, insurance and other costs.

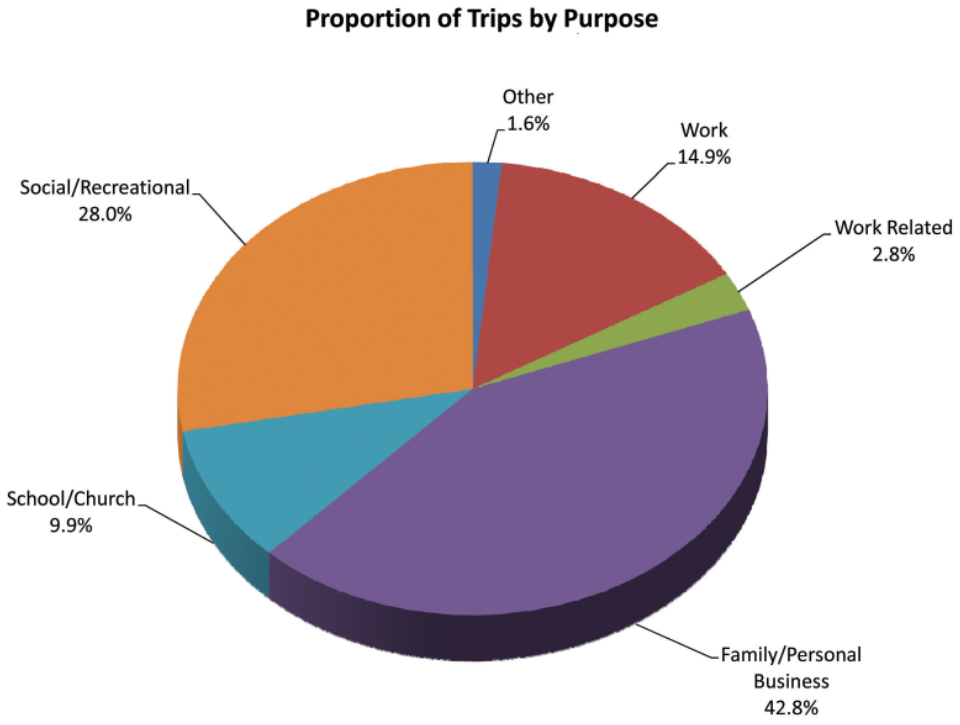
"We cannot successfully reform our transportation system without improving the way our communities are designed, and reducing the need for people to drive," Bragdon told the committee. "We can't simply reform the 'supply' of transportation; we have to reduce 'demand' – and the way our communities are laid out is a major determinant of demand. Changing fuels and reducing emissions from vehicles are good efforts as far as they go, but they will not get us the change we need unless we also reduce miles traveled."

[7] See the Environmental Protection Agency's explanation of the greenhouse effect at the EPA website, http://www.epa.gov/climatechange/science/index.html
[8] See "Scientific Consensus Statement on the Likely Impacts of Climate Change on the Pacific Northwest" at http://egov.oregon.gov/ENERGY/GBLWRM/docs/Global-AppendixC.pdf, p. 1
[9] Almost identical findings appear in the purpose section of House Bill 3543, which the Oregon Legislature passed in 2007. The law calls for "immediate and significant action to address global warming."
[10] See http://ri.uoregon.edu/publicationspress/Consensus_report.pdf
[11] Portland and Multnomah County Climate Action Plan 2009, p. 61 at http://www.portlandonline.com/bps/index.cfm?c=41896
[12] National Academy of Sciences, Understanding and Responding to Climate Change, 2008, p. 20
[13] Portland Climate Action Plan 2009, p. 7, http://www.portlandonline.com/bps/index.cfm?c=49989&a=268612

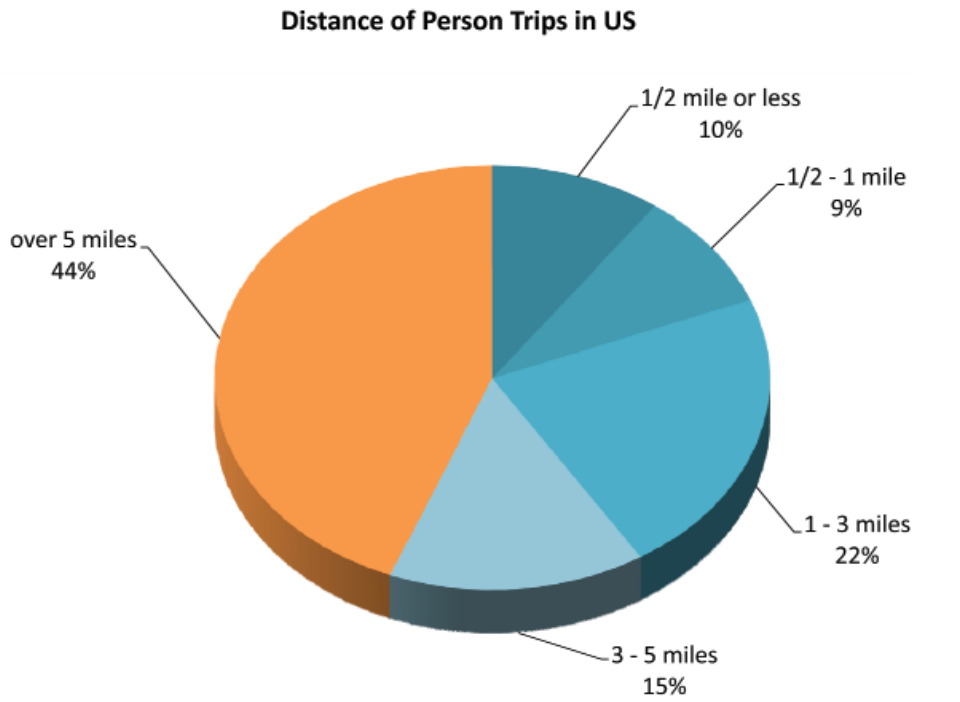
3 How Does Community Design Affect Greenhouse Gas Emissions?

The central premise of this handbook is straightforward: If communities grow smart, VMT (Vehicle Miles Traveled, or the amount of driving we do) will decline, CO_2 emissions will lessen, and we will help reduce climate change. This premise is based on the fact that our land use policies and settlement patterns significantly affect how much we drive. If we live in an area in which the places we want to go are at some distance and randomly scattered, we drive more. If we live in well-centered, compact communities in which work, schools, and shops are conveniently nearby and good transportation choices abound, we drive less. People take fewer and shorter trips.

Consider that most of the trips we take as Americans are not commutes to work, but rather trips to stores, schools, church, friends' houses, the doctor, and the like. Transportation experts classify about 82 percent of our trips as being unrelated to work. Less than 15 percent of all trips are commutes to work. [14]



Source: Federal Highway Administration, Office of Policy, 2009 National Household Travel Survey [15]



Source: Federal Highway Administration , Office of Policy, 2009 National Household Travel Survey

Many of the trips we Americans take are short. Ten percent of all trips are ½ mile or less; 19 percent, one mile or less; 41 percent, three miles or less; and 56 percent, 5 miles or less. [16]

"Cargo bikes," such as the one shown here by a local Portland company, Metrofiets, have emerged as a new product to enable people to carry groceries and other heavy things on bikes.

Image: Metrofiets

Short trips are convertible trips. That is, they are amenable to conversion from motor vehicles powered by fossil fuels to foot- or pedal-powered modes. This is why the 2009 Climate Action Plan for the City of Portland and Multnomah County endorses the creation of "20-Minute, Complete Neighborhoods" – neighborhoods in which people can carry out many of their daily activities through a short walk to nearby stores and services. [17]

For these reasons, many experts believe that reducing VMT is not only one of the most important ways to reduce transportation-related GHG emissions but also among the more feasible ways.[18] "The fact that there is pent-up market demand for pedestrian-friendly urban development makes [VMT reduction] a relatively easy policy for consumers to accept," says Christopher Leinberger, author of The Option of Urbanism. [19]

Differences among cities in GHG emissions

Each year, the United States produces about 24 metric tons [20] of greenhouse gases per person. A number that large is hard to comprehend, so instead of describing the weight of those gases in metric tons, it may be useful to express it in terms of something more familiar, like a small car. Most small cars weigh a bit more than a metric ton. A 2010 Honda Civic, for example, weighs roughly 2,700 pounds or $1^1/_4$ metric tons. So, we can say that the weight of the greenhouse gases our nation produces each year per person is equivalent to about 20 Honda Civics.

But some places in the U.S. produce a lot less GHG than others. New York City, for example, emits about seven tons – think six Honda Civics – of GHG per person a year, less than a third of the American average.[21]

Of the nation's 100 largest metropolitan areas, New Yorkers drive the least: 3,658 VMT per capita per year. At the other extreme, residents of the more sprawling Jackson, Mississippi, metropolitan area drive the most: 8,182 VMT per capita. The yearly per capita VMT for residents in California's Riverside-San Bernardino area is 6,765; that for residents of Portland, Oregon: 4,403 VMT. [22]

Such large differences from one place to another raise an obvious question: why do some communities have higher per capita VMT and thereby produce more greenhouse gases, while other cities have much lower VMT – and lower carbon emissions?

Community design affects travel behavior

Many land use experts attribute these variations to local differences in community design features that significantly influence travel behavior.[23] Features widely considered to rank among the most important are sometimes referred to as the five "D's":

- Density
- Diversity (of land uses)
- Design
- Destination Accessibility
- Distance to Transit

Density of development can be measured in several ways. Most often, the term refers to density of residential development in the number

Using more land

"Sprawl" comes in many forms: big-box stores with acres and acres of free parking; ever-larger schools on ever-larger campuses built at ever-greater distances from the neighborhoods they serve; larger homes on larger lots farther from their community's center . . . Developments such as these cause our per capita consumption of land to climb rapidly. The authors of Growing Cooler observe, "Land is being consumed for development at a rate almost three times faster than population growth. This expansive development has caused CO_2 emissions from cars to rise even as it has reduced the amount of forest land available to absorb CO_2."

A good read

With Growing Cooler (ULI, 2008) authors Reid Ewing, Keith Bartholomew, Steve Winkelman, Jerry Walters and Don Chen have produced a useful analysis of how urban development affects our climate change. Along the way, they offer a good discussion of what sprawl is and why it occurs. Our description of the 5 D's borrows extensively from their work.

of dwelling units per acre. Lower densities are often associated with sprawl; higher densities, with smart growth. (See page 180 for a definition of smart growth) All other things being equal, the more units per acre, the fewer vehicle miles are traveled. And the fewer vehicle miles traveled, the fewer greenhouse gases emitted.

Diversity refers to the mix of land uses: residential, commercial, industrial, public, and open space. A community's land use is diverse to the extent it has a variety of uses in close proximity. The classic example is the mixed-use development with retail shops on the first floor, offices and businesses on the second, and dwelling units on one or more floors above. The idea here is that people can walk or bike from home to work or to shops without getting into a car. As the number of non-driving trips goes up, VMT and CO_2 go down.

Design in this context doesn't refer to architecture, the design of individual buildings (although that certainly can help reduce greenhouse gases, too). Here, we are speaking of community design, the layout and planning of subdivisions, neighborhoods, planned unit developments, and infrastructure. For example, a well-designed subdivision will have well-connected streets, bike paths, and walkways. These and other features give residents a greater range of transportation choices and lessen their need to drive. That in turn reduces VMT and CO_2.

Destination accessibility means the ease (or difficulty) with which people can reach the destinations – work, school, and stores – essential to their daily routine. It's often expressed in terms of the number of jobs within a given distance or travel time from home. Residents of areas with high destination accessibility generally need to drive less.

Distance to transit refers to the shortest distance between homes and transit stations. Shorter distances make transit usage more feasible. Greater transit use in turn reduces VMT and CO_2 emissions. Of course, distance to destinations besides transit stops – e.g., schools, shops, and services – is also important.

Those, then, are the five Ds. "Non-D" factors deemed equally important include parking and "centeredness."

Parking, notably the supply, management, and pricing thereof, ranks among the most powerful determinants of travel behavior. When it is free and ample, people tend to drive more. But as we will see in Chapter 12, where parking is discussed in some detail, free and plentiful parking can significantly increase distances between local

destinations, thereby decreasing the practicality of travel by low-carbon modes.

Centeredness (sometimes referred to as centrality)[24] is a seventh critical factor. It's a concept reflected in expressions like "city center," "the downtown," "Main Street," or "the central business district." Such centers have a high concentration of jobs and services, often with pleasant streets, plazas and other amenities that make it easy to walk. Compact communities have strong centers (and perhaps some sub-centers). In contrast, sprawling communities tend to have weak centers, with development spread haphazardly over a large area.

These seven factors – the five D's plus parking and centeredness – greatly affect VMT and, therefore, GHG emissions:

- higher densities
- greater diversity of land uses
- community design that provides good connectivity
- better destination access and greater choice of transportation modes
- shorter distances to transit
- appropriate parking supplies, management, and pricing
- concentration of activities in centers.

Gresham Station is a part of the Gresham Civic Neighborhood, a mixed-use, transit-oriented regional center.

Image: Metro

Potential for smart growth

"There were almost 116 million units of housing in the United States in 2000. By the time we reach 350 million people in 2030, we'll need a total of 155 million homes. Considering that about 18 percent of existing units will be lost to fire, natural disasters, or demolition in the next 25 years, we'll need to build about 60 million new units to house the population. And that doesn't include the 104 billion square feet of new space that will be needed for commercial, industrial, and institutional uses."*

If good planning and smart growth principles are used to shape all that new development, the benefits to our communities and to our climate would be tremendous.

*Source: Julie Campoi and Alex S. MacLean, Visualizing Density. Cambridge, Mass., Lincoln Institute of Land Policy, 2007, p. 5.

Planners often use the term "smart growth" to describe development with all or many of the above characteristics. Development that lacks them is characterized as "sprawl." Since the focus of this handbook is on reducing climate change, we describe growth and development as "smart" if it helps to address these seven factors in a way that reduces greenhouse gas emissions. We hasten to add, however, that smart growth measures are smart for a lot of other reasons, too. They enhance livability, increase efficiency of public service systems, reduce travel costs, and more. In short, smart growth is good for communities as well as the planet.

Smart Growth

Can smart growth make a big difference?

Faced with an array of policy choices, local governments seeking to reduce their community's carbon footprint through smart growth want to know which strategies will yield the best results. Is increasing density the most important thing to do? Providing for mixed land uses? Changing parking policies? All of the above and more? How do these and other community design features stack up in terms of their effectiveness?

Because research on the relationships among transportation, land use, community design, and GHG emissions has become one of the hottest topics in planning circles in recent years, we can look to a number of studies for insights into these questions.

Many studies have found strong correlations between higher-density developments on the one hand and lower VMT and lower GHG emissions on the other. [25] For example, a study from Georgia Tech compared two scenarios in selected U.S. urban areas for reducing CO_2: converting all cars and trucks in the urban areas to higher-mileage hybrid vehicles by 2050, versus doubling density of development over the same period:

> Our results suggest that, all else being equal, a doubling of mean population density throughout the median metropolitan area would have the effect of reducing vehicle CO_2 emissions by about 30% relative to the BAU [Business As Usual] scenario, while the full dissemination of conventional hybrid technology was found to reduce vehicle CO_2 emissions by 18%. [26]

In other words, the study suggested that doubling of density by 2050 would do more to alleviate vehicular GHG emissions than putting everyone in hybrid vehicles by that same year. Neither event is likely to occur, but the comparison of these two hypothetical scenarios is instructive.

The idea that compact urban form can play an important part in dealing with climate change is reinforced by other studies. An analysis conducted for the book Growing Cooler concluded "compact development has the potential to reduce total U.S. VMT by 10 to 14 percent and total U.S. transportation CO_2 emissions by 7 to 10 percent." [27] Ewing and his co-authors argue that such a reduction is highly significant, with CO_2 savings comparable to that of a $1-a-gallon gasoline tax increase.

Likewise, a national study comparing the ten most sprawling American urban areas with the ten least sprawling supports this idea of a land use–transportation–GHG relationship. Average daily VMT per capita in the more sprawled-out communities was 27 miles; the daily average in the more compact communities was 21 miles – a 29 percent difference. [28]

In short, the relationship between density of urban development and VMT is well documented. Numerous studies have come to the same conclusion: the higher a city's density is, the lower its per capita carbon emissions will be. [29]

Because higher-density development is often enmeshed with other community design features, however, many studies have examined the combined impact of several variables, including some combination of density, access to transit services, mixed land use, centeredness,

connectivity, the quality of the pedestrian environment, and parking policies.

In a study for King County, Washington, for example, Lawrence Frank, Bombardier Chair in Sustainable Transportation at the University of British Columbia, found that residents of walkable neighborhoods – areas with higher density, greater diversity of land uses, more accessible destinations, and better connected streets – drive 26 percent fewer miles per day than people living in the most sprawling areas. [30]

VMT and GHG reduction benefits achievable through transportation and land use strategies are noted in Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions, a 2009 report by Cambridge Systematics, Inc. This study found that "changes in land use and investments in improved transit and transportation options…could achieve meaningful GHG reductions by 2050, ranging from nine percent to 15 percent without economy-wide pricing [i.e., without higher gas taxes applied generally]."[31]

After conducting a comprehensive review of the literature on links between urban development patterns and travel behavior, Growing Cooler authors Reid Ewing et al see an even stronger connection. They conclude that with more compact development (defined to include mixed land uses, strong population and employment centers, well-connected streets, and pedestrian-friendly building and site design), people drive 20 to 40 percent less than in conventional (sprawl) development. [32] Growing Cooler observes that this estimate is probably on the low side given that the travel models used in many studies only crudely account for travel within neighborhoods and disregard walk and bike trips entirely. [33]

Travel models

Regarding travel models, one challenge in analyzing the effects of community design on travel behavior lies in the lack of good assessment tools. Modeling tools now widely used are not well adapted to predicting the trip-reduction benefits of smart growth. For example, the Institute of Transportation Engineers' Trip Generation Manual, generally used by local engineers to predict traffic likely to be generated by new development, is based almost entirely on studies of trip generation from auto-oriented developments. [34] The good news is that new tools are becoming available to provide better information on the effects of compact, mixed use, and pedestrian-friendly development in reducing vehicle travel.

Use the whole palette

If a major theme runs through research in this area, it is this: while density is clearly a major factor in reducing VMT and GHG emissions, other community design features are also important. Their relative importance, however, is difficult to tease out because they tend to interact with each other. Indeed, density is sometimes used as a proxy for mixed-use development and centeredness.

The key point is that communities should use the whole palette: higher density, where appropriate and when well-designed; mixed-use development; access to transit; centeredness; compact development; connectivity; appropriate parking policies; comprehensive bicycle and pedestrian networks; and pedestrian-friendly environments. All these community design features help reduce VMT – and, therefore, greenhouse gas emissions. They also maximize transportation choices, especially the lower-carbon modes such as walking, biking, and using transit.

It all comes down to this: with regard to climate change community design can be part of the problem or part of the solution. Sprawl – growth and development that increase our per capita VMT and per capita consumption of land and infrastructure –– will make the problem of global warming worse. Smart growth – growth and development that reduce our VMT and consumption of land and services –– will help to combat global warming.

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[14] Of course, many commutes involve stops along the way – e.g., dropping children off at school, picking up groceries, etc. That said, a large percentage of trips are unrelated to commutes.

[15] July 16, 2010 e-mail from Nancy McGuckin, Travel Behavior Analyst, National Household Travel Survey Technical Support, Federal Highway Administration, to Constance Beaumont, Oregon Dept. of Land Conservation & Development. The numbers shown in the chart on page 13 reflect new data and are slightly different from those found at the Bureau of Transportation Statistics chart at http://www.bts.gov/publications/highlights_of_the_2001_national_household_travel_survey/html/figure_07.html

[16] Ibid.

[17] See p. 40 of the Portland and Multnomah County Climate Action Plan 2009, at http://www.portlandonline.com/bps/index.cfm?a=268612&c=49989

[18] According to a report by Governor Kulongoski's Climate Change Integration Group, "A Framework for Addressing Rapid Climate Change," State of Oregon (January 2008), in the transportation area, "Reducing VMT is simply the single most effective way to reduce greenhouse gas emissions." See p. 46 at http://www.oregon.gov/ENERGY/GBLWRM/docs/CCIGReport08Web.pdf.

[19] http://www.brookings.edu/opinions/2009/1112_carbon-leinberger.aspx?p=1

[20] A metric ton (or "tonne") is 1,000 kilograms or 2,204 pounds. GHG emissions data are from the Energy Information Administration's "Emissions of Greenhouse Gases" (for 2007) at http://www.eia.doe.gov/oiaf/1605/ggrpt/index.html

[21] GHG emissions data in this handbook are from the Energy Information Administration's "Emissions of Greenhouse Gases" (for 2007) at http://www.eia.doe.gov/oiaf/1605/ggrpt/index.html

[22] The VMT figures cited here are for the year 2006. See Robert Puentes and Adie Tomer, "The Road…Less Traveled: An Analysis of Vehicle Miles Traveled Trends in the U.S.," Brookings Metropolitan Policy Program, 2008, at: http://www.brookings.edu/reports/2008/~/media/Files/rc/reports/2008/1216_transportation_tomer_puentes/vehicle_miles_traveled_report.pdf. P. 25.

[23] According to Brian Gregor, senior transportation analyst of the Oregon Department of Transportation, "Land use patterns affect how far people travel and the modes by which they travel. People will do more of their travel by automobile and will drive farther if activities are dispersed. The distribution and mixing of land uses has similar effects. The design of land uses affects the ease and amounts of travel by walking, bicycling and using public transportation." See Background Report: The Status of Oregon Greenhouse Gas Emissions and Analysis, October 2009, prepared for the Metropolitan Planning Organization Greenhouse Gas Emissions Task Force, p. 20

[24] The idea of centrality (or centeredness) is developed in the book Measuring Sprawl and Its Impact, by Reid Ewing, Rolf Pendall, and Don Chen, published by Smart Growth America. It's available online at http://www.smartgrowthamerica.org/sprawlindex/MeasuringSprawl.PDF

[25] Conversely, reducing residential densities – from 20 to five dwelling units per acre, a typical suburban density, increases vehicle travel by about 40 percent, according to Todd Litman, executive director of the Victoria Transport Policy Institute. Land Use Impacts on Transport: How Land Use Factors Affect Travel Behavior, Victoria Transport Planning Institute, May 21 2010, p. 11. See http://www.vtpi.org/landtravel.pdf

[26] Brian Stone Jr., Adam C. Mednick, Tracey Holloway, and Scott N. Spak (2009) "Mobile Source CO_2 Mitigation through Smart Growth Development and Vehicle Fleet Hybridization" in Environmental Science Technology, 2009, as reported on-line February 11, 2009, at http://www.greencarcongress.com/2009/02/study-reducing.html

[27] Reid Ewing, Keith Bartholomew, Steve Winkelman, Jerry Walters, and Don Chen's Growing Cooler: The Evidence on Urban Development and Climate Change, Washington D.C: The Urban Land Institute, 2008, p. 35

[28] Reid Ewing, R. Pendall and D. Chen, Measuring Sprawl and Its Impact. Washington, DC.: Smart Growth America/US Environmental Protection Agency, 2002, p. 18, as quoted in Reid Ewing, Keith Bartholomew, Steve Winkelman, Jerry Walters, and Don Chen's Growing Cooler: The Evidence on Urban Development and Climate Change, Washington D.C.: The Urban Land Institute, 2008, p. 6.

[29] Two examples of such studies are Marilyn A. Brown, Frank Southworth, and Andrea Sarzynski, Shrinking the Carbon Footprint of Metropolitan America, The Brookings Institution, 2005; and Thomas F. Golob and David Brownstone, "The Impact of Residential Density on Vehicle Usage and Energy Consumption," March 31, 2008, p. 2

[30] Cited in Growing Cooler, p. 6. See Frank, L.D., S. Kavage, and B. Appleyard, "The Urban Form and Climate Change Gamble," Planning, Vol. 73, No. 8, August/September 2007, p. 18-23.

[31] Executive Summary, Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions, by Cambridge Systematics, Inc. Urban Land Institute (2009). See p. 8. Visit http://movingcooler.info/Library/Documents/Moving%20Cooler%20Executive%20Summary.pdf

[32] Growing Cooler: The Evidence on Urban Development and Climate Change, by Reid Ewing et al. Urban Land Institute, 2007. See p. 4

[33] Growing Cooler, p. 7

[34] See p. 2 of "Crediting Low-Traffic Developments: Adjusting Site-Level Vehicle Trip Generation Using URBEMIS, by Nelson/Nygaard Consulting Associates, August 2005.

Part II Ways To Grow Cooler

Each of the chapters in Part Two presents a local planning strategy and explains how it can help to reduce VMT and GHG emissions to slow climate change

It's important to note that the strategies described here do not impose great burdens or call for great sacrifice. They are not bad-tasting medicine a community must reluctantly swallow to cure the problem of climate change. Quite the contrary: these strategies can yield multiple dividends. They not only can help to slow global warming but also can make your community more livable. Moreover, they can improve the everyday lives of people in the community by saving them money and time in their daily travels.

We also note that these are proven, time-tested strategies, not new ideas developed solely for the purpose of dealing with climate change. They are sound planning methods that have taken on a new importance in the face of climate change.

For ease of reading, we have arranged this handbook in small chapters, one for each strategy. But as you read each chapter, please keep in mind the idea of synergy.

Synergy means an enhanced state in which the overall effect from a system is greater than the sum of individual effects from its parts. For example, suppose a city takes strong measures to increase walkability, and it takes equally strong measures to promote bicycling. The pedestrian-friendly measures alone could be expected to reduce per capita VMT by, say, two percent. Likewise, the bike-friendly measures alone would reduce per capita VMT by two percent. But if those measures are coordinated so as to enhance both walking and cycling, the resulting system might reduce per capita VMT not by four percent but by six.

The additional two percent reduction in VMT resulting from the combined approach is the product of synergy. It's the payoff from a holistic approach to planning. So even though this handbook presents a list of separate tools that can be used to deal with climate change, we urge you not to use them separately. Use them together, in an integrated and systematic way. Doing so will generate big dividends for your community.

4 Grow More Compact

One of the most important ways for a community to grow smart is to bring things closer together. One way to do this is by increasing density. When coupled with mixed land uses (more on those in Chapter 6), higher-density development:

- reduces distances people have to drive;
- gives people more transportation options; and
- makes walking, biking, and transit trips more feasible.

All this helps to reduce Vehicle Miles Traveled (VMT, or driving) and greenhouse gas emissions. Moreover, the more compact (denser) community is often a more convenient community.

Density, however, is a sensitive subject. For many Americans who grew up in low-density suburbs, the words "increase in density" conjure up images of traffic congestion, ugly buildings, loss of green space, and high-rise towers. Such images obscure two important facts: there is a significant difference between "high" density and "higher" density, and higher-density developments can be designed well or designed poorly.

A compact neighborhood with convenient stores within walking distance.

Between the low density of late 20th-century subdivisions (three to six dwelling units per acre) and the high density of Manhattan high-rises (hundred of units per acre) lies a broad range of housing densities and types that are neither "high-density" nor "high-rise." They may have several times the density of last century's typical subdivision, but when they embody good design and offer amenities – e.g., trees, landscaping, and small shops within an easy stroll – they enjoy great popularity as a place to live.

Let's look more closely at some widely held beliefs about density and its relation to traffic, appearance, and loss of open space.

Traffic

Many people associate higher densities of development with increased traffic. For example, someone hears that a vacant lot is going to be developed with 20 units of garden apartments as opposed to 10 single-family dwellings, and she declares, "Those apartments will generate a lot more traffic!" But she would probably be surprised to learn that folks who live in apartments typically drive less and own fewer cars, per unit, than their neighbors in low density neighborhoods.

As noted in Chapter 3, many studies have documented an inverse relationship between density and VMT: in other words, the higher the density, the lower the per capita VMT. Residents of higher-density urban areas make about 25 percent fewer automobile trips and more than twice as many pedestrian and transit trips than the national average, according to Todd Litman, director of the Victoria Transport Policy Institute. [35]

Conversely, lower density has been linked to more traffic. That's mainly because lower-density development increases distances between local destinations, thus making it impractical for people to get around without driving. A study conducted by the Brookings Institution found that when two households similar in every respect except density were compared, the household in a neighborhood with 1,000 fewer housing units per square mile drives almost 1,200 miles more and consumes 65 more gallons of fuel per year over its peer household in a higher-density neighborhood." [36]

Time stuck in traffic, a consequence of sprawl.

Granted, a higher-density development will increase travel in a neighborhood that might otherwise have developed at a low density. Your community can lessen this localized traffic by providing well-connected street networks, good sidewalks, bike lanes and the other features described in chapters 10, 11, and 13 of this handbook. In the context of the larger neighborhood and city, higher density is an important strategy to reducing VMT per capita.

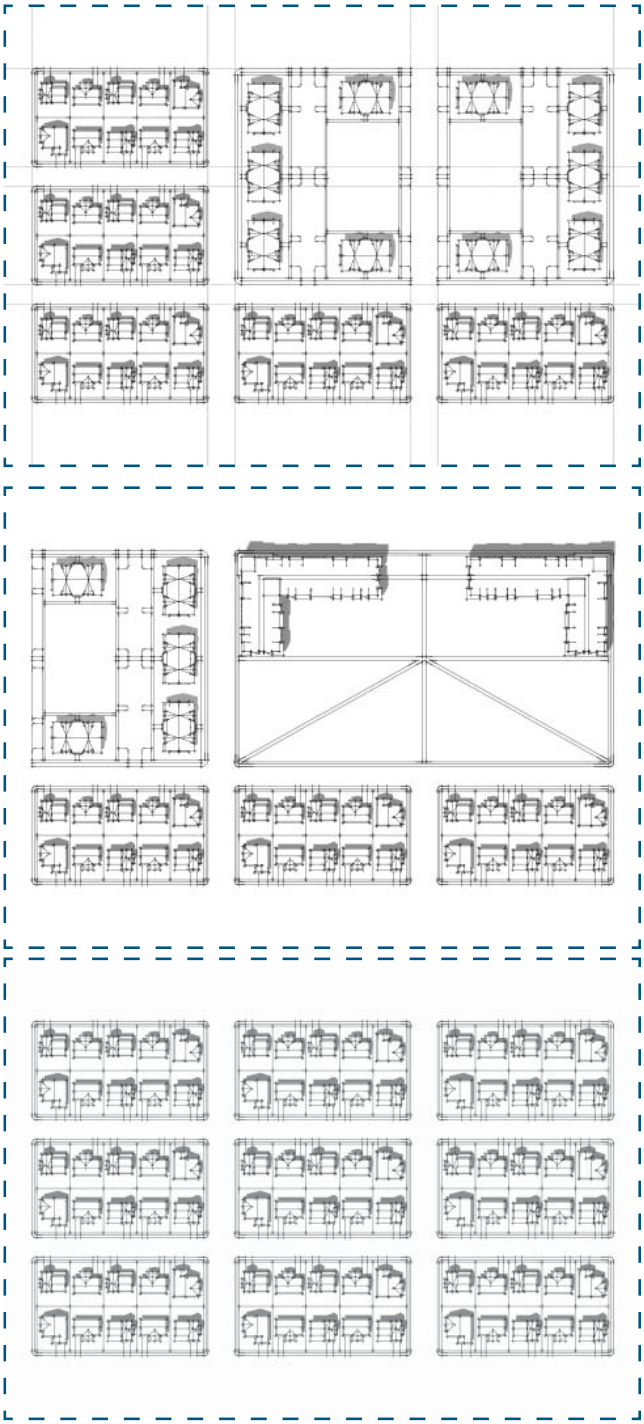
Ugly buildings

Yes, some higher-density developments do seem ugly and off-putting. But it's not density that makes them ugly, it's bad design.

"There is such a thing as 'bad' density – that which is poorly planned and designed without an understanding or concern for human needs," write Julie Campoli and Alex S. MacLean in Visualizing Density. [37] That's why good design and amenities must accompany such developments if they are to win acceptance and succeed.

The presence (or absence) of quality design and amenities greatly affects public perceptions of density. In fact, visual preference surveys (visualizations contrasting high- with low-density projects) have shown that people may dismiss one project as too dense while approving of another one with the exact same density. [38] "Two neighborhoods [with identical densities] can look as different as night and day," write Campoli and MacLean. "Although they measure out at the same density, they are not necessarily perceived to be equally dense. What really matters is how the streets are laid out, how the land is subdivided, how the buildings are arranged and detailed, whether trees are planted, and where the sidewalks lead. These are all functions of design."[39]

Many cities across the country have enacted design guidelines or standards to enhance the prospects for more attractive developments and to give local residents an opportunity to voice concerns they may have about higher-density development. Do proposed projects follow good design principles? Are the buildings compatible in design with those in the surrounding neighborhood? How close do buildings come to the street? How tall are they? Are they landscaped? In the case of townhouses, do the front entrances step up from the street to a higher elevation so that their residents can enjoy privacy? Has the architect considered how well the proposed development transitions into nearby neighborhoods so that the character of the latter, if historic or otherwise special, can be preserved? These are just a few of the questions that local design guidelines can help to address.



Each of the above block configurations is 7 units per acre.

Townhomes with a shared green space.

Image: Otak

A central park at Nunan Square, a smart growth project in Jacksonville, Oregon.

Loss of open space

When people say that higher-density developments have "less open space" than those with lower density, they're often using that as shorthand for several concerns. They think of large buildings dominating the landscape; a near absence of trees and lawns and gardens; and a lack of inviting places where people can play, walk or picnic. In effect, they're saying you can't have higher density without losing many of the amenities and aesthetic features that make a neighborhood desirable. But you can. Good design and pleasant amenities can make higher-density developments seem more open and inviting than their lower-density counterparts.

That's why attention to landscaping, street trees, and other amenities is so important to the success (and acceptance) of higher-density development. Homeowners are often willing to forgo a large yard if they can enjoy nearby parks or gardens. Developers often use courtyards, landscaped lanes, and central parks to meet the need for green space. Trees are especially important, because they can fit into small spaces and their presence can make nearby buildings seem far away. The main advantage of "green infrastructure," according to Campoli and MacLean, is that "it provides an element of tranquility in areas of high activity. It satisfies a human need that is often denied in urban life."[40] Of course trees also help with carbon sequestration and air quality.

The density dividend

As we mentioned above, higher density often gets a bad rap: people tend to assume bad things about it that aren't necessarily true. Likewise, higher density has some key advantages that often get overlooked. The biggest advantage is simply this: greater convenience.

Residents of lower-density developments often wish they had easier access to conveniences typically found in higher-density areas: restaurants, stores, coffee shops, newsstands, post offices, beauty salons, hardware stores, schools, libraries, theaters, cultural events, etc. When located a short distance away and in a walkable environment, the presence of these shops and services can eliminate the need for residents to slog through heavy traffic to carry out simple, everyday errands like buying a quart of milk. But local shops and services generally cannot survive in lower-density neighborhoods; they require higher densities to generate an adequate customer base. A neighborhood shopping center requires a minimum of 3,000 people within a three-mile radius to be viable.[41]

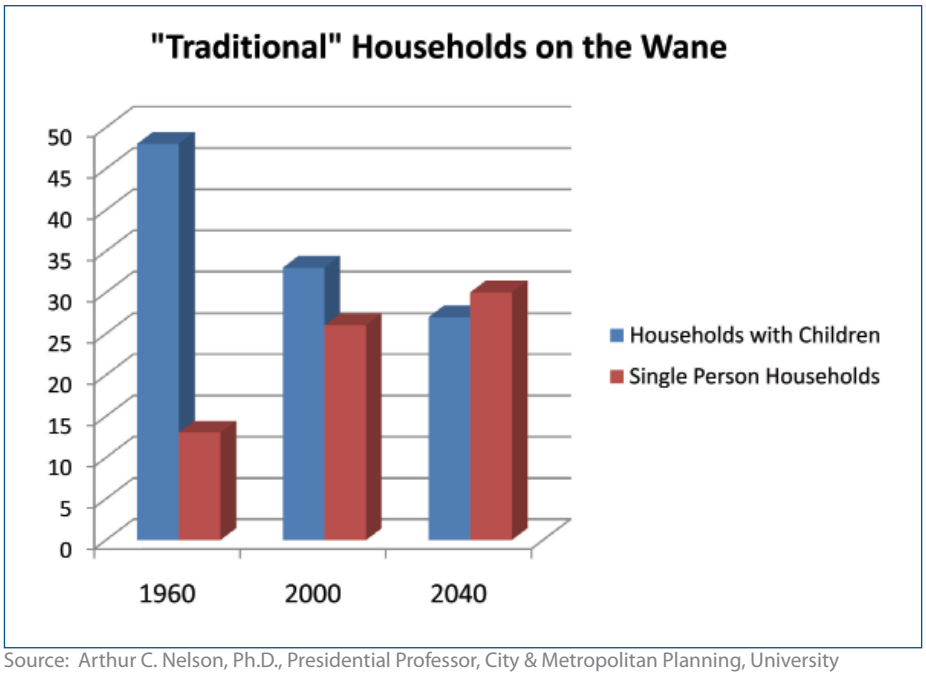
Many people are willing to pay premium prices to live in well-designed, well-planned higher-density developments. For those people, benefits from the convenience and accessibility of high-density areas exceed costs. The value of such convenience might be called their "density dividend."

Running errands in a 20-minute neighborhood. [42]

Image: Pedestrian & Bicycle Information Center credit: Dan Burden

Running errands in a sprawling neighborhood.

To be sure, higher-density living is not for everyone. Many Americans will continue to prefer single-family houses on large lots in lower-density developments. This option should, and undoubtedly will, remain available. For most communities, then, the "right" mix of development is likely to be a combination of both.



Source: Arthur C. Nelson, Ph.D., Presidential Professor, City & Metropolitan Planning, University of Utah

That mix will vary from one community to another, depending on local conditions. Across the nation, however, a clear trend in housing mix is emerging: demand for higher-density neighborhoods has grown rapidly in recent decades and is likely to continue growing. The reason for this trend comes down to two words: changing demographics.

As the chart above illustrates, the percentage of American households with children – i.e., those most attracted to lower-density neighborhoods – has fallen significantly: from 48 to 33 percent between 1960 and 2000. Moreover, it is expected to fall further: to about 27 percent by 2040. Meanwhile, the percentage of single-person households – those most drawn to higher-density neighborhoods – increased from 13 to 26 percent between 1960 and 2000 and is expected to rise to about 34 percent by 2040. Young singles seeking more social interaction, childless couples, empty-nesters eager to downsize and shed the burden of maintaining large yards, and others often prefer the car-free life style and convenience that frequently go with higher-density neighborhoods.

For these reasons, higher-density residential development can meet the needs of an important segment of the changing housing market The five-unit-per-acre suburban subdivision may have been right for the American household of 1960 – and it will continue to be the choice of many – but it fails to meet the housing needs and preferences of many Americans today. For the growing number of small households, a large home and yard are neither necessary nor desirable. Thus more and more communities are taking a second look at their land-use policies to see whether they give developers the ability to respond to these new markets for higher-density development.

Another reason to expect an increase in demand for higher-density development is that an oversupply of low-density housing now appears to exist in many urban areas. Across our nation, both residential lot size and house size [43] have increased steadily for the past fifty years. As a result, the average density of American urban areas has steadily decreased. [44] As American households grow smaller, however, the demand for those large houses on big lots seems likely to diminish.

Car sharing programs are becoming more popular.

Images: Otak

Ways to do density right

Assuming that greater density is beneficial and desirable for some

Row houses (at left) and single-family houses on smaller lots (at right). As one can tell from the photos, these developments are neither high-rise nor high-density. Yet they are considerably denser than the typical subdivisions that surround many American cities. The point is this: higher density doesn't mean lower livability. In fact, as we'll see in the next chapter, higher density and greater livability often go hand in hand. An increase in residential density can help reduce carbon emissions, enhance a community's livability, and provide great places to live.

Image on left: Otak

parts of your community, what can be done to help higher-density development occur?

The first step is to see what your community's plan and land-use regulations say about density. Older policies and ordinance provisions may prohibit even modest increases in density. For example, a typical R-1 residential zone adopted in the 1960's might specify the following:

- A minimum lot size in the range of 6,000 to 10,000 square feet;
- Lot coverage of no more than 35 percent;
- Minimum street frontage of 50 feet;
- Broad street widths of 34-36 feet;
- One dwelling unit per lot, with no auxiliary dwellings, duplexes, or common-wall construction allowed.

Under these requirements, the maximum density that could be achieved is about six dwelling units per acre, and in most cases it would be lower. Such a low density, if it occupies large areas of a community, essentially means the area's residents will be compelled to drive wherever they want to go. It also is too low for cost-effective service by any form of transit. [45]

Higher–density housing with amenities.

To be sure, many communities in Oregon have updated their ordinances: the above standards are no longer the norm. But some communities still have out-of-date ordinance provisions that bar some or many of the higher-density alternatives to a detached single-family dwelling on a large lot. In some cases, even seemingly trivial provisions can preclude a desired form of development. For example, in a city that has lowered its minimum lot size requirement to 4,000 square feet, out-of-date side-yard requirements still may hinder or bar development on lots that small.

Local officials who want their community's plan and land use regulations to provide for greater densities (and lower VMT) should address these questions:

- Do the plan and code encourage well-designed, pedestrian-friendly infill development (building on vacant lots in developed areas)?
- Is zero-lot line development (the type of common-wall construction typical of rowhouses) allowed in areas where it is appropriate?

- Are auxiliary dwellings such as apartments above garages permitted?
- Are off-street parking requirements appropriate for the desired density of development?
- Are the zoning ordinance's dimensional requirements for yards, setbacks, lot coverage, etc., consistent with the desired density of development?
- Can lot sizes be averaged so that a variety of dwelling types and clustered development can help achieve planned densities?
- Does each individual development approval contribute to the creation of a connected network of streets, walking paths, and bike lanes?
- Do the plan and code provide strong protection for well-designed and walkable historic neighborhoods?

A "no" answer to any of those questions reveals an area where plan or ordinance amendments might enable higher densities to be achieved.

A handy guideline to use in achieving well-designed density is: "the higher the density, the greater the amenities." This means that communities should ensure that the neighborhoods with apartments, townhomes and other

Shared space.

Walking paths through development.

Image: Otak

attached dwellings should have wider sidewalks, many plazas and pocket parks, and other civic amenities that will make them attractive, livable, and well-regarded areas.

Next we'll look at "centeredness," a community design feature as important as density to the reduction of VMT and GHG emissions.

Publications and Resources

- Higher-Density Development: Myth and Fact, by the Urban Land Institute, at http://www.uli.org/sitecore/content/ULI2Home/ResearchAndPublications/Reports/Affordable%20Housing/Content/~/media/Documents/ResearchAndPublications/Reports/Affordable%20Housing/HigherDensity_MythFact.ashx
- Images of housing at various densities can be found on the Washington County, Oregon's web site in the section on the Bethany Concept Plan, at http://www.bethanyplan.org/images/1.07_res_density_1.9.07oh_1.pdf
- Innovative Design and Development Codes, a toolkit aimed at enabling smart development that can be tailored to the unique identities of different communities, at http://library.oregonmetro.gov/files/design_dev_codes_toolkit.pdf
- Living Smart House Designs, City of Portland, at http://www.livingsmartpdx.com/home/
- Project Files, Portland Bureau of Planning and Sustainability (see Rowhouse Profile 24 for images of higher-density rowhouses, at http://www.portlandonline.com/planning/index.cfm?c=49249&a=223705)
- Re-Thinking Density To Create Stronger Healthier Communities, a useful downloadable PowerPoint presentation from the American Multi Housing Council, at http://www.nmhc.org/Content/ServeContent.cfm?ContentItemID=3423
- Visualizing Density, a book by Julie Campoli and Alex S. MacLean (Lincoln Institute of Land Policy, 2007) as well as a slide show that graphically illustrate a variety of housing densities and types. See http://www.lincolninst.edu/pubs/1178_Visualizing-Density and http://www.lincolninst.edu/subcenters/visualizing-density/

Two examples of higher-density housing: a house on a small lot (left) and multi-family housing centered on a park. (at right)

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[35] See Todd Litman, "Land Use Impacts on Transport: How Land Use Factors Affect Travel Behavior," Victoria Transport Policy Institute, August 19, 2009, p. 28. See http://www.vtpi.org/landtravel.pdf

[36] "Shrinking the Carbon Footprint of Metropolitan America," by Marilyn A. Brown et al. The Brookings Institution, May 2008. See p. 12 at http://www.brookings.edu/reports/2008/05_carbon_footprint_sarzynski.aspx

[37] See Campoli, Julie, and Alex S. MacLean, Visualizing Density. Cambridge: Lincoln Institute of Land Policy, 2007, p. 11, at http://www.lincolninst.edu/pubs/1178_Visualizing-Density

[38] See "Getting the Design You Want," by Elizabeth Humstone. Planning Commissioners Journal, Number 74, Spring 2009.

[39] Visualizing Density, p. 14.

[40] Visualizing Density, p. 21.

[41] Visualizing Density, p. 11.

[42] Twenty-minute neighborhoods are "complete neighborhoods" in which at least 80 percent of the residents can fulfill daily, non-work needs within a 20-minute walk.

[43] Federal census data reveal that the average floor space in new private one-family homes expanded to 2,227 square feet in 2005 from 1,905 square feet in 1990.

[44] The idea that average density of urban areas is decreasing may seem counter-intuitive. After all, aren't more and more people living in urban areas? The answer is yes – but the land area occupied by those urban areas is increasing more rapidly than the population.

[45] The minimum density necessary to support a transit system varies with factors such as street layouts, level of transit service, and so on. A common rule of thumb is that bus service can be cost-effective only where densities exceed 7 dwelling units per acre.

Image: Otak

5 Get Centered

If density ranks at the top of the list of factors that affect local VMT and GHG emissions, then "centeredness" (or "centrality") is close behind in importance.

A city with a strong center.

Image: Pedestrian & Bicycle Information Center credit:Dan Burden

Town centers, neighborhood centers, Main Streets, downtowns, activity centers, activity nodes . . . The nomenclature varies from one community to another, but the idea is the same: key places are planned and zoned to provide for a rich combination of commercial, residential, and public uses that can provide a broad range of services to the surrounding area. In larger cities such centers typically are found in the downtown or at major street intersections and are well served by transit. In smaller communities, these centers are found on Main Street, within easy walking distance of neighborhoods.

Strong centers help reduce VMT in two ways. First, they are readily accessible by several modes of transportation, including transit. Second, such concentrations enable drivers to park once and then accomplish several tasks on foot. They can complete all their errands with just one motor vehicle trip to a center rather than having to make several such trips to separate locations.

For example, a study conducted on Davis, California, found that people who live in a central location typically drive between 20 and 40 percent less and walk, cycle, and use public transit two to four times more than they would at a suburban fringe location, where goods and services are more scattered and distant. These differences reflect shorter commute trips, shorter errand trips, and better travel options in more central locations. [46]

To maintain and enhance downtowns and other centers, redevelopment and preservation are two important planning strategies. To create new centers, mixed-use and transit-oriented development strategies can be used. These are discussed later in Chapters 6 and 13.

A popular mixed-use center in Arlington, Virginia that replaced an old strip development.

Local examples of centeredness

Several Northwest cities have taken steps to strengthen the economic vitality and transportation efficiency of their centers.

Getting centers starts with your downtown. Oregon has many success stories of revitalized downtowns: Lake Oswego, McMinnville, Bend, Corvallis and Ashland are just a few examples. All of these communities have invested in their centers and adopted land use regulations which promote higher densities, mixed use, good design, and building a walkable setting.

At the neighborhood level, Salem, for example, currently is developing a "Mixed-Use Neighborhood Center Zone." [47] This new zone is expected to be applied first in a largely residential area several miles from the downtown or any other commercial services. The zoning will promote development of an activity center at the intersection of two major collector streets a few blocks from a large new high school. With such a center nearby, the students, teachers, and neighborhood residents won't have to drive several miles for routine purchases and services.

In Tigard, the city's plan calls for concentrating jobs, housing, and services in its downtown. The goal is to create an economically vibrant center where people can socialize, transact business, and move about

Downtown Bend, Oregon

Image: Otak

easily in pleasant surroundings. In one of several actions taken with this goal in mind, the city raised the allowable density for a new senior housing project from 4.5 dwelling units per acre to 50 units per acre.[48]

Public investments in centers

The locational decisions of public agencies can weaken or strengthen a community's centeredness. For example, locating a courthouse, post office, city hall, or library on the outskirts of town can have several unintended effects. Doing so can make it impractical for people to reach the building except by driving, thereby increasing VMT and GHG emissions. It can weaken the economic vitality of a pedestrian-friendly town center by drawing people out to the edge of town. And it can trigger vacancies in existing buildings downtown or in other centers. Conversely, a public agency's decision to locate (or stay) in a compact center can provide an economic boost for centrally located local businesses, as agency employees generate revenue for downtown restaurants, stores, and services.

The State of Oregon adopted a policy in 1994 encouraging state agencies to locate in compact, central locations, especially ones served by transit. The policy, Governor Barbara Roberts' Executive Order 94-07, "Siting State Offices in Oregon's Community Centers," requires state agencies to give first priority for new building sites to properties

Fairview Village, Oregon, located its city hall, library, and post office within walking distance of nearby neighborhoods.

located within a central business district and close to transit. Local governments may adopt similar policies. In January 2010, Governor Ted Kulongoski issued a new executive order directing state agencies to locate downtown – and in historic buildings – whenever possible. [49]

Many communities never establish a center, or they undercut its vitality by encouraging strip development on the outskirts of town. Their urban form is often determined by a highway that passes through town. Businesses seeking access and exposure to the highway will sprawl along it until the town takes on the classic linear form of strip development. The result is a community that gives people little choice in how they travel: it virtually requires them to drive.

This strip development also tends to clog the highway. As roadside attractions, curb-cuts and parking lots increase, traffic slows, congestion grows, and the highway no longer can move traffic safely and efficiently. [50]

In our research for this handbook, we interviewed a variety of experts. We repeatedly heard from them that one of the most effective ways to curb greenhouse gases is for communities to focus new development into centers. In so doing, a community can realize three major

Hillsboro, Oregon contributed to its town center by locating its new Civic Center, City Hall complex at its heart. The mixed use development is a block from the light rail stop and includes residential units and commercial space.

benefits, and a host of other collateral benefits. Concentration of new development in centers will improve the community's tax base by decreasing the cost of providing and maintaining infrastructure. It will improve the citizen's quality of life by providing employment, retail, and other community services close to housing. And it will reduce the community's impact on climate change by lowering VMT. Collateral benefits include less pollution, cleaner air, and greater convenience to citizens in their everyday activities.

Publications and Resources

- Financial Incentives, a toolkit describing approaches that local governments can use to stimulate mixed-use development in centers and corridors and near transit areas. It also explains ways to redevelop underused property and to finance infrastructure improvements necessary to enable private development to occur, at http://library.oregonmetro.gov/files/financial_incentives_toolkit_final.pdf
- Main Street Success Stories, at http://www.preservationbooks.org/Bookstore.asp?category_id=76
- Main Street: When a Highway Runs through It, a TGM publication (1999), presents practical alternatives to strip development. It is available online in PDF format at http://www.oregon.gov/LCD/TGM/docs/mainstreet.pdf
- Model Town Center Zoning Ordinance provides examples of several different types of ordinances that can help shape strong town centers. See the American Planning Association's web site at https://www.planning.org/research/smartgrowth/pdf/section43.pdf
- National Main Street Center, at http://www.preservationnation.org/main-street/
- Oregon Main Street Program, a program administered by the Oregon Business Development Department to help communities strengthen their downtowns. See http://www.oregon.gov/OBDD/mainstreet/index.shtml
- Revitalizing Main Street: A Practitioner's Guide to Comprehensive Commercial District Revitalization, at http://www.preservationbooks.org/Bookstore.asp?category_id=76
- Urban Revitalization: Centers and Corridors (Metro, 2009), at http://www.oregonmetro.gov/index.cfm/go/by.web/id=6555

It is easy to run errands on foot in a well centered community.

[46] "Land Use Impacts on Transport: How Land Use Factors Affect Travel Behavior," by Todd Litman, Victoria Transport Policy Institute, May 21, 2010, p. 4, at http://www.vtpi.org/landtravel.pdf. In "Travel and the Built Environment" (Journal of the American Planning Association, Summer 2010, Vol. 76, No. 2), co-authors Reid Ewing and Robert Cervero note: "Almost any development in a central location is likely to generate less automobile travel than the best designed, compact, mixed-use development in a more remote location." p. 276. See http://www.informaworld.com/smpp/section?content=a922131982&fulltext=713240928

[47] This zone is mapped and explained at http://www.cityofsalem.net/Departments/CommunityDevelopment/Planning/mixed-use_neighborhood_center_zone/Documents/Code_Concepts_v7.pdf

[48] July 30, 2009 telephone interview of Sean Farrelly, senior planner, City of Tigard, by Constance Beaumont

[49] January 13, 2010 press release from the Office of Governor Ted Kulongoski of Oregon, at http://governor.oregon.gov/Gov/P2010/press_011310.shtml

[50] All highways in urban areas have two main functions: to move traffic safely and efficiently, and to provide access to local businesses and residents. Unfortunately, the two functions often compete. A freeway that passes through a small town without exits is a triumph of mobility over access. Conversely, a highway where traffic crawls through a town with businesses, driveways, and parking lots adjoining the road for miles surrenders mobility to access. The resulting congestion not only slows the movement of passenger vehicles but also of trucks. The uncontrolled highway access that is said to be "good for business" may actually be quite costly to those businesses that depend on efficient movement of freight.

LOFT

6 Mix Up Your Land Uses

For most American cities, 20th-century land-use regulations were mainly about separating land uses. Cities were divided into different zones. Each zone allowed certain uses deemed to be compatible with each other while prohibiting others viewed as incompatible. Residential zones allowed housing; commercial zones permitted offices and businesses; and industrial zones contained factories, warehouses, and other large or intensive land uses.

There were (and still are) some good reasons for this system. Mainly, it served to protect the value of the single biggest investment made by millions of homeowners: their home. The zoning also brought some needed predictability for private parties who would invest in land or for public officials who provided infrastructure like sewer lines and water systems. In addition, zoning was simple to understand and administer.

But rigid separation of land uses, accompanied by large minimum lot-size requirements in residential zones, had a huge influence on travel behavior. By increasing distances between local destinations, this separation virtually required people to drive farther and more frequently. The well-documented result has been a steady and dramatic increase in VMT. That was fine when gas was 25 cents a gallon and no one had heard of climate change. It's not fine today.

Separation of land uses with specific zones for housing and large retail.

The obvious solution to the problem is to modify certain zones to allow a mixture of uses. The result is the "mixed-use district," a zone that allows a compatible mixture of dwellings, offices, and small retail stores. Many cities in Oregon and around the country have embraced this idea. And some have gone one step further, and adopted "form-based code" provisions. Such ordinances focus less on land use (the main activity that takes place in a building) and more on the physical form, scale

and design of buildings. The form-based code thus encourages or at least allows a diverse mix of uses in the same neighborhood.

Writing a workable mixed-use zone or form-based code presents four challenges:

- to continue providing protection of property from incompatible uses (the most basic idea of zoning);
- to write the zone so as to allow a combination of uses that meet a market need;
- to set standards that maintain a true mix of uses, rather than allowing one type to dominate
- to decide whether to simply allow and encourage mixed use or to require it.

The most common mixed-use developments have some combination of medium-density dwellings plus commercial or institutional uses of six main types:

- Personal services (hair care, banking, or pharmacy, for example)
- Food and entertainment (delicatessen, cafe, health club, etc.)
- Product repair and service (shoe repair, tailor, locksmith, etc.)
- Offices (law, real estate agency, etc.)
- Care facilities (day care, pre-school, adult day care, etc.)
- Retail (grocery stores, basic goods).

Mixed use zones must also take care to preclude or restrict auto-oriented uses such as drive-through restaurants, which will detract from the area's walkable character. Oregon's Model Code for Small Communities (cited below) has excellent code text for this issue and other aspects of writing mixed use codes.

Get the mix right, and VMT goes down. For example, a lawyer, architect, or accountant can work in a street-level office with her home up above. The daily "commute" is a walk down or up the stairs. The car stays in the garage all week.

Publications and Resources

- Code Assistance is provided at no charge to local governments in Oregon by the Oregon Transportation and Growth Management Program. This service helps communities seeking to make their codes more supportive of transportation-efficient, smart development. See http://www.oregon.gov/LCD/TGM/codeassistance.shtml
- Commercial and Mixed-Use Development Code Handbook, an Oregon Transportation and Growth Management Program (TGM) publication to help communities develop or refine their policies on mixed-use development: at http://www.oregon.gov/LCD/docs/publications/commmixedusecode.pdf
- A model mixed-use zoning ordinance is available through the American Planning Association (APA) at https://www.planning.org/research/smartgrowth/pdf/section41.pdf
- Oregon's Model Development Code for Small Cities, another publication from the Transportation and Growth Management (TGM) Program, aims to help smaller communities improve and update their land-use regulations. The code is available on-line in PDF at http://www.oregon.gov/LCD/TGM/modelCode05.shtml
- The Form-Based Codes Institute also has useful guidance on mixed-use code provisions on-line at http://www.formbasedcodes.org/definition.html
- The SmartCode is a form-based code that addresses primarily the physical form of buildings and community. A customizable template is available for download at http://www.smartcodecentral.org/

Tualatin Commons in Tualatin, Oregon combines retail, housing, and offices.

Image: StastnyBrun Architects

Renovated building on transit line.

Image: Venerable Properties

7 Recycle Urban Land and Buildings

Oregonians know about recycling. We understand the value of re-using paper, metal and glass. But what about land and buildings? Can we recycle developed land and structures that have grown obsolete or are underused?

The answer is yes. It's not usually called "recycling," but urban land and structures can be reused, or used more intensively, in three different ways: infill, redevelopment, and historic preservation. We define these terms as follows:

- Infill is the process of developing vacant or underused urban sites that, because of their size, shape, or other factors, sit empty or unproductive. Infill involves the construction of new buildings.
- Redevelopment of urban land typically calls for a more intense use of vacant, blighted, or underused urban land as well as for the rehabilitation of older structures that have deteriorated or outlived their usefulness. Redevelopment may also involve the removal of derelict buildings and their replacement with new, often larger structures.

This building was rehabilitated for the Astoria Transit Center and includes offices and a community room.

Image: Otak

- Historic preservation is the act of protecting and maintaining significant historical structures that might otherwise fall into decay and disuse. It extends the life of old buildings. Many preservation projects involve adaptive reuse, the conversion of an older building to a new use – a school to senior housing, for example.

Many studies have emphasized the importance of these strategies to the reduction of VMT and GHG emissions. They are seen as "one of the most effective transportation and emission reduction investments regions can pursue," according to an EPA study. [51] Infill

and redevelopment hold the potential to reduce site-specific VMT by 15 to 50 percent, according to the Center for Clean Air Policy. [52]

Often, the lands most in need of infill and recycling are older properties near or in the city's center. They may be quite valuable due to their central location and historical significance. The city may also have made a large investment of public moneys in these properties for infrastructure needed to serve them over many decades.

But in spite of such value, these older properties may sit vacant or unproductive for decades because of major barriers to their recycling. Land in the central city often is the most expensive in town. Unusable or unsafe buildings sometimes must be razed (at considerable cost) before the land underneath can be redeveloped. Land contamination may stymie a project. More usable older structures must be "brought up to code" (remodeled to meet modern standards for plumbing, wiring, seismic resistance and accessibility). Excessive or inappropriate local parking requirements may hinder an older site's redevelopment.[53] Property taxes may be higher on land in the city center. And construction in a crowded downtown is likely to be more expensive and difficult than on a rural site.

For all of these reasons, developers often prefer so-called "greenfield sites": undeveloped properties in less central areas, where land may be cheaper, taxes lower, and construction easier. Moreover, the average-cost pricing system used for most municipal services and utilities often means that developers can get the same urban services in outlying locations as they can get downtown for the same price. This happens even though it's generally far more costly to provide infrastructure to an outlying area. [54] Under such conditions, it's not surprising that developers and investors often turn away from the downtown and look for their future in the green fields at the edge of town.

There are, however, significant public costs associated with greenfield development in outlying areas. We described those costs in Part I and therefore won't repeat them here. Suffice it to say, infill, redevelopment, and historic preservation all help to create or maintain a more compact urban form and reduce VMT. They should, therefore, be considered an important part of the local toolkit for reducing greenhouse gas emissions.

Examples

Examples of cities that have included infill, redevelopment, or historic preservation strategies in their climate action or sustainability initiatives include:

- Fort Collins, Colorado: "Infill and refill developments have the potential to address… greenhouse gas emissions by reducing the number of vehicle miles of travel (VMT) and allowing easier access to transit and pedestrian-oriented facilities," states Fort Collins' Climate Action Plan." [55]
- Chattanooga, Tennessee, which recommends incentives to encourage the renovation of existing buildings as well as the revision of zoning regulations to accommodate infill that is compatible with the architecture of existing homes and businesses. [56]

An example of infill and redevelopment from Fort Collins, Colorado. "Before" at left; "after" at right.

Images: Fort Collins Community Development and Neighborhood Services

Many cities in Oregon have downtown redevelopment programs. Typically, these use a combination of strategies such as tax-increment financing, infrastructure investment, and planning and zoning techniques such as design review to build a stronger downtown.

The City of Gresham offers a good example of such a program. Because downtown grocery stores are seen as an important complement to downtown housing – and as a way to shorten or reduce car trips to grocers – Gresham has examined demographic and market forces considered necessary to attract a grocery store to the downtown. [57]

Gresham has also worked with University of Oregon planning and architecture students to explore how suburban development in the city's Rockwood district could be modified, through infill and possible redesign, to attain sustainability goals.

Increasingly, cities are redeveloping strip developments and "grayfield sites." The latter are abandoned or underused commercial properties such as shopping malls and big-box stores that have gone out of business or moved farther out. Unlike "brownfields," which require expensive clean-up of industrial wastes and chemicals before they can be reused, grayfields typically are cleaner and cheaper to redevelop.

The historic business district of Independence, Oregon.

Image: Otak

Hotel renovation in Pendleton, Oregon.

Historic preservation

Historic downtowns and neighborhoods typically embody design features that encourage walking and reduce the need to drive: smaller, well-connected blocks; higher densities; mixed land uses; tree-lined, narrower streets with sidewalks; pedestrian-friendly architecture; and compact development in central locations. Indeed, many historic neighborhoods are "20-minute complete neighborhoods," a concept gaining popularity as a way to reduce greenhouse gas emissions) [58]

Older buildings often are assumed to be energy hogs. Many are, and their energy efficiency can and should be improved through retrofits. Yet thousands of "green" historic rehabilitation projects have taken place across the country in a way that boosts the energy efficiency of historic buildings while maintaining their unique character.

At the same time, it's worth noting that many historic buildings are more energy-efficient than some of recent vintage due to their site sensitivity, high quality of construction, and use of passive heating and cooling. [59] Having been built with natural heating and cooling systems in mind, historic buildings often have thick walls and cross-ventilating, operable windows. Such features as well as the energy and landfill costs of demolishing an old building and putting a new one in its place warrant consideration in any decision to replace an old building with a new one. As Richard Moe, former president of the National Trust for Historic Preservation, has observed:

> Buildings are vast repositories of energy. It takes energy to manufacture or extract building materials, more energy to transport them to a construction site, still more energy to assemble them into a building. All of that energy is embodied in the finished structure and if the structure is demolished and land-filled, the energy locked up in it is totally wasted. What's more, the process of demolition itself uses more energy and, of

course, the construction of a new building in place of the demolished one uses more yet….[Often t]he greenest building is the one that already exists. [60]

Many Oregon cities are working to strengthen their centrally located, transportation-efficient downtowns through historic preservation. Albany features preservation as a central element of its downtown redevelopment program, which includes a nine-block area designated as the Downtown Commercial Historic District. [61]

Baker City, Oregon

Baker City is a participant in the Oregon Main Street Program, a downtown revitalization initiative modeled after the National Trust for Historic Preservation's National Main Street Center. The Main Street Program revolves around a structured approach to downtown revitalization: organization, design, promotion and economic development. [62]

Advice from infill, redevelopment and preservation veterans

Cities and developers experienced in infill and redevelopment offer these suggestions for successful projects:

- Coordinate early with key stakeholders – e.g., affected neighborhoods, realtors and developers – to avoid pitfalls late in the planning process.

- Assign high priority to infill and redevelopment projects in the local capital improvement program to attract private investment to targeted areas.
- Help developers close financial gaps by eliminating unnecessary and/or burdensome development fees or regulations. Look especially hard at parking requirements.
- Market infill and redevelopment sites as well as historic buildings suitable for rehabilitation to developers.
- Assign (or hire) staff to guide projects through the development review system and to facilitate solutions to problems that arise.
- Provide incentives to offset extraordinary costs and special challenges often involved in infill, redevelopment, and historic preservation.
- Make developers aware of tax incentives available for the renovation of old and historic buildings. These incentives include a federal 20 percent rehabilitation tax credit for income-producing (residential rental, commercial, and industrial) historic properties) and Oregon's 10-year property tax abatement for rehabilitated historic structures.
- Consider tax-increment financing, public infrastructure investments, property tax abatement and other incentives to reclaim older buildings and sites.

Image: Go Downtown! Salem

- Use design standards and illustrated guidelines to encourage attractive, pedestrian-friendly projects that blend well with surrounding neighborhoods. Poorly designed projects will make it harder to win neighborhood approval of future projects.
- Choose architects with experience in historic preservation to evaluate the feasibility of renovating historic structures.

In summary, infill, redevelopment, and historic preservation offer many benefits. Besides enabling communities to take advantage of

the transportation efficiencies inherent in compact centers, these strategies help to revitalize aging commercial areas, contribute to the vitality of a downtown, and add variety to housing opportunities. They also provide a time-tested way for cities to gain efficiencies in land use and save money on public facilities and services.

Publications and Resources

- Infill and Redevelopment Code Handbook (Oregon Transportation and Growth Management Program, 1999). The handbook describes "six steps to success" and provides examples of infill programs and design standards, including ones from Ashland, Brookings and Portland. See http://www.oregon.gov/LCD/docs/publications/infilldevcode.pdf.
- Long Beach Boulevard: Infill Analysis and Redevelopment Strategies, a report that identifies ways to overcome zoning barriers to redevelopment and examines strategies to help developers succeed financially.
- National Trust for Historic Preservation, at http://www.preservationnation.org/issues/sustainability/ and https://www.preservationbooks.org/Bookstore.asp?Type=epolicy&Item=1177
- Playbook for Green Buildings + Neighborhoods provides information on redevelopment. The Playbook was developed by a consortium of more than 20 local governments, non-profit organizations, government agencies, and utilities to help promote the goals set out in the U.S. Conference of Mayors Climate Protection Agreement. The City of Portland's Office of Sustainable Development is one of those partners. See http://www.greenplaybook.org/infrastructure/index.htm
- Refill Fort Collins: Overcoming Challenges to Redevelopment and Infill, a treasure trove of useful ideas and insights from Fort Collins, Colorado, at http://www.fcgov.com/currentplanning/pdf/refill-final.pdf
- Whole Building Design Guide's section, "Apply the Preservation Process Successfully (2008), for information on design details and issues in preserving individual structures. See http://www.wbdg.org/design/apply_process.php

[51] "Measuring the Air Quality and Transportation Impacts of Infill Development," p. ii. U.S. EPA. See http://www.epa.gov/smartgrowth/pdf/transp_impacts_infill.pdf. Industrial Economics, Inc., in association with Cambridge Systematics, Inc. EPA 231-R-07-001. November 2007

[52] Transportation Emissions Guidebook, "Policy Comparison Matrix, "Center for Clean Air Policy., at http://www.ccap.org/safe/guidebook/guide_complete.html

[53] Read more about the impact of new parking requirements on old buildings in Chapter 16, Put Parking in its Place.

[54] "According to Scott Bernstein from the Center for Neighborhood Technology, the cost of the infrastructure required (including water, sewage, electricity) to service a new unit in a greenfield neighborhood is $50,000 to $60,000 per unit, whereas it costs $5,000 to $10,000 per unit in a brown or greyfield." Quoted in Energy and Smart Growth: It's about How and Where We Build, Funders Network for Smart Growth and Livable Communities, 2004, at http://www.fundersnetwork.org/files/Energy_and_Smart_Growth.pdf

[55] See Fort Collins Climate Action Plan: Interim Strategic Plan Towards 2020 Goal, at http://www.fcgov.com/climateprotection/pdf/climate_action_plan.pdf , p. 58

[56] The Chattanooga Climate Action Plan, p. 41.

[57] See http://www.gdda.org/index.html

[58] As the Climate Action Plan for the City of Portland and Multnomah County states, "A critical and basic step to reduce automobile dependence is to ensure that residents live in '20-minute neighborhoods,' meaning that they can comfortably fulfill their daily needs within a 20-minute walk from home." See p. 39 of the Portland and Multnomah County Climate Action Plan at http://www.portlandonline.com/bps/index.cfm?a=268612&c=49989

[59] See Patrice Fey, Building Reuse: Finding a Place on American Climate Policy Agenda, National Trust for Historic Preservation, 2008, p.2, at http://www.preservationnation.org/issues/sustainability/additional-Publications and Resources/buillding_reuse.pdf

[60] See "Historic Preservation and Green Building: Finding Common Ground," an address delivered by Richard Moe, November 20, 2008. See http://www.preservationnation.org/issues/sustainability/sustainability-preservation-1.html

[61] See http://www.cityofalbany.net/comdev/historic/dist/dtcomm.php

[62] See website for Historic Baker City, Inc. at http://www.historicbakercity.com/

[63] See "Historic Property Tax Incentives, Oregon State Historic Preservation Office, at http://www.oregon.gov/OPRD/HCD/SHPO/tax_assessment.shtml

8 Make Streets Complete

Streets are often regarded strictly as a way to move cars. The fact is, streets can and should serve a variety of purposes and functions, only one of which is to get cars from A to B. Streets can provide walkways for pedestrians and bike paths for cyclists. Streets are delivery networks for trucks and services like garbage pick-up and mail delivery. They are corridors of commerce that convey vast amounts of freight. Streets often provide parking. They are essential to our most common form of urban transit, buses. Streets and the lands on which they lie are rights-of-way for a complex network of urban services and utilities such as power lines and storm drains. And finally, streets are, in varying degree, public meeting places, open spaces, playgrounds and parks.

This is not a complete street.

It's little wonder, then, that design of our street systems and streetscapes is a part of good community planning – and of reducing VMT. In the words of urban designer Tony Nelessen, "Streets are our most important public places." [64]

Of course, streetscapes can be designed in such a way as to emphasize the car and downplay the other functions described above. Such streets will have high speed limits, long distances between intersections, little in the way of landscaping or trees, no sidewalks or bike lanes, no on-street parking, large auto-directed signs, and few concessions to other modes of transport (like shelters at bus stops or curb extensions to shorten crossing distance for pedestrians).

A complete street includes amenities for pedestrians .

Image: Otak

The result is a streetscape that practically compels people to drive, such a street is indeed all about the car.

But streetscapes can be transformed. Allow on-street parking. Lower the speed limit. Install landscaped medians and curb extensions. Designate a bike lane. Replace tall "cobra-head" streetlights with pedestrian-scale lighting. Install

The Complete Street

"Davis and Seskin (1997) showed that people are more likely to walk or bicycle for shorter trips, and both walking and bicycling are more viable when streets are built for those on foot as well as drivers, or 'complete streets.' This 1997 analysis of California Air Publications and Resources Board data showed a significant correlation between improved pedestrian access to shopping centers and reduced vehicle trip rates (Davis and Seskin, 1997)."

Bailey, Mokhtarian and Little, The Broader Connection between Public Transportation, Energy Conservation and Greenhouse Gas Reduction, ICF International, 2006, at: http://www.reconnectingamerica.org/public/show/bestpractice247

street furniture such as benches. Build shelters for transit users. Make signs human-scale. Such measures can transform a single-purpose thoroughfare devoted to the car into a multi-purpose boulevard that serves a wider variety of people and also reduces VMT.

The main objective, then, of street design is to maximize the number of people and functions that the street may serve. In the words of the APA publication listed below, the objective is to create "complete streets," not single-function thoroughfares.

Streets, of course, vary widely in their form and function. Measures that make one street more complete and multi-functional may not be appropriate for another street. For example, the traffic calming, dedicated bicycle lanes, and curb extensions that work well to make a residential collector street more complete may not be appropriate for a freight route used by large trucks. On such routes, movement of freight is an essential function that must be maintained.

Note! Creation of complete streets is not solely or even mostly about the new streets we will build tomorrow. More often, it is about redesigning and refitting the streets that exist in our communities today. With the right combination of sidewalks, bike lanes, curb extensions and other enhancements, even the most auto-centric street can be turned into a multi-function boulevard.

Image: Otak

Image: Otak

Publications and Resources

The literature on streetscape design is voluminous. Planners, landscape architects, and engineers all have thoughts on this topic. The publications and resources listed below will get you started on the path to this wealth of ideas and information.

- Complete Streets (American Planning Association, 2006) at: http://www.planning.org/research/streets/index.htm. A short but helpful explanation of streetscape design principles.
- Creating Livable Streets (Metro, 2002), a handbook on ways to design streets to be people friendly, at: http://www.oregonmetro.gov/livablestreets.
- Getting Streetscape Design Right (2006), at: http://www.planning.org/planning/2006/jun/streetscape.htm. This website at the American Planning Association presents useful excerpts from a larger publication.
- Institute of Transportation Engineers, Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities, 2006, at: http://www.ite.org/bookstore/RP036.pdf. Presents a detailed description of the key elements of streetscape design; compares a wide variety of streetscapes in "before" and "after" scenarios.
- National Complete Streets Coalition, an organization dedicated to making streets safer and more comfortable for pedestrians, bicyclists, and transit users. See http://www.completestreets.org/
- Oregon TGM Program, Street Design Basics (2003) contains examples of streetscape design and improvements from several Oregon cities: Hood River, Independence, Redmond and Sisters. See http://web.pdx.edu/~jdill/Street%20Design.pdf

[64] Anton Nelessen, Visions for a New American Dream: Process, Principles, & an Ordinance to Plan & Design Small Communities, APA Press, 1994

Image: Otak

9 Make Way for Pedestrians

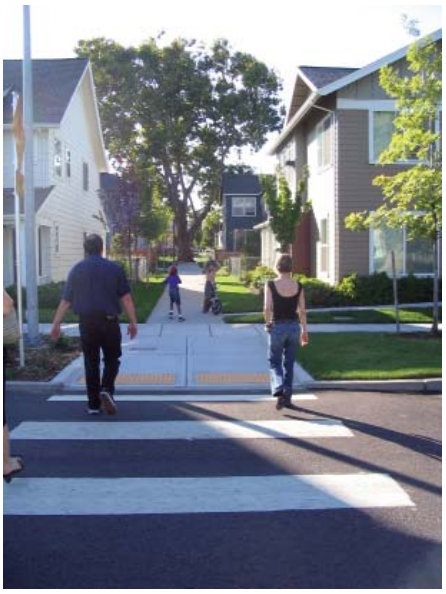
Successful communities across America are increasingly defined by their walkability. Everyone is a pedestrian, but all too often, walking is not a safe and convenient option for getting to work or school or meeting daily travel needs. This travel mode is the common denominator for all other modes of travel, as each trip begins or ends with at least a short walk. Transit trips in particular are based on walk access to transit stops and stations.

One reason we drive so much is that the places we visit usually cater to cars. Such places welcome cars and drivers, emphasize parking and discourage walking. It doesn't have to be that way: development can be done so as to serve pedestrians as well as cars. Many cities in Oregon have adopted mandatory design standards to ensure that new developments are pedestrian-friendly. Existing development also can be redesigned and refitted to provide a more walkable environment. The combination of well maintained and well lit sidewalks of the right width, with curb ramps, safe street crossings, and streetscape amenities such as benches, landscaping and planting strips makes walking an attractive, convenient and safe mode of travel. On-street facilities might be supplemented with trails and separate sidewalk connections that provide direct and pleasant connections for the pedestrian.

What does it mean to be "pedestrian-friendly"? Here are the criteria the City of Corvallis uses in its Pedestrian Oriented Design Standards:[65]

Foster human-scale development that emphasizes pedestrian rather than vehicular features;

- Promote pedestrian oriented buildings, pedestrian amenities, and landscaping that contribute positively to an appealing streetscape;
- Promote an environment where developed areas, recreational areas, and multi-use paths are accessible to all;



Dedicated pedestrian paths provide increased connectivity and visibility.

Image: Otak

- Promote pedestrian safety by increasing the visibility and vitality of pedestrian areas;
- Ensure direct and convenient access and connections for pedestrians and bicyclists;
- Augment the sidewalk and multi-use path system for pedestrians;
- Provide a connected network of sidewalks and multi-use paths;
- Encourage street activity to support livable neighborhoods and vital commercial areas;
- Ensure that developments contribute to the logical continuation of the City's street and block form and/or establish block patterns in parts of the City where they do not exist;
- Provide a sense of diversity and architectural variety, especially in residential areas, through the use of varied site design layouts and building types and varied densities, sizes, styles, and materials;
- Encourage development and building designs that promote crime prevention and personal and community safety; and
- Encourage development and building designs that maintain some level of privacy for individual dwelling units.

The ordinance then goes on to specify precise requirements for various aspects of development. Here's just one example: Large buildings with facades that border sidewalks and walkways are required to have doors and windows make up a large part of the facade area. The doors and windows offer the pedestrian better access to the store, greater safety, and more visual interest than would a solid wall. This is a common requirement now used in many development codes. Pedestrians need visual stimulation to maintain their interest in walking and to encourage trip continuation. As Jane Jacobs, author of The Death and Life of Great American Cities, observed: "Almost nobody travels willingly from sameness to sameness and repetition to repetition, even if the physical effort required is trivial." [66]

Large windows along building facades provide more visual interest for pedestrians.

Image: Otak

In addition to the Corvallis criteria quoted above, "walkability" also is enhanced by these design features:

- small blocks (see Chapter 13)
- placement of buildings close to the street
- building entrances oriented to the street
- wide sidewalks with street trees and on-street parking

- placement of parking behind buildings and in shared lots (see Chapter 13)
- pedestrian crossing islands
- raised crosswalks
- off-street walkway connections

The result of development with design features such as those listed above is a fine-grained, human-scale community that is eminently walkable. Examples of such places in Oregon include Sisters, Ashland, Cannon Beach, Hillsboro's Orenco Station, and Bend's Northwest Crossing.

These walkable places result from a combination of strong municipal design codes and innovative, well designed private development. But a city can enhance such walkability by making strategic public investments in public walkways and pedestrian facilities. The City of Salem offers a good example of this.

The city recently bought an old railroad bridge across the Willamette River in downtown Salem. The city paid the Union Pacific Railroad the princely sum of one dollar for the 1913 structure, which was no longer being used by the railroad and had fallen into disrepair. But the bridge's strategic location, connecting the West Salem Marine Park and the downtown Riverfront Park, made it the perfect place for a pedestrian and cyclist link connecting the two parks. With the help of a grant from the state, the city refurbished the bridge, making it a path for people rather than trains. It opened in the spring of 2009 and already has become a favorite route for walkers, runners, cyclists, and families picnicking in the two parks.

Salem's success story illustrates an important point: several state and federal programs are available to help local governments develop pedestrian facilities. For example, the City of Bend combined $50,000 of local funds with $124,724 in federal grants to begin a Safe Routes to School (SRTS) infrastructure project. The project will establish sidewalks along an arterial that serves a local elementary school. ODOT awarded eight such grants to Oregon cities in 2008 under provisions of the Safe Routes to School Program. [67]

The ODOT Bicycle and Pedestrian Program provides grants that enable local governments to construct bicycle and pedestrian facilities along state highways. The federal Transportation Enhancements program pays for major sidewalk and streetscape improvements, bicycle

The "room effect" created by buildings that come up to the sidewalk, coupled with the landscaping, help to make this street pedestrian-friendly.

Image: Otak

Salem's bicycle-pedestrian path on the old Union railroad bridge.

Image: Otak

lanes, and multi-use pathways projects. And the Oregon Safe Routes to School program supports education and enforcement as well as construction projects designed to enable students to walk and bike to and from school safely, thus reducing their need to be driven. [68]

Publications and Resources

- Balancing Street Space for Pedestrians and Vehicles (Project for Public Spaces) at http://www.pps.org/balancing-street-space-for-pedestrians-and-vehicles/
- A Convenient Remedy: Walkable Urban Neighborhoods, a Congress for the New Urbanism (CNU) video on how neighborhood design can help reduce contributions to global warming. See http://www.cnu.org/climatemovie
- Footloose and Fancy Free: A Field Survey of Walkable Urban Places in the Top 30 U.S. Metropolitan Areas, by Christopher B. Leinberger. See http://www.brookings.edu/~/media/Files/rc/papers/2007/1128_walkableurbanism_leinberg/1128_walkableurbanism_leinberger.pdf
- Pedestrian and Transit-Friendly Design: A Primer for Smart Growth, by Reid Ewing. See EPA's Smart Growth Network at http://www.epa.gov/smartgrowth/pdf/ptfd_primer.pdf
- Walk Score, a website for analyzing the walkability of American cities. Check your neighborhood's Walk Score at http://www.walkscore.com/

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[65] See Ordinance Section 4.10 at http://www.ci.corvallis.or.us/downloads/cd/Land%20Development%20Code-%20Ordinance%20Exhibit%20A/CHAPTER%204_10.pdf
[66] Jane Jacobs, The Death and Life of Great American Cities, 129. Cited in Suburban Nation: The Rise of Sprawl and the Decline of the American Dream. New York: North Point Press, 2000.
[67] "City of Bend Awarded Safe Routes to School Infrastructure Funds, "city news release, January 23, 2008, at http://www.ci.bend.or.us/docs/SRTS_Funds_Awarded1_23_08.pdf
[68] ODOT Briefing Paper: ODOT's Efforts on Climate Change, 2008, p. 6, at http://www.oregon.gov/ODOT/SUS/docs/BriefingPaperEffortsClimateChange.pdf

10 Make Your City Bike-Friendly for Everyone

Four decades ago, Oregonians decided that bicycles merit a place in our state and local transportation systems when they passed the now famous "bike bill." This law, enacted by the Oregon Legislature in 1971, requires the inclusion of pedestrian and bicycle facilities wherever a road, street or highway is built. The Oregon Department of Transportation as well as Oregon cities and counties must spend "reasonable amounts" of their share of the state highway fund on such facilities, which must be located within the right-of-way of public roads, streets or highways open to motor vehicle traffic. [69]

Thanks to this legislation as well as leadership and bike advocacy at the local level, Oregon is ahead of most states today in encouraging bicycling. Many Oregon cities now have the basic elements for a bike-friendly community: design standards, requirements for construction of bicycle facilities in new developments, and public investment in bikeways.

Eugene, for example, now has 30 miles of off-street paths, 89 miles of on-street bicycle lanes, and five bicycle/pedestrian bridges spanning the Willamette River. [70] The city initiated a city-wide system of bike routes in the early 1970s and its efforts to promote cycling continue to this day.

Eugene's extensive path system makes getting around easy.
Image: Otak

Other Oregon cities have followed in Eugene's footsteps to create networks of bikeways that work well. The League of American Bicyclists gives Portland its highest rating: "Platinum." It rates Corvallis and Eugene "Gold," and Ashland, Beaverton, Bend, and Salem "Bronze." [71]

Having a basic bike infrastructure in place, however, does not guarantee success. Bicycling remains impractical or intimidating in many Oregon cities – even in sections of cities recognized

Expand the bicycle network by adding bike lanes to major streets.

Image: Pedestrian & Bicycle Information Center
credit: Jennifer Campos

for their bike-friendliness. Many communities still lack well-connected, continuous systems that connect bikeways with each other and with major destinations. Too often, those who would bike to work, stores or school face challenging routes when a designated bikeway suddenly ends, forcing the cyclist onto a street full of speeding traffic. Gaps in bike systems expose cyclists to fast-moving cars, unexpected car-door openings, collisions, and other hazards.

For bicycling to become more commonplace, cities must form safer, more convenient networks in which routes to destinations are shorter and more direct. In order to contribute to the reduction of carbon emissions, bike systems must enable people to employ the bike as an effective alternative to the automobile. They must enable cycling to "graduate" from being merely an occasional form of recreation for some to being a practical and reliable mode of transport for many.

Create a bike plan and identify gaps in the bike network.

Image: Otak

Toward that end, cities are using a variety of tools to refine and complete their bike networks:

Bike plans and gap identification. The community should have a clear vision of how it wants to connect job and housing centers by bicycle. Through the creation (or updating) of comprehensive bike plans, communities can create this vision, identify gaps in the local bicycle network, and formulate a plan to fill the gaps. Having a well-thought through plan also enhances the prospects for obtaining grants to help implement the plan from state and federal agencies. The Oregon Transportation and Growth Management Program (TGM) awards grants to local governments in this state to help them do exactly that. [72]

Bike lanes. Adding striped bike lanes along major streets is the most common and cost-effective way to expand a city's bicycle network. Corvallis has installed bike lanes on 97 percent of the city's arterial and collector streets. [73] These lanes have been financed in large part by system development charges paid by developers of new homes

and subdivisions. Corvallis' now standard practice of integrating bicycling facilities into existing road repair projects as well as new road projects dates to the 1970s, when the city made a commitment to safer bicycling conditions.

A well-designed bike path provides safe and secure routes separate from auto traffic.

Bike boulevards. While bike lanes work well for the more intrepid cyclists, many people who would like to bicycle choose not to because they don't feel safe cycling on busy streets, even where there is a bike lane. Bike boulevards provide safe and secure bike routes for these cyclists. The boulevards are shared streets on which vehicular traffic is light, car speeds are slow, and biker-activated signals enable safe crossings at intersections. Stop signs are turned to keep cyclists moving, and cars are discouraged from using boulevards as cut-through routes. Bike boulevards are being expanded in cities such as Portland and Eugene, Oregon, and Vancouver, British Columbia.

Off-street bike trails. Bike trails, many of which adjoin abandoned railroad tracks, are gaining popularity. One example is the 21-mile Springwater Corridor (shown here) that will eventually link the cities of Boring, Gresham, and Milwaukie to each other as well as to neighborhoods in southeast Portland, where bikers can continue on downtown via the Eastbank Esplanade. Another example: the Ash Creek Trail slated to link downtown Independence to Western Oregon University in nearby Monmouth. When completed, this four-mile trail will give people an alternative to driving on Oregon 51 and provide better bicycle access to local parks and shops. It will also enable more students to bike safely to school by connecting residential neighborhoods to five public schools.

This bike station uses simple staple racks and provides shelter.

Bicycle parking. The Oregon Bicycle and Pedestrian Program recommends the installation of simple "staple racks" as a way to expand bike parking inexpensively and easily. A growing number of cities have amended their codes to require bike racks or other storage facilities for bikes. Milwaukie, Oregon, for example, requires

TriMet offers an example of connecting the bicycle and transit networks by allowing cyclists to load bikes on its buses, trains, and streetcars.

that bicycle parking spaces comprise at least 10 percent of the required automobile parking in all new commercial and multifamily development. Private developers can get a credit for bike parking under the LEED program for green buildings. [74]

Bicycle wayfinding. A consistent, logical and comprehensive wayfinding system makes bicyclists feel safe and comfortable by guiding bicyclists along the best routes for riding in a particular direction or to a desired destination. Elements of a wayfinding system may include bicycle boulevard pavement markings, destination signs and bike route signs. These facilities increase the visibility of the bicycle network, and make bicycling easier.

Bicycle connections to transit. Effectively linking bicycling with transit increases the reach of both modes. It allows longer trips to be made without driving and reduces the need to provide auto park-and-ride lots at transit stations. Cities should work with their local public transit agency to connect bicycling and transit through tools such as secure large-scale bicycle parking at transit stations, on-board accommodation of bicycles on transit vehicles, and routes that provide direct and safe access to stations.

Employer incentives and facilities for bicycling. Larger employers should be required to provide facilities and incentives for bicycling. People who commute by bike need safe, enclosed bike storage and access to lockers and showers. An example of one large firm's voluntary application of this concept is found at the David Evans & Associates' Portland office. It provides shower facilities and a secure bike cage for bicycle commuters. The company's Bellevue, Washington, office gives its employees cash incentives for commuting by means other than single-occupancy vehicles. Under DEA's company-wide Guaranteed Ride Home Program, employees who commute by alternative modes are provided transportation (cab, company car, etc.) in the event of a personal emergency. [75]

Simple information. Inexpensive measures, like simply providing useful information, can also boost bicycling. For example, city-wide bike maps help people identify the fastest, safest routes to their destinations. When such maps are placed on the internet, cyclists can

enter their trip origin and destination into the computer, which brings up the optimal route on a map, along with information on travel times, bike parking availability, and public transportation connections. [76]

Skeptics discount the bicycle as a meaningful form of transportation, but that tends to be a self-fulfilling prophesy. If a community doubts the feasibility of cycling and therefore provides no bike lanes, paths, or routes, cycling will indeed not be very feasible. But in communities that have developed such facilities, the bike has proven an effective mode of transport – even in rainy western Oregon. Local plans, policies, and funding priorities do make a difference. When it comes to bicycle improvements, if communities build them, people will indeed use them.

Consider these facts: 8.5 percent of Eugene residents now commute to work by bicycle. [77] In Portland, the percentage of work commute trips taken by bicycle soared by 146 percent between 1996 and 2006, a rate increase that dwarfs those of all other modes. [78] Portland aims to increase the percentage of trips taken by bike to 25 percent over the next 15 years. [79]

Boulder, Colorado, today enjoys an 8.8 percent bike mode share. [80] One factor behind this city's success in expanding transportation options may be the attention given to alternative transportation modes in the local budget. Boulder devoted 49 percent of its transportation budget to bicycle, pedestrian, transit and transportation demand management projects in 2007 and 2008. [81]

Pedal Power Benefits

"The only energy cycling requires is provided directly by the traveler, and the very use of that energy offers valuable cardiovascular exercise…Because it is affordable by virtually everyone, cycling is among the most equitable of all transport modes."

– John Pucher, urban planning professor at Rutgers University, and Ralph Buehler, assistant professor at Virginia Tech, in Making Cycling Irresistible: Lessons from The Netherlands, Denmark, and Germany

Lessons from abroad

One should not suppose that the bike ridership of such cities as Eugene, Portland, or Boulder marks the upper limit of what can be achieved. To understand the bicycle's full potential as a practical and convenient mode of transport, we must look abroad. In Amsterdam, widely regarded as the "bicycle capital of the world," 40 percent of the traffic on city streets is bicycles. In Copenhagen, more than 30 percent of the work force commutes by bike. [82] These northern European cities demonstrate that cycling is not just a fair-weather phenomenon or casual form of recreation.

A cycle track in Amsterdam.

Image: Ronald Tamse

Portland's first cycle track on Broadway through Portland State University.
Image: Otak

One European concept starting to gain attention in this country is the "cycle track." Like bike lanes, cycle tracks are special lanes dedicated to bicyclists. But instead of being sandwiched between the main road and parked cars, they are buffered from vehicular traffic by the parked cars – or by a curb or narrow median. This arrangement reduces bicyclists' exposure to dangerous traffic and sudden car-door openings. Cycle tracks are common in Holland and Denmark, where bicycling rivals motoring as a transportation mode for shorter trips. Some experts believe that many American streets, especially in the suburbs, are wider than they need to be and could be refitted over time, as they require repairs, to accommodate cycle tracks. Portland recently opened cycle tracks on a major arterial. [83]

Perhaps the most important thing for cities to do is to define transportation challenges in a way that taps the creativity of traffic engineers. As Boulder engineer Michael Gardner-Sweeney, says, "Engineers are problem solvers. If the problem is to move as many cars as possible through an intersection, that's what they'll do. If you define the problem differently, you get different results." [84] Boulder has redefined the problem to be one of moving people in a multi-modal system, with a strong emphasis on bicycles, pedestrians, and transit. This mindset has yielded encouraging results in Boulder and could do so in other cities as well.

Publications and Resources

The Publications and Resources listed in Chapter 9 above for pedestrian-friendly development also provide useful information on bicycle-friendly designs and programs. In addition, the following sites offer valuable ideas and information:

- Best Practices: Bicycling in Seattle: http://www.seattle.gov/transportation/docs/ump/08%20SEATTLE%20Bicycle%20and%20Pedestrian%20Travel.pdf
- Bicycle Master Plan, 1998 City of Portland update in PDF format, at http://www.portlandonline.com/shared/cfm/image.cfm?id=40414 (An updated edition of this plan was adopted by the City of Portland as this handbook went to press in 2010. Portions of the updated plan are on-line at http://www.portlandonline.com/transportation/index.cfm?c=44597)
- Bicycle Transportation Alliance: http://www.bta4bikes.org/
- Bikeway Design Best Practice, Appendix D of draft Portland Bicycle Plan for 2030: http://www.portlandonline.com/transportation/index.cfm?c=44674&a=266116
- City of Boulder Transportation Master Plan: http://www.bouldercolorado.gov/files/Transportation_Master_Plan/TMP_111303_72dpi.pdf
- International Scan Summary Report on Pedestrian and Bicyclist Safety and Mobility, at http://www.international.fhwa.dot.gov/pubs/pbs/index.cfm and http://www.oregon.gov/ODOT/HWY/BIKEPED/docs/ppt/Scan_Tour.pdf
- League of American Bicyclists, at http://www.bikeleague.org/programs/bicyclefriendlyamerica/communities/
- "Making Cycling Irresistible," Lessons from the Netherlands, Denmark, and Germany," by John Pucher and Ralph Buehler, in Transport Reviews, Volume 28, No. 4, 495-528, July 2008, at http://policy.rutgers.edu/faculty/pucher/Irresistible.pdf
- Oregon Bicycle and Pedestrian Program web site: http://www.oregon.gov/ODOT/HWY/BIKEPED/
- Oregon Bicycle and Pedestrian Plan: http://www.oregon.gov/ODOT/HWY/BIKEPED/docs/or_bicycle_ped_plan.pdf
- Pedestrian and Bicycling Information Center, http://www.bicyclinginfo.org/

- The Pedaling Revolution: How Cyclists Are Changing American Cities, by Jeff Mapes (Oregon State University Press, 2009)
- "Connecting (and Transforming) the Future of Transportation: A Brief and Practical Primer for Implementing Sustainable Door-to-Door Transportation Systems in Communities and Regions," by Susan Zielinski, Managing Director of SMART, University of Michigan, Transportation Research Institute: http://deepblue.lib.umich.edu/handle/2027.42/69252

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[69] See ODOT website at http://www.oregon.gov/ODOT/HWY/BIKEPED/bike_bill.shtml. A "reasonable amount" is considered at least one percent but can be more when appropriate. The funds cannot be spent on trails in parks or other areas outside the right-of-way. See also ODOT's 2007/2008 summary of bike bill expenditures in the Pedestrian and Bicycle Bi-Annual Report at http://www.oregon.gov/ODOT/HWY/BIKEPED/docs/Bi-annual_Report_0708.pdf

[70] City of Eugene's website, at http://www.eugene-or.gov/portal/server.pt?open=512&objID=744&PageID=3998&cached=true&mode=2&userID=2

[71] League of American Bicyclists, at http://www.bikeleague.org/programs/bicyclefriendlyamerica/communities/

[72] For more information on TGM services, visit http://www.oregon.gov/LCD/TGM

[73] March 25, 2010 E-mail from Jo Morgan, transportation program specialist for City of Corvallis, to Constance Beaumont

[74] See LEED 2009 for New Construction and Major Renovations (Credit 4.2 on Bicycle Storage & Changing Rooms) at http://www.usgbc.org/ShowFile.aspx?DocumentID=5546, p. 7

[75] March 25, 2010 e-mail communication from Tami Boardman, of David Evans & Associates, to Constance Beaumont

[76] "Making Cycling Irresistible," Lessons from the Netherlands, Denmark, and Germany," by John Pucher and Ralph Buehler, in Transport Reviews, Volume 28, No. 4, 495-528, July 2008, at http://policy.rutgers.edu/faculty/pucher/Irresistible.pdf . See p. 513.

[77] See "Eugene Cyclists Climb to New High," by Mark Baker. Register-Guard, October 4, 2008. The survey cited is the U.S. Census Bureau's 2007 American Community Survey.

[78] Source: Portland Office of Transportation. U.S. Census Bureau, June 13, 2007 news release reporting results of the 2007 American Community Survey (at http://www.census.gov/newsroom/releases/archives/american_community_survey_acs/cb07-cn06.html)

[79] "The Case for Federal Support for Bicycle and Pedestrian Improvements in the City of Portland and Portland Metropolitan Region." See p. 2 of the Executive Summary.

[80] According to the American Community Survey of the U.S. Census Bureau. A recent travel diary study shows that the percentage of such trips taken by Boulder residents may have risen to 20.5 percent. Modal Split of Trips for the Work Commute: 1990 to 2006, City of Boulder Travel Diary Study

[81] "Development of Boulder's Multimodal System," by Martha Roskowski et al. See http://www.walkinginfo.org/library/details.cfm?id=4299

[82] Data are from the Bicycle City website at http://www.bicyclecity.com/bicycle-friendly-communities

[83] "Some Paint, and Voilà! A Bike-Lane Experiment," by Joseph Rose, The Oregonian, September 1, 2009

[84] "Development of Boulder's Multimodal System," by Martha Roskowski et al. See http://www.walkinginfo.org/library/details.cfm?id=4299

11 Get Well-Connected

One of the buzzwords in transportation planning is "connectivity." The word means having a wide range of routes and connections to get from A to B. The neighborhood with high connectivity will have some or all of these features:

- Many connections and frequent street intersections
- Smaller blocks
- A fine-grained network of numerous interconnecting streets
- Continuous, uninterrupted sidewalks and pedestrian and bike paths
- Narrower streets
- Few "closed-end streets" (culs-de-sac, loop streets, dead-ends)
- Few barriers to crossing, such as freeways, rivers, railroads, walls, etc.

Many 20th-century subdivisions lack connectivity. They were designed with the primary intent of keeping traffic out of residential neighborhoods. Each subdivision thus is an enclave with only one or just a few points of access to other parts of the community.

As the image on the left shows, such designs are easy to recognize from the air. There aren't many intersections. The curvy street patterns and culs-de-sac look like a can of worms. And all the local streets converge into one or two collectors, which funnel traffic into and out of the subdivision.

One problem with the can-o-worms design is that it unnecessarily lengthens the distances that pedestrians and motorists alike must

The walled-off subdivision forces all auto traffic to a single arterial access point.

Image: Otak

travel to reach their destinations. Often it rules walking trips out altogether, even when destinations are nearby as the crow flies.

Another problem with this design is that it puts excessive pressure on the collector streets that serve the subdivision. An accident, weather problems, or a signal failure will easily cause cars to back up where the local streets funnel into the collector. The collector is one of the few routes – perhaps the only route – in and out of the neighborhood. If the collector fails, the cars become, to use the name of an excellent book by Anthony Downs, Stuck in Traffic.

A street network with high connectivity will have more intersections and smaller blocks than a less well-connected network. More intersections offer motorists and pedestrians alike shorter, more direct routes to their destinations.

A grid pattern of streets generally provides the most connectivity, but a grid is not always possible or appropriate. Topographic features such as a wetland or ridge, for example, may require a more curvilinear street design and the occasional use of culs de sac.

Connectivity can be measured by counting the number of intersections per square mile. The LEED standards developed by the U.S. Green Building Council for neighborhood development recommend at least 90 to 140 intersections per square mile. [85]

Importance of Small Blocks

Consider the lowly block. It is the most basic element of urban design and layout, yet few city dwellers ever realize how much the size and shape of blocks affect their everyday activities.

Blocks are squares or rectangles bordered by a city's streets. A typical city block in the U.S. is a square 300 to 400 feet on a side, but there's widespread variation from that norm. Some cities have large blocks 600 feet or more on a side. In contrast, the City of Portland's downtown is a grid made up of unusually small square blocks 200 feet on side – about one acre per block. By shortening distances and travel times to

a wide variety of destinations, Portland's combination of small blocks and relatively narrow streets makes it easier for people to carry out many trips on foot.

Of course, the block size of a city's downtown is, well, cast in concrete. It's not a design variable that is often or easily changed. But new subdivisions and other large developments do create new blocks. Generally, large block sizes yield more land for development and offer less area for streets. They also are more accommodating of large lots. But big blocks are less friendly to pedestrians and have less connectivity: driving from one place to another takes longer, and walking there is more difficult. Big blocks also present greater difficulty in providing access to interior lots: the result may be a proliferation of flag lots or culs de sac.

For such reasons, many city plans and zoning ordinances contain provisions limiting both block size and the length of culs de sac. A maximum block size of 600 feet is widely used, but such a maximum is not a desirable standard: it's much too large. For greater connectivity and more walkability, shorter block lengths (200-400 feet) are essential. The Institute of Transportation Engineers says this:

> Pedestrian facilities should be spaced so block lengths in less dense areas (suburban or general urban) do not exceed 600 ft. (preferably 200 to 400 ft.) and relatively direct routes are available. In the densest urban areas (urban centers and urban cores), block length should not exceed 400 ft. (preferably 200 to 300 ft.) to support higher densities and pedestrian activity. [86]

Similar guidance is found in the Oregon Transportation and Growth Management Program's Model Code/User's Guide for Small Cities, which suggests this standard:

> Streets are connected and blocks are walkable in scale (e.g., 200-600 feet in length, with an average perimeter no greater than 1,400 feet), except where topography, existing development, or other physical features require longer blocks. [87]

Downtown Oregon City
Image: Otak

The common thread in these recommendations is to limit the block length (or perimeter) and focus on smaller block sizes in centers (200 – 300 feet) and allow for larger block lengths (400 feet) in neighborhoods. For good examples of 300-foot block lengths, see the

downtown historic blocks of Oregon City, West Linn, and Newberg. For beautifully-scaled 400-foot block lengths in a neighborhood setting, Portland's Sellwood and Westmoreland neighborhoods are great examples.

Publications and Resources

- Congress for New Urbanism, a national organization that promotes walkable, neighborhood-based development as an alternative to sprawl. See http://www.cnu.org/
- LEED-ND, a rating system that neighborhood development that integrates the principles of smart growth, urbanism and green building into the first national system for neighborhood design. Developed by LEED (Leadership in Energy and Environmental Design), a program of the U.S. Green Building Council. See http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148
- Neighborhood Street Design Guidelines: An Oregon Guide for Reducing Street Widths (2000), a helpful TGM guide, at http://www.oregon.gov/LCD/docs/publications/neighstreet.pdf
- Skinny Streets and Fire Trucks, by Reid Ewing, Ted Stevens, and Steven J. Brown in the August 2007 Urban Land. See http://www.smartgrowth.umd.edu/pdf/ULI_SkinnyStreets.pdf

[85] That is, 140 intersections per square mile for projects with internal streets; for other projects: 90 intersections per square mile. LEED 2009 rating system for Neighborhood Development at http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148

[86] Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities, 2006, page 32, at http://www.ite.org/bookstore/RP036.pdf

[87] http://www.oregon.gov/LCD/TGM/modelCode05.shtml

12 Put Parking in its Place

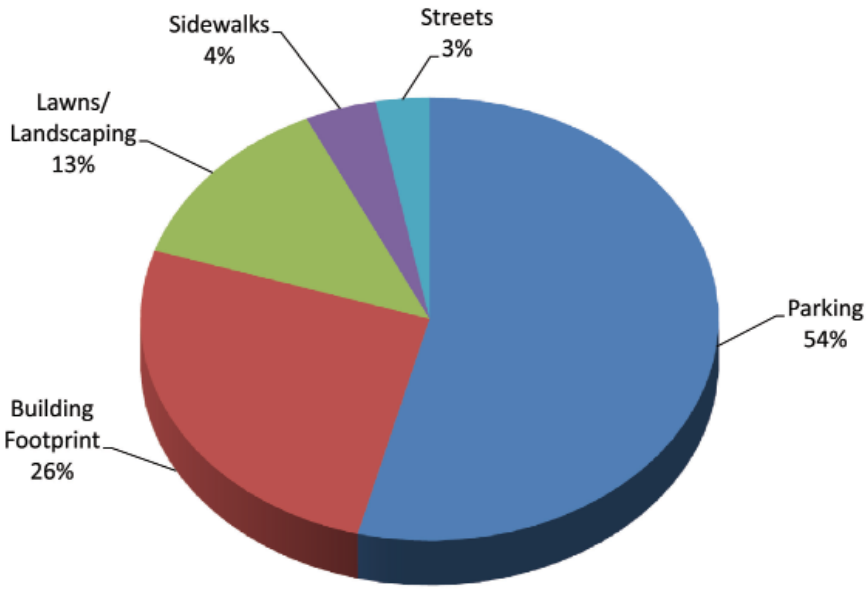
One of the most important influences on travel behavior is the way parking is planned and managed in our cities and towns. That means local parking policies and practices can play a major role in reducing carbon emissions.

Parking's place in land use and transportation

The United States now has a population of about 300,000,000 people and 200,000,000 "cars" of various types: passenger cars, mini-vans, SUVs and light-duty trucks. [88] In other words, for every three people, we have about two "cars" (using the term broadly to include all forms of personal transport with four wheels).

Of course, not all of our nation's 300 million people drive. The number of registered drivers in 2001 was 190,425,000. [89] We thus have more cars than drivers!

Site Coverage for Typical Commercial Development
(average for Olympia, Washington)

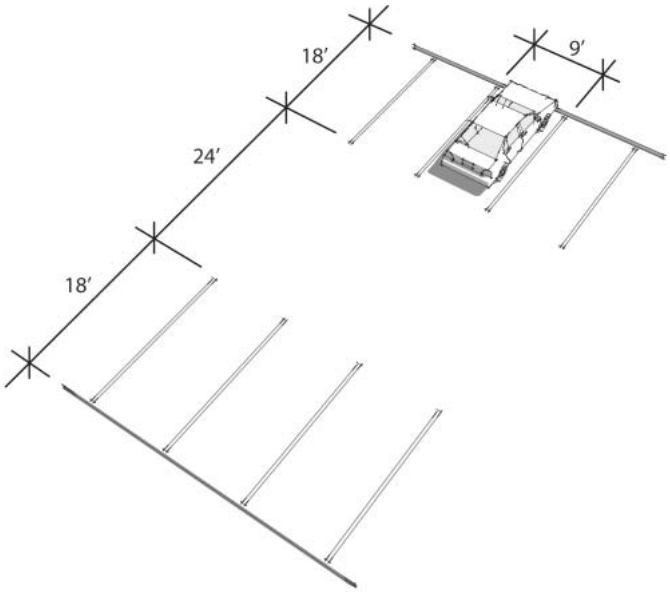


Source: City of Olympia Public Works Department, and the Washington State Department of Ecology, 1995.

Parking lots, which often consume more land than the buildings they serve, increase distances between local destinations, thus increasing the likelihood that people will drive from place to place.

Most of us are well aware of the streets and roads and highways necessary to carry out all these vehicles when they are moving. We are, however, less mindful of all the space needed to accommodate them when they are standing still. A typical "car" needs 150-200 square feet on which to park (assuming you want to open your vehicle's door). America's 200,000,000 vehicles therefore take up almost a million acres when they are standing still. [90]

But vehicles must be stored at the beginning and end of each trip. We therefore provide a total number of parking places that is many times larger than the number of vehicles. Also, additional space is needed to maneuver vehicles into and out of their parking places. As a result, parking lots typically contain more than 300 square feet of land for each vehicle. [91]



A typical parking aisle requires a surprising amount of space.

No one knows the number of parking spaces that exist in the U.S., but by any calculation, parking is one of our largest urban land uses. In most central cities, it occupies a large fraction of the total land area. It shapes our cities and neighborhoods, and it strongly affects the type and amount of travel we do.

Can there be too much parking?

Urban drivers sometimes feel like birds of prey. Eyes peeled, they circle their destination intently, poised to pounce on the first vacant parking space. After a few such experiences, their perspective on parking becomes quite simple: "There should be more of it!"

That perspective has driven us – pun intended – to devote vast areas of urban land to parking.

The extreme case probably is the City of Los Angeles. The "parking coverage" (the area occupied by all parking spaces divided by the land area of the CBD) in that city's central business district (CBD) has been estimated to be 81 percent. We hasten to add that four-fifths of central Los Angeles is not covered by parking spaces: many of the spaces are in multi-story structures. A five-story parking structure on one acre of land thus has five acres of "parking coverage." Still, it seems safe to say that Los Angeles has a lot of parking (107,441 spaces, to be precise). [92]

Other American cities may have more modest parking coverage, but they still offer abundant parking (often free of charge), for several reasons. The first and most obvious is simply this: we have a lot of cars, and the number has been growing. In the past fifty years, for example, the number of cars in the U.S. more than doubled.

A second reason is market demand. Developers and business owners know that many of their potential customers use cars. Those customers expect places to park, and so developers and business owners often try to provide them.

Finally, planning and zoning regulations usually require those developers and business owners to provide some minimum number of off-street parking places. Many communities have detailed ordinances and elaborate standards and formulae to specify the number of off-street parking spaces that must accompany different types of land uses. For retail uses, the regulations often require more land for parking than will be occupied by the buildings served by the parking.

For example, a common formula for urban retail stores is "no less than one parking space for every 300 square feet of gross retail floor area." Parking areas usually contain at least 300 square feet for each parking space. The formula therefore amounts to a one-to-one requirement: a square foot of parking for each square foot of floor area.

Local parking ordinances usually are based on the concept of "trip generation" – that every land use from an asylum to a zoo generates a certain number of vehicle trips to and from its premises and a corresponding need for parking. The ordinance formulae for parking thus are only as valid as the data on trip generation. Unfortunately, the data for trip generation sometimes are not valid. The few trip generation studies that are done often focus on suburban uses that are not served by transit and are neither pedestrian- nor bicycle-friendly. Trip generation studies may overestimate the amount of parking

Oregon Examples

Parking standards vary from one city to another. Here are standards for "general retail stores" from several western Oregon cities:

Corvallis Land Development Code 4.1.30(c) (25): One space per 400 sq. ft. of floor area

Keizer Development Code 2.303.06: One space per 300 sq. ft.

McMinnville Zoning Ordinance 17.60.060(C) (17): One space per 250 sq. ft.

Salem Revised Code 133-1(6): One space per 200 sq.ft.

Springfield Development Code 4.6-125: One space per 300 sq. ft.

Woodburn Development Ordinance Table 3.1.2 (12): One space per 250 sq. ft.

needed if pedestrian, bicycle, and transportation modes as well as smart growth community design concepts are not taken into account. The data from such studies indicate higher trip generation than would be the case in an urban location where a variety of transportation modes is available. [93] Such auto-centric data thus exaggerate the need for parking spaces.

Parking is expensive to develop and maintain. Many developers consider the local parking requirements excessive, but they often encounter strong local resistance to any proposal to lower the parking standards. The driving public wants and has come to expect readily available (and in many cases, free) parking. Such demand means that if private businesses don't provide their own off-street parking, the city may be forced to. Also, local off-street parking requirements allay conflicts and competition among landowners for the limited number of public on-street parking spaces. For example, if a restaurant is built near a residential neighborhood and the restaurant lacks off-street parking, clients will park on-street in the neighborhood. Residents may dislike such traffic and feel that they are being denied public parking spaces that "belong" to them.

Typical parking requirements result in excessive parking areas for normal shopping days.
Image: Otak

These types of conflicts led planners and engineers to recommend parking ordinances that require sufficient off-street parking to satisfy all or most of the expected peak demand. The required parking areas thus are fully occupied on only a few of the busiest shopping days of the year. In some cases, the parking requirements are so excessive that the resulting parking lots never fill.

The result in many cities has been convenient and often free parking for anyone who chooses to drive. But this convenience comes with hidden costs. Here is how Donald Shoup, author of The High Cost of Free Parking and a national expert on the topic, describes it:

> Urban planners typically set the minimum parking requirements for every land use to satisfy the peak demand for free parking. As a result, parking is free for 99 percent of automobile trips in the United States. Minimum parking requirements increase the supply and reduce the price–but not the cost–of parking. They bundle the cost of parking spaces into the cost

of development, and thereby increase the prices of all the goods and services sold at the sites that offer free parking. [94]

As Shoup notes, the required parking is far from "free." Quite the contrary. The costs are very high indeed to provide something that requires so much land in the urban areas where land is most expensive. Most of those costs, however, have been shifted away from the driver. Americans drivers have come to expect "free" parking, but they remain unaware that the actual costs of parking are hidden in the prices of other goods – housing, for example. After half a century of abundant and subsidized parking, they tend to support strong parking regulations and to resist measures that would reduce the amount of parking or shift its costs toward them. The mode message over the years has been a consistent "Drive, drive, drive" – and we have listened.

If the system of parking described above is both longstanding and popular (at least with drivers), why would anyone want to change it? As it turns out, the American way of parking presents some significant costs and issues.

A planning disaster?

"A cost of somewhere between $127 billion and $374 billion a year for off-street parking [nationwide] has been shifted into higher prices for everything else. This cost disappears from sight when drivers park free, but it does not cease to exist. Instead, free parking increases the demand for driving, which in turn increases the subsidy necessary to meet the peak parking demand. Minimum parking requirements are truly a great planning disaster – perhaps the greatest of all time." Donald C. Shoup, The High Cost of Free Parking, p. 219

Re-thinking parking's place

As its title suggests, Donald Shoup's 2005 book The High Cost of Free Parking raises serious concerns about the costs and impacts of traditional parking practices and regulations. Increasingly, those concerns are being echoed elsewhere in planning literature, and a growing number of American cities now are revamping their parking regulations for reasons outlined below:

1. Parking's threat to the vitality of city and town centers

What is the single biggest attraction of a city's central business district? The answer is density and diversity of uses. People are drawn to shop, work, live and visit in the "downtown" because it has such an array of attractions clustered together. In just one city block, they may find several shops, a restaurant, a theater, offices, and so on. Such proximity is the main

The deadening effect surface parking can have on the density and diversity of uses in a downtown.

reason they come there. Parking, however, decreases that proximity, increasing the distance from one destination to the next. It thus can become a powerful enemy of urban density and diversity. It is a land-intensive use that, at some level, works against a downtown's most important qualities. As more parking is made available in an urban area, the density and proximity of urban uses decrease. That makes walking, cycling, and transit less feasible. VMT goes up – and so do the carbon emissions.

2. A subsidy to drive

Abundant parking, especially when there is no charge to those who use it, encourages people to choose the car over other means of transport. If drivers had to pay the actual costs of parking, they might find walking, cycling, or transit to be attractive alternatives to the car. Subsidized or "free" parking thus favors the one transportation mode that contributes the most to carbon emissions. That subsidy works directly against public policies that encourage the public to walk and cycle more and use transit.

Moreover, the dollar amount of that subsidy is far from trivial. For the nation as a whole, the subsidy amounts to several hundred billion dollars each year, with drivers paying only one to four percent of the total costs of parking. [95]

3. A cause of congestion

Off-street parking often increases traffic congestion in urban areas, for this simple reason: the number of parking spaces in the urban area keeps growing, but the number of streets is fixed. The streets and blocks in the typical American city were laid out more than a century ago. As development followed, the resulting street network has become almost literally "cast in concrete." It is difficult, sometimes impossible, to add many new streets. It is, however, possible and usually required by law to keep creating more parking. The growing number of parking places served by a fixed number of streets thus produces congestion downtown.

> The space available to park cars thus rises much faster than the space available for them to drive. This asymmetry between streets and parking makes congestion worse and undermines one of density's great benefits—vibrant street life. [96]

4. Lost opportunities for urban investment

Land in a central business district or a town center is almost always the most expensive land in a given urban area. Therefore, land used

for parking in such centers is quite costly. The money spent on such parking is capital that could have been invested in other amenities or facilities that would enhance the downtown or town center.

Shoup suggests that the capital costs for our nation's parking exceed the total value of all our vehicles and of all our streets and roads.[97] Making some of that money available for transit, pedestrian, and bicycling facilities would help cut carbon emissions.

5. Hindering redevelopment and preservation

When a city increases its off-street parking requirements, it typically "grandfathers in" older uses. Such uses need not comply with the new requirements. But they also become "nonconforming uses." That means they will be subject to the new parking requirements if the grandfathered use is changed, the site is redeveloped, or an older building is renovated. This can present a serious barrier to downtown revitalization. The high costs and great difficulty of meeting the parking requirements thus may preclude redevelopment or enhancement of older buildings.

6. Creating cities for cars

Because parking lots and structures are large and land-extensive, they greatly affect urban design and urban form. A city with numerous parking lots, parking structures, driver-oriented strip malls, and large auto-oriented signs and street lights becomes a city designed for cars rather than people. Its urban form is neither attractive nor inviting. At that point, the abundance of parking has defeated its own purpose: even the drivers it was intended to serve are repelled. In the words of William H. Whyte, author of The City: Rediscovering the Center:

> In some American cities, so much of the center has been cleared to make way for parking that there is more parking than there is city. . . . Some cities . . . have gone so far as to reach a tipping point. If they clear away any more of what's left, there would not be much reason to go there to park. [98]

Active ground floor uses in parking structures help to enliven the street.

This problem is compounded by what might be called the snowball effect. That is, abundant and free parking encourages people to drive and discourages walking, cycling, and transit use. As more people drive to the downtown or commercial centers, the demand for parking there increases. If more free parking is provided, more driving occurs, and voila: more parking is needed.

As long as parking is free or heavily subsidized, there is in effect no limit to such "demand" for parking. The demand will keep increasing until parking displaces all the urban amenities, features, diversity and variety that caused one to drive there in the first place.

7. Squeezing out housing

Most cities encourage the development of housing, especially higher-density and more affordable housing, in downtowns and town centers. Usually, they do this by zoning certain areas for multi-family dwellings with densities of several dozen units per acre. Excessive parking requirements, however, often defeat the purpose of such zoning: they require so many parking spaces that the allowed densities cannot be achieved. In effect, the housing developer must sacrifice dwelling units for parking spaces. That, of course, drives up the cost of housing.

All of this is not to say that an excess of parking lots, free parking, and parking requirements exists in every community or that such excess causes all of the problems summarized above. It is to say – emphatically – that local parking conditions are one of the first things a community should evaluate in a quest to reduce carbon emissions. Refining a city's parking ordinances can bring a multitude of benefits, not least of which is downtown revitalization.

Carbon-cutting parking practices

Here are some ways in which communities can refine their parking policies and practices to lower VMT and reduce carbon emissions. It is by no means a complete list. Rather, it's a summary of steps that a local government could take.

1. Change minimums to maximums.

Some cities have changed their minimum requirements for off-street parking to maximum requirements. In other words, the revised parking ordinances specify the most off-street parking that can be built for any given development rather than the least. Planners Manville and Shoup put it this way:

> Perhaps the simplest and most productive reform of American zoning would be to declare that all existing off-street parking requirements are maximums rather than minimums. The examples of New York and San Francisco suggest that limits on off-street parking can foster many of density's benefits, and urbanists who admire these cities might urge other places to adopt their approaches to parking. [99]

The American Planning Association (APA) suggests that minimums and maximums both be used:

> Combined with parking minimums, maximum standards limit the range of parking spaces supplied. Maximum standards are typically based on one of three criteria. Some communities set a ratio per number of square feet of building area to establish a maximum. Others base the maximum on some aspect of the minimum standard (e.g., if one space is the minimum requirement, 1.5 spaces might be the maximum). The third type of maximum occurs when a municipality provides a limit on the overall number of parking spaces in a particular geographic area (e.g., a downtown or a historic district). [100]

In Oregon, the trend seems to be one of setting both floor and ceiling. For example, the City of Bend's development code says, "The number of parking spaces provided by any particular use in ground surface parking lots shall not exceed the required minimum number of spaces provided by this Section by more than 50%." [101]

Likewise, Salem's zoning code sets a ceiling and floor for parking. It specifies a minimum number of spaces that must be provided for various uses and a maximum number. The maximum ranges from 1.75 to 2.5 times the minimum. [102] Medford uses a similar floor-ceiling combination.

2. Eliminate parking requirements in key areas to encourage alternative modes of transportation.

Some communities eliminate or reduce parking requirements where an area is well served by transit. Such measures have a dual benefit: they encourage use of transit and reduce VMT. For example, Portland's parking requirements contain this exemption: "There is no minimum parking requirement for sites located less than 500 feet from a transit street with 20-minute peak hour service." [103]

Likewise, Medford eliminates parking requirements for certain areas and zones. Its development code says, "For non-residential uses, there is no minimum number of off-street parking spaces required in the Downtown Parking District, per Section 10.358(1)(a); and the Southeast (S-E) Overlay District, Commercial Center, per Section 10.378 (6)." [104]

The City of Salem has a variation on this theme. It allows for alternative parking plans with reduced numbers of spaces in certain cases:

Notwithstanding any other provision of this code, off-street parking requirements for nonresidential uses may be satisfied by

As shown, Ashland requires parking to be placed behind or on the sides of the building.

Image: Otak

implementation of a plan whereby the owner or any lessee will provide for or will increase the use of alternate modes of transportation and thereby decrease the need for off-street parking. Salem Revised Code 133.150

Some cities (Corvallis, for example) exempt their historic downtown areas from minimum off-street parking requirements. [105]

3. Set design standards for parking.

In auto-oriented development such as a strip mall, parking usually is located in front of the buildings served by the parking. Such placement has several unfortunate consequences. First, it separates the building from the street, sidewalk (if any), and transit stop (if any). Such separation sends the strong "mode message" that driving is preferred over walking, cycling, or transit use. Second, such placement creates an uninviting environment for potential customers on the street. A design that brings the buildings forward and moves the parking to the back is better suited to a variety of transportation modes and also is likely to be more attractive.

The City of Ashland's design standards illustrate this principle. For industrial and commercial uses, they require that parking areas be "located behind buildings or on one or both sides." They also require the parking areas to be "shaded by deciduous trees, buffered from adjacent non-residential uses and screened from non-residential uses." [106]

Good site design for parking is a big subject, one beyond the scope of this handbook. But the interested reader will find some useful ideas in Vinit Mukhija and Donald Shoup's "Quality versus Quantity in Off-Street Parking Regulations." [107]

Their design ideas include the following:

- Put required parking areas behind, beside, or below the buildings, not between the sidewalk and the buildings.

- In commercial or mixed use areas, replace the setback with the "build-to line," requiring buildings to be located close to or adjoining the sidewalk.
- Drop parking lots a few feet below ground level, so pedestrians don't look across a sea of cars.
- Require parking lots to be screened from view.
- Landscape parking lots with trees, shrubs, benches, fountains, decorative surfaces, etc.

Some cities use a point system, whereby a developer may pick from among a variety of design and landscaping options to achieve a required number of points.

4. Let the market work.

"The market" in this case has three main components: off-street parking, on-street or curbside parking, and commercial parking lots. The full "market price" of parking in any one place thus depends on the supply of all three types of parking. For example, if a city requires extensive off-street parking for each private development and does not charge for curbside parking, it is subsidizing two forms of parking, which will result in artificially lower prices at commercial lots.

Such subsidies are not merely a matter of economics. They also play a significant role in carbon emissions. For example, free curbside parking not only distorts the market, but it also produces significant congestion and carbon emissions as drivers "cruise," looking for an available space.

Shoup suggests that the proper pricing for on-street metered parking should be one that "will maintain a 15 percent curb vacancy rate." In his estimation, it is difficult to determine that price but well worth doing: "[T]he evidence suggests that market prices for curb parking can create enough vacancies to guarantee easy parking access and eliminate cruising." [108]

Proper on-street pricing should result in a certain level of parking space vacancy.

Image: Otak

Some cities, such as Davis, California, offer developers the option to pay "in lieu fees": that is, a developer of downtown property

An example of off street bicycle parking in Portland.

Image: Otak

can pay a fee rather than be required to meet requirements for a set amount of off-street parking. Generally, the revenues then go into a dedicated municipal parking fund. [109, 110]

5. Provide more parking for bikes.

Many cities now require certain types of new development to provide parking areas for bicycles as well as cars. For example, Salem's zoning code says, "Bicycle parking shall be provided for all new multiple family residential developments (4 units or more), commercial, industrial and institutional uses, in the following manner . . . ." The code then goes on to specify how the needed bicycle spaces are to be calculated and how the parking areas are to be designed. [111]

Some cities also allow parking areas for bicycles to substitute for required auto parking areas. For example, the City of Portland's development code specifies:

> Bicycle parking may substitute for up to 25 percent of required parking. For every five non-required bicycle parking spaces that meet the short or long-term bicycle parking standards, the motor vehicle parking requirement is reduced by one space. [112]

6. Share the space.

An increasingly common way to reduce excessive parking requirements is to provide for the sharing of off-street parking space. For example, an office complex that receives almost all its vehicular traffic during the day may share those spaces with a theater or night-club that gets most of its traffic at night.

Many communities now have provisions in their development codes for shared parking. For example, the City of Salem allows for "joint parking" to be shared by certain daytime and nighttime uses (per Salem Revised Code133.130).

7. Provide remote parking for the downtown.

To protect densely developed and often historical downtown areas, some larger cities provide or require remote parking at the city's edge,

where drivers can then shuttle into the city's center. It's the same kind of system used for long-term parking at Portland's airport.

Here's an example from Tennessee:

> To encourage downtown development the Chattanooga Area Regional Transit Authority developed peripheral parking garages with free shuttle service. By constructing parking facilities at either end of the business district, the system intercepts commuters and visitors before they drive into the city center, reducing traffic problems. The garages' parking revenues finance the free shuttle buses. They depart from each garage every five minutes all day, every day, and pass within walking distance of most downtown destinations. The electric-powered shuttles transport approximately one million riders each year, making shuttle-served property attractive to businesses. Since 1992, when the shuttle service began, over $400 million has been invested in the downtown, including a major freshwater aquarium, over 100 retail shops and 60 restaurants.[113]

One final note . . .

Parking often is viewed as a technical subject best left to engineers, and its relevance to carbon emissions and global warming may not be readily apparent. But many experts believe that, when it comes to land use decisions and related policies, the most substantial greenhouse gas reductions are likely to emerge from parking supply policies. [114]

Publications and Resources

- Driving Urban Environments: Smart Growth Parking Best Practices, a publication of the Maryland Governor's Office of Smart Growth, no date, at http://www.contextsensitivesolutions.org/content/reading/parking_md/resources/parking_paper_md/
- The High Cost of Free Parking, Donald Shoup. Planners Press, 2004
- Parking Management Made Easy: A Guide to Taming the Downtown Parking Beast (Oregon Transportation and Growth Management Program, 2001), at http://www.oregon.gov/LCD/docs/publications/parkingguide.pdf
- Parking Spaces/Community Places: Finding the Balance through Smart Growth Solutions, U.S. Environmental Protection Agency, at http://www.epa.gov/smartgrowth/parking.htm

[88] The U.S. Census estimates that our nation, as of May 10, 2009, has 300,009,000 people. The precise number of vehicles (for the year 2000) was 212,706,399 –133,621,420 passenger cars and 79,084,979 "other 2-axle 4-tire vehicles." Bureau of Transportation Statistics, Research and Innovative Technology Administration, Table 1-11, Number of U.S. Aircraft, Vehicles, Vessels, and Other Conveyances, at: http://www.bts.gov/publications/national_transportation_statistics/2002/html/table_01_11.html

[89] US Federal Highway Administration, Highway Statistics 2007, at: http://www.fhwa.dot.gov/policyinformation/statistics/2007/nhts621.cfm

[90] 200,000,000 vehicles x 200 square feet divided by 43,560 square feet per acre = 918,274 acres.

[91] "A typical parking lot holds about 130 cars per acre (335 square feet per car) . . ." Donald C. Shoup, The High Cost of Free Parking, APA Planners Press, 2005, p. 17, footnote 12.

[92] Michael Manville and Donald C. Shoup, "Parking, People, and Cities," Journal of Urban Planning and Development, Vol.131, No. 4, December 1, 2005, p. 243

[93] "Trip generation rates thus measure the average number of vehicle trips observed at a few suburban sites with plentiful free parking but no public transit, pedestrian amenities, or TDM programs. Urban planners who rely on these trip generation rates to design the transportation system are planning cities for cars, not people." Donald C. Shoup, The High Cost of Free Parking, APA Planners Press, 2005, p. 43.

[94] Donald C. Shoup, The Trouble with Minimum Parking Requirements, 1999, posted on-line by the Victoria Transport Policy Institute at: http://www.vtpi.org/shoup.htm

[95] "[T]he total subsidy for off-street parking in 2002 was between $127 billion and $374 billion." Donald C. Shoup, The High Cost of Free Parking, APA Planners Press, 2005, p. 43.

[96] Michael Manville and Donald C. Shoup, "Parking, People, and Cities," Journal of Urban Planning and Development, Vol.131, No. 4, December 1, 2005, p. 233

[97] Donald C. Shoup, The High Cost of Free Parking, APA Planners Press, 2005, p. 208-210

[98] William H. Whyte, The City: Rediscovering the Center, CITY, Anchor Books, 1998, p. 314

[99] Michael Manville and Donald C. Shoup, "Parking, People, and Cities," Journal of Urban Planning and Development, Vol.131, No. 4, December 1, 2005, p. 245

[100] American Planning Association, The Dynamics of Off-Street Parking, Planners Advisory Service (PAS), p. 3, at: http://www.planning.org/pas/reports/subscribers/pdf/pas510-4-26.pdf

[101] Bend Land Development Code 3.3.300(E)

[102] Salem Revised Code (SRC) 133.100

[103] Portland Zoning Code 33.266.110(B)(3)

[104] Medford Land Development Code 10.743(1)

[105] Corvallis Land Development Code 4.1.20(n)

[107] City of Ashland's Site Design and Use Standards, Section II-C-1d, at: http://www.ashland.or.us/Files/SiteDesign-and-UseStandards.pdf

[107] Journal of the American Planning Association, Vol. 72, No. 3, Summer 2006, at: http://shoup.bol.ucla.edu/QuantityVersusQualityInOff-StreetParkingRequirements.pdf

[108] Donald C. Shoup, The High Cost of Free Parking, APA Planners Press, 2005, p. 313

[109] See Donald C. Shoup, "In Lieu of Required Parking," Journal of Planning Education and Research 18:307-320, 1999, at: http://www.mrsc.org/ArtDocMisc/Shoup_Pkg_InLieu_Fees.pdf

[110] See Donald C. Shoup, "In Lieu of Required Parking," Journal of Planning Education and Research 18:307-320, 1999, at: http://www.mrsc.org/ArtDocMisc/Shoup_Pkg_InLieu_Fees.pdf

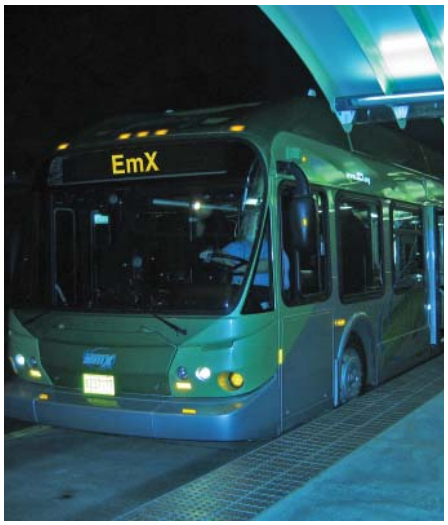
[111] Salem Revised Code (SRC) 133.110

[112] Portland Zoning Code 33.266.110(B)(4)

[113] See The Chattanooga example comes from Natural Capitalism Solutions' Climate Manual for Cities, at: http://www.climatemanual.org/Cities/Chapter5/BestBets/CPM_Chapter5_LocalActionPlan_BestBets_TransportationResidential.htm#pmb. The manual has an excellent and detailed description of carbon-reducing parking measures in its chapter, "Implement Parking Management Programs."

[114] See, for example, Kara Kockelman et al., GHG Emissions Control Options: Opportunities for Conservation, University of Texas at Austin, 2008. This study was commissioned for the National Academy of Sciences. See http://www.ce.utexas.edu/prof/kockelman/public_html/NAS_CarbonReductions.pdf at p. 60.

13 Make Way for Transit and Transit-Oriented Development



Bus Rapid Transit in Eugene

Image: Lane Transit District

Following a major decline in the use of public transit after World War II, this mode of transportation is enjoying a revival today. In Oregon, transit use in Portland has increased by 75 percent since 1990. Major new light-rail lines have been added along with a Central City Streetcar.[115] The city of Eugene launched a Bus Rapid Transit System in 2007 to improve connections between downtown Eugene and downtown Springfield. A commuter rail service opened in 2009 linking Beaverton to Wilsonville. Baker City inaugurated a new trolley service in 2009 to connect five business districts and residential neighborhoods. Increasingly, cities around the country see transit as a way to protect their economies from the possibility of sudden gas price hikes and future fuel shortages triggered by global forces beyond their control.

But even greater use of public transit in Oregon and elsewhere will be essential if greenhouse gases are to be reduced. Greater use of transit means attracting more "choice riders"— people who choose to leave their car at home and use transit for that trip. These riders are strongly motivated in their choice to travel by transit by cost, convenience, and service. They also are motivated by their perceptions of the walking trip to transit, the qualities of the transit vehicle, and the qualities of the stop or station. Planning and design that make transit more convenient, with more service, and more "customer appeal" are key parts of "Cool Planning."

Having a transit center that is accessible increases transit use.

Image: Otak

Getting Good Transit

Every transit trip begins and ends with a walk. If such walks are convenient, safe and pleasant, transit use increases. But if the walk to and from the transit station or stop is inconvenient, unsafe or unpleasant, the transit system will languish.

A high-quality pedestrian environment near transit stops therefore is critical. As Peter Calthorpe writes in The Next American Metropolis, "A healthy walking environment can succeed without transit, but a transit system cannot exist without the pedestrian." Pedestrian crossing facilities, suitable turning radii at street corners

on transit routes, proper spacing of transit stops, and amenities such as benches and shelters at transit stops are all part of the experience of taking transit.

For such reasons, good transportation system planning is essential. Transit typically runs along a city's main transportation corridors, the collector and arterial streets. The design and spacing of such streets play an important role in the effectiveness of the transit system. A city that hasn't planned for transit use will find it difficult to establish an effective transit system.

For example, transit riders typically will walk no more than ten minutes or half a mile to reach a transit stop or station. But they are unlikely to walk at all if the street system has only a few local streets providing direct routes to transit, streets lack continuous sidewalks and good lighting, and busy collectors and arterials offer no safe places for pedestrians to cross.

Spacing of major streets and number of intersections per square mile are two key indicators of a street network's suitability for transit. Generally, it's desirable for arterials and collectors to be spaced approximately half a mile apart. Likewise, an average of 200 or more intersections per square mile is considered to be good for transit. Stops should be spaced between 750 feet and 1,000 feet apart and there must be direct walking routes between the stop and the destinations. Increasing pedestrian appeal through attractive streetscapes with buildings oriented toward the street will generally make people comfortable walking longer distances as part of their transit trip.

Providing information on transit arrival times is a valuable amenity for riders.

Image: Otak

Amenities count, too. Because time spent waiting for buses can discourage people from using transit, little things that make time seem to pass faster or that enable passengers to use wait times more productively can make a big difference. For example, Portland now provides phone numbers at every bus stop for riders to call if they want up-to-the-minute information on a bus's arrival time. This enables passengers to make better use of their waiting time–perhaps even to run a quick errand nearby. Many transit operations encourage the location of newsstands, coffee shops, and other amenities close to transit stops to help passengers pass the time and meet a daily need while waiting for a bus or train.

Transit and Land Use Synergy

Center Commons, a transit-oriented development in Portland, is located on bus and light rail transit lines and provides greater well-designed density and fewer parking spaces as residents rely on the transit system.

Image: Otak

Land use and development patterns also affect a city's capacity to maintain an effective transit system. At the very low densities typical of modern suburbs, no transit of any kind is likely to be feasible. At higher densities, transit becomes more cost-effective and a community has more choices among types of transit. Many planners refer to "TOD" when talking about transit planning. The initials stand for "transit-oriented development," the purpose of which is to create the kind of development that will put high numbers of potential transit riders in close proximity to transit service. These developments, often called station communities, are compact, walkable areas centered on transit stops or stations. If the "T" in TOD is the transit, then the "D" of development is really about three other D's–density, diversity, and design. Without those qualities transit may be adjacent to development but not fully integrated with it.

The community should have an integrated master plan for transit and land use together. A single TOD project does little good unless it helps to inspire a whole network of TODs. This network will help recapture the sizable investment that transit requires and will help sustain good service. In any community, there should be policies to support density, mixed uses and mixed income, compact development patterns, and good design standards for both the private and public realms. Indeed, failure to coordinate land use policies with transit investments is a prescription for underused transit services and wasted public dollars.

Many of the land-use strategies described in this handbook are transit-supportive. For example, higher densities, well-centered and mixed-use development, and pedestrian-friendly environments all work to enhance the use of all types of public transit. Specifically, transit-oriented development is nodal development defined by these features:

- Location surrounding a station or stop for a "premium service" transit line. Premium service is considered to be high-frequency bus service, streetcars, and light rail transit.

- Comfortable pedestrian and bicycle environments at the origin and destination of each trip, with safe and sheltered transit stops.
- Medium- to high-intensity development, with residential densities of 30- 50 units per acre (or more) in urban areas providing premium service, and the lower densities of 12-24 units per acre in a less urban neighborhood.
- A mix of land uses – commercial, residential and perhaps public or civic uses. Station communities with a high number of business and commercial uses are often regarded as trip-destination communities. Where the density and total number of housing units is high, it is a trip-origin community.
- A complete and connected street system that provides multiple, direct walking routes and a development pattern of small blocks.
- A network of TODs throughout a region can improve the overall performance of transit and create a transit region. From the community perspective this will create a wider marketplace for TOD, use land efficiently, and enhance walkability, regional connectivity, and community revitalization efforts. From the perspective of transit, there will be increased ridership, operational efficiency, and a better financial return on investment.

This transit-oriented development is located one block from a MAX light rail station.

Image: Otak

Implementation Strategies

The WES Commuter Rail links commuters with bus and light rail transit.

Image: TriMet

Several communities in Oregon have amended their codes and instituted policies to promote TODs and transit through the creation of Transit-Oriented Districts and/or zoning to support higher densities of residential infill and mixed uses. These cities include Gresham, Tigard, Medford, and Portland. Some of the key provisions in their TOD ordinances are:

- Bonus density (25-50%) close to transit stops
- Required store fronts along the transit street
- Prohibition of auto-oriented uses (e.g., auto repair)
- "Build-to" lines to bring buildings close to sidewalks
- Weather protection (especially important in rainy Oregon!) along walking routes to transit stops
- Wider sidewalks, benches and other pedestrian amenities

But zoning alone is often not enough, particularly if it is not well-aligned with market conditions and the fiscal feasibility of new development in a particular station community. A more comprehensive implementation strategy might be similar to the strategies identified in the recent Eastside MAX Station Communities Project in Portland. That planning effort addressed:

- Station area framework planning based on community input and on a wider master plan for urban form and development within the transit corridor.
- Public investments to improve pedestrian and bike mobility;
- Public investments to improve street connectivity;
- Zoning changes that would increase the intensity of redevelopment and also encourage good transitions to existing neighborhoods;
- Supplemental design standards;
- Other actions to improve safety and security at transit stops and stations.

Other transit-supportive strategies to consider include shared parking and parking management, expedited permits and reviews for transit-oriented development, and joint development ventures.

Cool Planning Benefits

Can increased transit use and investment in transit-oriented development really do much to lower a community's greenhouse gas emissions? The answer surely is "yes." After all, the private vehicle is a major contributor to the carbon footprint of a household. The Federal Transit Administration puts it this way: "By moving more people with fewer vehicles, public transportation can reduce greenhouse gas emissions." [116]

But that begs the question, "How much would increased transit use reduce GHG emissions?" Researchers disagree on the answer to that: some anticipate only moderate effects, while others foresee dramatic results. According to one study; "Reducing the daily use of one low-occupancy vehicle and using public transit can reduce a household's carbon footprint between 25-30 percent." [117] Likewise, the American Public Transportation Association concluded that "by reducing the growth in vehicles miles of travel, easing congestion and supporting more efficient land use patterns, public transit can reduce harmful CO_2 emissions by 37 million metric tons annually." [118]

Whatever the actual numbers prove to be, it seems certain that increased use of transit will be an essential part of most communities' strategies for meeting the challenge of climate change.

Image: Otak

Publications and Resources

- Peter Calthorpe, The Next American Metropolis, Princeton Architectural Press, 1993.
- EPA Smart Growth's Examples of Codes That Support Smart Growth Development at http://www.epa.gov/dced/codeexamples.htm#trans
- Public Transportation Reduces Greenhouse Gases and Conserves Energy: The Benefits of Public Transportation, American Public Transportation Association, at http://apta.com/resources/reportsandpublications/Documents/greenhouse_brochure.pdf
- Transit-Friendly Design Guidelines (2009), a useful 30-page manual published by Frederick County, Maryland, at http://www.co.frederick.md.us/documents/Transit/0409TFDGFINALnoblanks.PDF
- Transit-oriented Development, Portland Metropolitan Service District (Metro), 2009, at http://www.oregonmetro.gov/index.cfm/go/by.web/id=140. A good collection of TOD examples from the Portland area, complete with photos, design specifications, and a video.
- Transit Oriented Design, Components of Transit Oriented Design, at: http://www.transitorienteddevelopment.org/
- Reconnecting America, Center for Transit-Oriented Development, at: http://www.reconnectingamerica.org/
- U. S. Environmental Protection Agency's Pedestrian and Transit-Friendly Design: A Primer for Smart Growth by Reid Ewing, at http://www.epa.gov/dced/pdf/ptfd_primer.pdf

[115] Nicki Kipen, "New York, Portland and Chicago are among the greenest U.S. cities," April 2006, at the U.S. City Mayor's website: http://www.citymayors.com/environment/usmayors_kyoto.html
[116] USDOT Federal Transit Administration's Reduce Greenhouse Gas Emissions, at http://www.fta.dot.gov/planning/planning_environment_8518.html
[117] Todd Davis and Monica Hale, Public Transportation's Contribution to U.S. Greenhouse Gas Reduction, 2007, p. 2, at http://www.apta.com/resources/reportsandpublications/Documents/climate_change.pdf
[118] "Public Transportation Reduces Greenhouse Gases and Conserves Energy, American Public Transportation Association, at http://www.apta.com/resources/reportsandpublications/Documents/greenhouse_brochure.pdf

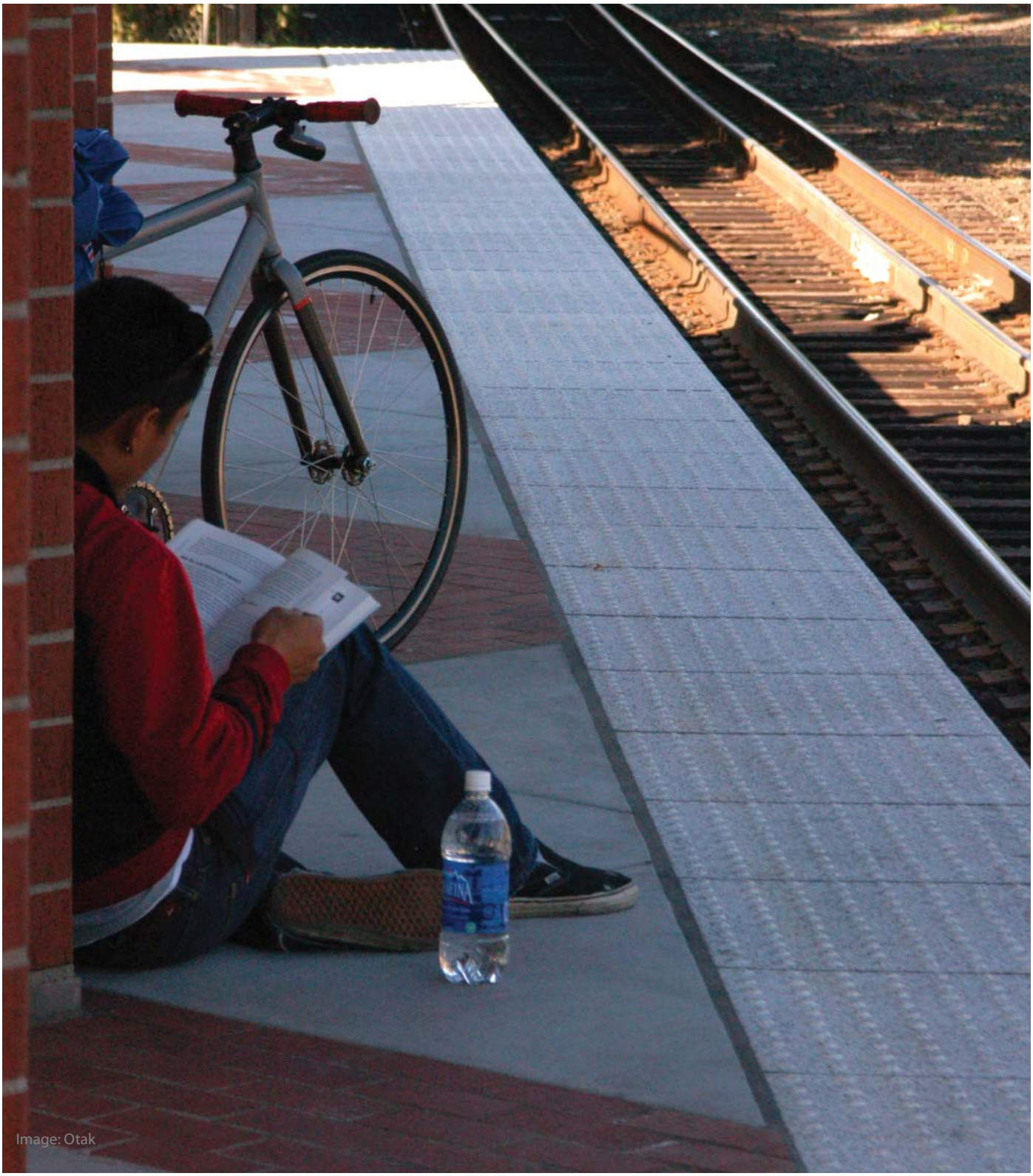


Image: Otak

14 Change Travel Habits

Clackamas Town Center now provides employees and shoppers additional transit options with the new park and ride garage and MAX station.

Image: Otak

One of the most important tools available to reduce carbon emissions is TDM: transportation demand management. The term is cumbersome, but the idea behind it is simple. TDM is simply the process of shaping or directing ways in which people travel and use transportation systems.

Such demand management is analogous to asking people to remove their shoes at the door to your house because it has beautiful old cherry-wood floors that are easily scratched. To address the floor problem, you would have two main choices: system management, and demand management. System management consists of making changes to the system itself – in this case, the floor. You could resurface it, or you could wax and polish it after every visit by shoe-wearing guests. Demand management consists of shaping the behavior of those who use the system. In this case, the demand management – asking guests to remove shoes – is likely to be less costly and more effective. The same is often true of TDM.

A common example of TDM is found in the parking policies of businesses in large cities. Suppose that one firm engages in the common practice of giving all its employees free parking worth, say, $100 a month. This acts as a $100-a-month incentive for employees to drive to work. It increases their demand for auto-related transportation services and decreases their demand for other types of transportation services. Now suppose the same business decides to give its employees one-hundred-dollar free monthly bus passes rather than free parking. This, too, will alter their demand for transportation services: it will influence them to use transit rather than drive to work. That's TDM.

The term TDM encompasses a large array of practices and policies used by private businesses, public agencies and nonprofit organizations. Some forms of TDM consist of public education and outreach – "Ride the Bus!" campaigns, for example. Others involve incentives and subsidies to encourage desired behavior. The free bus pass above is one kind of incentive. Other forms of TDM involve disincentives or sanctions. For example, some large cities charge auto users fees to drive in downtown areas during peak travel periods, a practice known as "congestion pricing." Other cities ban private autos altogether in the downtown during rush hours.

The table below demonstrates the great number and variety of TDM strategies and practices that are available. It is taken from the Victoria Transport Policy Institute's Online TDM Encyclopedia. [119]

Table 1 TDM Strategies Described In This Encyclopedia

Improves Transport Options	Incentives	Land Use Management	Policies and Programs
Transit improvements	Road pricing	Smart growth	TDM Programs
Nonmotorized improvements	Distance-based fees	New urbanism	Commute trip reduction
Rideshare programs	Commuter financial incentives	Location-efficient development	Campus transport management
Flextime	Parking pricing	Parking management	Freight transport management
Car sharing	Pay-as-you-drive vehicle insurance	Transit oriented development	Tourist transport management
Telework	Fuel tax increases	Car free planning	TDM marketing
Taxi improvements	Nonmotorized encouragement	Traffic calming	Least-Cost planning
Bike/transit integration			Market reforms
Guaranteed ride home			
HOV Priority			

This table lists various mobility management strategies

The number and variety of TDM measures continue to grow. Policymakers often find that they cannot "build their way out" of traffic congestion problems. A better alternative – in many cases the only alternative – is TDM. Some good examples of such demand management in Oregon:

Travel Smart – ODOT contracted with a private marketing firm in 2006 to conduct a marketing campaign in Salem-Keizer, Eugene, and Bend. The goal of this pilot project was to persuade people to use environmentally friendly modes of transport such as walking, bicycling, ridesharing, and transit rather than driving their cars. The campaign brought about a significant reduction – about 10 percent – in Single Occupancy Vehicle (SOV) use among project participants.

Carpool Match NW – This is an on-line matching service for commuters in Oregon and southwest Washington who want to carpool and rideshare. It uses email to link commuters in the region who seek alternatives to the SOV commute. About 11,000 commuters participate. [120]

Lane Transit District Commuter Solutions Program – This program helps make transit services more readily available to commuters in Lane County. For example, the district works with employers to provide discounted transit passes for the employees of participating firms. Almost 100 businesses now participate in the group pass program. [121]

Corvallis TDM: The city of Corvallis has encouraged several large local employers – Hewlett-Packard, Corvallis State University, and the local hospital, among others – to promote the use of transportation alternatives by offering transit passes, bike parking, and other incentives. The city makes information on TDM tax incentives available to employers, and the employers themselves get together as a group periodically to discuss ways to improve their efforts.

A key factor in most TDM measures is the "mode message." By that, we mean the combination of information that influences a person to choose a particular mode of travel. A wide variety of factors such as cost, convenience, and safety go into a seemingly simple travel question like "How shall I get to work?" Very often, TDM is about changing those factors to communicate a different message and hence a different choice of modes. To combat global warming, the primary message needs to be "Drive less."

Or perhaps one should say that the key message is "Drive alone less." Recent data from Oregon's Department of Transportation show that more than two-thirds of Oregon's commuters drive to work in an SOV. [122] One of the best ways to reduce greenhouse gases would be to knock that number down – to get more people in each car (car pooling), or to get more people to use other modes of transport such as transit, walking or cycling. In the words of the Governor's Climate Change Integration Group, "Currently, 71.4 percent of Oregonians drive alone to work, which produces far more greenhouse gases per person/mile than other modes such as carpooling, bicycling, walking, transit and rail." [123]

Communities that pursue TDM strategies will find that state and federal agencies are prepared to offer considerable help in the form of funding and technical assistance. For example, the federal Congestion

The Mode Message

In modern American cities, we move about in variety of ways: board a bus, ride a bike, walk, drive a car, take a taxi, commute by rail, use the subway, or (in a few places) travel by water on a ferry. Our decisions about which mode of transport to use depend on signals we get from markets and prices, from laws and policies, from urban design, and so on. For example, a shopper might choose to ride a bus downtown rather than drive to a strip mall because the bus is cheaper, the route is attractive, and she likes the old historical buildings downtown. These pieces of information influencing her choice of transport can be called "mode messages."

Mitigation and Air Quality (CMAQ) Improvement Program provides approximately $14 million per year of funds across Oregon for TDM, transit, and bicycle and pedestrian facility projects. [124]

Note that Oregon's Transportation Planning Rule, at OAR 660-012-0020(2) (f), requires that any transportation system plans for an urban area with at least 25,000 people contain "a plan for transportation system management and demand management."

For more information on TDM, check these Publications and Resources:

- Promising Practices in Transportation Efficiency: A Resource Guide for Local Leaders. The guidebook discusses building the demand for climate-friendly transportation options as well as the supply and provides case studies on successful local initiatives around the country. Institute for Sustainable Communities, at http://www.iscvt.org/who_we_are/publications/Chicago_CLA_Resource_Guide.pdf
- Transportation Research Board of the National Academies, list of publications on TDM: http://www.trb.org/Search.asp?cx=006885581591357793506%3Ajd-s4zv_7lc&cof=FORID%3A9&q=TDM&sa=Search#959
- Victoria Transport Policy Institute's Online TDM Encyclopedia: http://www.vtpi.org/tdm/tdm12.htm

[119] The encyclopedia is an excellent source of information about transportation demand management. Visit the Institute's website at http://www.vtpi.org/tdm/tdm12.htm
[120] See http://www.carpoolmatchnw.org/
[121] See http://www.ltd.org/cs/csindex.html?SESSIONID=a5092d03b990fa507a070a270a437145
[122] ODOT Annual Performance Progress Report Fiscal Year 2006-07, p. 37, at http://www.oregon.gov/ODOT/CS/PERFORMANCE/docs/2007ODOTAnnualPerformanceReport.pdf (The US Census Bureau reports the SOV percentage for Oregon commuters to be 72.5 percent.)
[123] The Governor's Climate Change Integration Group: Final Report to the Governor, p. 48, at http://www.oregon.gov/ENERGY/GBLWRM/docs/CCIGReport08Web.pdf
[124] Oregon Department of Transportation, Briefing Paper: ODOT's Efforts on Climate Change, p. 6, 2008, at http://www.oregon.gov/ODOT/SUS/docs/BriefingPaperEffortsClimateChange.pdf

15 Find Better Models for Big Trip Generators

An urban Target store in downtown Minneapolis.

Image: Ellerbe Becket Architects
credit: Joel Koyama Photography

Some land uses generate so many trips that they warrant special attention. Schools and big-box stores are two examples. According to some studies, school-related trips can increase morning rush-hour traffic by as much as 30 percent,[125] while big-box stores can generate as many as 10,000 car trips a day. [126] So many motor vehicle trips mean big carbon footprints.

These land uses also have indirect effects on greenhouse gas emissions through what might be called their "gravitational pull." That is, they are big land uses that attract people and other development that want ready access to them. For example, schools strongly influence home-buying decisions, often attracting homeowners away from closer-in, walkable neighborhoods to auto-dependent subdivisions in outlying areas. Big-box stores can, and often do, shift local retail centers of gravity and draw merchants away from compact, pedestrian-friendly downtowns to car-reliant exurbs. [127]

Fortunately, and as we shall see below, local governments, schools, and big-box stores can work together cooperatively (and in a number of cases, have done just that) to reduce carbon-generating trips through good location decisions and more creative building and site design.

In this chapter we focus not on school or big-box structures, which sometimes incorporate green building concepts. Rather, we look at siting practices that increase reliance on carbon-intensive transportation modes for these big land uses.

Schools

Where's the oldest high school in your town or neighborhood? How much land does it occupy? How tall is it?

Now think of the newest school and ask yourself those same three questions: where is it, how much land does it take, and how tall is it?

Chances are the old school you're thinking of is quite different from the new one. If your town is like most American towns, the old school is near the downtown or nestled in a residential neighborhood. It's a multi-story building and doesn't take up much land. In contrast, the newest school probably is on the far edge of town, spreads over many acres, and has only one story. It's surrounded by a large parking lot for cars and a staging area for buses.

Children who once walked to the old school must now be bused or driven to the new one. The concept of spontaneous play on sites that young people once reached independently has yielded to the scheduling of athletic and other events in far-flung locations to which time-strapped parents must chauffeur their children, often through heavy traffic. [128] And all those cars and mini-vans and buses driving to and fro ever since have been emitting about a pound of carbon dioxide into the atmosphere for every mile driven.

Statewide data on the percentage of Oregon students who walk and bike to school are not available at this writing. For the nation, however, the percentage of students who walk or bike to school has fallen from 48 percent in 1969 to less than 13 percent today. [129] With this precipitous decline has come an equally dramatic increase in the size of school sites. According to one study, school site size has increased every decade since the 1950s and school sites developed in the last 20 years are 41 percent larger than those built on previously. [130]

Walking to school is more likely to be an option when the school is located on a smaller site and fits into the neighborhood.

The decline in walking to school and the increase in school site size are related. A major reason: Distance is the number one barrier to walking and biking to school. [131]

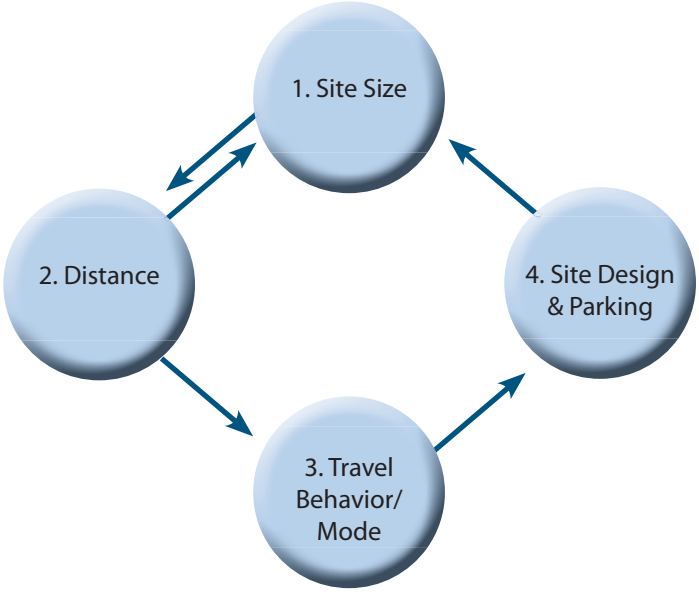
Large school site sizes increase the distance between schools and neighborhoods. School sites as large as 13 to 60 acres are common today. That's roughly the equivalent of 14 to 65 city blocks the size of those found in downtown Portland. Because parcels this large are hard to find at affordable prices in already developed areas, school districts often purchase sites on the

outskirts of town or even outside the urban growth boundary. But doing so may require the purchase of considerably more land in order to provide the large amounts of surface parking necessary because edge-of-town sites are usually so far away that students must drive or be driven to schools. School parking lots often exceed the size of the school building's footprint itself.

A remote and auto-centric school, inaccessible by foot or bike.

The more distant the school, the more students must drive or be driven or bused to school. Student travel modes, in turn, affect the school site design. The more students who arrive by motor vehicles, the more land is required for parking, bus staging areas, and retention zones to handle stormwater runoff from large, impermeable parking lots. The more driving to school, the more auto-centric and less pedestrian-friendly the school's site design.

The sequence in which one considers these factors is critical. School site size comes first, for it affects the distance between school and neighborhood. Distance influences student travel behavior – and the amount of parking needed at the school. The amount of parking, in turn, affects the school site size. In a nutshell, the problem is circular, as shown in the diagram.



School site size affects travel distance, travel behavior/ mode, and school site design, including the amount of parking needed.

Although putting a new school on a large site at the city's edge may reduce up-front capital costs for the school district, it is likely to increase other costs, especially those related to transportation. For the most part, those costs get passed on to the community or the state. During the 2008-09 school year, the State of Oregon paid $174 million – up from $120 million in the 2000-2001 school year –

A neighborhood centered school.

Image: Adrian Fine, National Trust for Historic Preservation

for student transportation. [132] The state reimburses school districts for between 70 and 90 percent of student transportation costs. [133] There are no incentives in this reimbursement formula for school districts to consider the effects of siting decisions on VMT or GHG emissions.

Public health officials lament the decline in walk-to-school rates and the hazards of walking in today's built environment. They see the elimination of simple exercise like walking from students' daily routine as partially responsible for the alarming obesity epidemic among young people. Conversely, they believe that a return to more walkable schools – and more pedestrian-friendly environments in general – would help. "A simple intervention like walking to school is a climate change intervention, an obesity intervention, a diabetes intervention, a safety intervention," says Dr. Howard Frumkin, M.D., director of the National Center for Environmental Health at the Centers for Disease Control and Prevention. [134] Richard J. Jackson, M.D., chair of the University of California's (at Los Angeles) Environmental Health Sciences Department, associates several educational benefits with walking and biking to school: increased concentration, greater alertness, and improved memory and learning. [135]

Some observers believe that the greatest contribution to physical activity among sedentary individuals must come from modest intensity activities such as walking and bicycling. They note that, in contrast to strenuous exercise programs, moderate activities such as walking can be more easily integrated into a person's daily schedule and are more likely to take hold as a permanent, lifelong habit. [136] As one report puts it:

"When we reduce physical activity to "exercise" that is separate and apart from our daily routines, we encounter obstacles related to time, money or motivation that make it difficult to maintain such activity over time. Reintroducing activity into daily routines is a practical way to overcome such obstacles." [137]

The most universal opportunity for "incidental" physical activity among children lies in getting to and from school, according to the Committee

on Environmental Health of the American Academy of Pediatrics. The Committee notes that "purposeful walks," such as a trip to school and other utilitarian trips play an important role in promoting healthy life styles and are influenced by neighborhood design. [138]

For public health and other reasons, school districts in Oregon and around the country are revisiting the merits of building schools on smaller sites in walkable neighborhoods. One example is the Bush Elementary School in Salem. Occupying a site of 2.6 acres, the school is nestled in a residential neighborhood while enjoying access to an adjacent park. In an example of school district-local government cooperation, the city of Salem waived a zoning provision to avoid forcing the school to build a parking lot that would have created a barrier between the school and an adjacent park. Now the students can enjoy the park during recess without having to cross a parking lot. Many parents now walk their children to school. Without large bus and car drop-off zones in front of the school, it's easier for the parents to stay a few extra minutes, after leaving their children, to visit informally and face-to-face with teachers and other parents.

The city of Salem and the Salem-Keizer School District collaborated to site Bush Elementary in the heart of a residential area and to design the school in a pedestrian friendly way.

According to the EPA, neighborhood schools, such as schools located on smaller sites in walkable communities, would reduce traffic, produce a 13 percent increase in walking and biking, and a reduction of at least 15 percent in emissions of concern. [139]

All of this is not to say that creating such schools is easy. Far from it: school board members and school officials face myriad competing demands and daunting challenges when making decisions about where to site schools. They typically struggle conscientiously to provide the best education for today's youth. By exploring the possibility of building schools on smaller sites – sites amenable to walking and biking – school districts can help not only to reduce vehicular travel and GHG emissions, but also to help make schools:

- stronger neighborhood anchors;
- easier for parents to engage in impromptu, face-to-face exchanges with teachers and other parents; and
- more accessible to the community for civic activities (a plus when community support is needed for school bond issues).

Finally, money saved on busing and other transportation costs is money that might go toward better teacher salaries, educational programs, or both.

How can local governments encourage climate-friendly school siting? Here are some actions to consider.

1. Request a copy of your school district's facility master plan. How does it relate to the city's local comprehensive plan? Is it compatible or does it run counter to the city's vision for its future? How will it affect the city's transportation-related carbon footprint? Will schools planned be within walking and biking distance of neighborhoods served? Can school facilities (ball fields, auditoriums, etc.) be shared with the community? Local governments should weigh in on these questions.
2. Work with the local school district. Coordinate local comprehensive plans with school facility plans. Avoid the "silo planning syndrome" in which school districts and local governments don't talk to each other. School siting decisions permanently affect local land use patterns, which affect city transportation and capital improvement budgets. Local governments have a big stake in school siting decisions.
3. Encourage the school district to maintain existing schools and to renovate them when possible. Many older and historic schools were well-built, are located in well-connected, walkable neighborhoods, and can be renovated to state-of-the-art standards. When they can't be, they might be replaced with a new, pedestrian-friendly school on the same site instead of a stand-alone facility on a remote site accessible only by motor vehicle.

Built in 1912, Lewis and Clark High School in Spokane, Washington has been renovated to meet state-of-the-art standards.

4. Do cost comparisons. If the construction of new schools on outlying sites is under consideration, look hard at the long-term transportation costs. Then factor these into the new-construction-vs.-rehabilitation cost comparison. In obtaining cost estimates for school renovation projects, turn to architects experienced in the rehabilitation of older buildings rather than to those who are unfamiliar with them.

5. Be aware that neither the State of Oregon nor the Federal Government sets minimum acreage requirements for school sites. Moreover, outdated standards once recommended by a private sector organization have been rescinded. [140] School districts are free to build multi-level schools with smaller footprints – schools more easily located on sites closer to population centers and in neighborhoods. The LEED-Neighborhood Development rating system, developed by the U.S. Green Building Council, recommends that new school campuses should not exceed five acres for an elementary school, ten acres for a middle school, and 15 acres for a high school. [141]

6. Encourage measures that will enable more students to walk or bike to school. Will the new school provide bike racks for students? Are there sidewalks and bike paths leading up to the school? How safe are they? Are they continuous and uninterrupted? Or do they have gaps that need filling? Are street crossings safe? Are streets near schools narrow enough to cross safely? When appropriate, contact the Oregon Safe Routes to School Program, which offers technical assistance and grants for pedestrian and bicycle improvements as well as education and advocacy initiatives. The Oregon Transportation and Growth Management Program (TGM) makes grants to local governments and school districts to help them plan for safe routes to school and to address school siting challenges.

Publications and Resources

- Historic Neighborhood Schools, National Trust for Historic Preservation, at http://www.preservationnation.org/issues/historic-schools/
- LEED-Neighborhood Development Rating System: http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148 (see the Neighborhood Schools section at p. 76.
- Oregon Safe Routes to School Program, at http://www.oregon.gov/ODOT/TS/saferoutes.shtml
- Smart Growth Schools, National Clearinghouse on Educational Facilities (section) at http://www.edfacilities.org/rl/smart_growth.cfm#9068
- Travel and Environmental Implications of School Siting, Smart Growth Network of the U. S. Environmental Protection Action, at http://www.epa.gov/livability/pdf/school_travel.pdf
- Walkable Schools Page on the Oregon Transportation and Growth Management Program's web site: http://www.oregon.gov/LCD/TGM/walkableschools.shtml

Big Box Stores

Between 1990 and 2001, the number of miles driven by the average U.S. household for shopping rose by more than 40 percent. Shopping-related driving for the country as a whole increased by almost 95 billion miles in just 11 years. It's not that Americans are taking more shopping trips. Rather, more of those trips are taken by car and the journeys are longer. [142]

As retailers build ever larger stores, each outlet depends on a greater number of households drawn from a wider geographic area. Thus the distance between home and store grows. By 2009 the average length of a shopping trip had risen to nearly seven miles, up from five miles two decades earlier. [143] A big box store may generate well over 10,000 vehicle trips per day. [144] As store size grows, so does the travel-shed (or retail-shed) of customers, who drive from ever greater distances.

Meanwhile, stores as large as 80,000 to 200,000 square feet can shift the retail center of gravity away from pedestrian-friendly downtowns and business districts to commercial areas on the outskirts of town. The resulting scattered nature of the development and absence of transportation alternatives means – yes, even more driving.

At the urging of local citizens and local governments, some big-box retailers have agreed to build stores that are more accessible by low-carbon transportation modes. Target, for example, has built downtown stores in Pasadena, California; Minneapolis, Minnesota; and elsewhere. Located in compact centers, these stores are accessible to customers by foot, bicycle, and transit as well as by car. In Pasadena, Target recycled a vacant, multi-level department store that uses structured parking and is not surrounded by a large parking lot. The Minneapolis store, also located close to transit services, features a pedestrian-friendly exterior that is broken up into several smaller facades likely to make the street more interesting to

An urban model Home Depot in Lincoln Park, Chicago.

The design of this big-box store, a Staples outlet in Santa Barbara, California, helps to maintain a pedestrian-friendly street.

pedestrians. This architecture contrasts with the kind of blank wall that deadens a pedestrian environment.

Cities, too, have changed their codes to make big box stores more accessible by foot, bicycle, or transit. In Fort Collins, Colorado, for example, guidelines require parking to be distributed around the store. Because no more than 50 percent of the parking can be in front, the store gets sited closer to the street. This requirement, coupled with another one for multiple entrances, makes walking trips to the store shorter and more direct. Sidewalks at least eight feet in width must be provided along all sides of a lot that abuts a public street, while a continuous pedestrian walkway must be provided for internal circulation. Sidewalks must line the full length of the store along any facade with a customer entrance.

How can local governments promote climate-friendly big box stores?

Given our state's GHG-reduction goals, it's time to develop a better, more climate-friendly prototype for the big-box store. Toward this end, local governments in Oregon can take several actions:

- Develop design guidelines for large retail stores, emphasizing easy pedestrian, bicycle, and transit access;
- Identify vacant buildings or sites suitable for large (multi-level) retail stores that are accessible by low-carbon transportation modes;
- Examine the long-term transportation and climate change impacts of proposed big-box stores. Consider not only the travel modes likely to be used by customers to get to the proposed store, but also the cost of abandoning (or under-using) transportation assets in which the public has already invested (e.g., walkable streets in a vacated downtown);
- Prohibit contracts whereby retailers vacate one building (often to build a new one on a site farther out) and then prevent other retailers from reusing the vacated store;
- Encourage neighborhood retail stores to meet shopping needs within walking distance of their customers;

- Encourage retailers to recycle older buildings in transportation-efficient, climate-wise downtowns or designated compact centers where low-carbon transportation alternatives exist;
- Require parking areas to be laid out so they can be infilled down the road and form walkable blocks;
- Encourage synergistic land uses so parking can be shared; and
- "Wrap" big box stores with "liner" buildings that have smaller shops.

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[125] See Travel and Environmental Implications of School Siting, U.S. Environmental Protection Agency, p. 3, at http://www.epa.gov/dced/school_travel.htm. See also "The California Environmental Quality Act: Addressing Global Warming Impacts at the Local Agency Level," State of California Department of Justice, p. 8.

[126] Of course people need to shop, but in contrast to the typical big-box location and site design, other retail formats enable shoppers to get to stores through several transportation modes. See http://davisretail.org/Target/articles/HowBig.pdf. See also the Trip Generation Manual of the Institute for Traffic Engineers (Land Use 813).

[127] As a report by the Bay Area Economic Forum puts it, "It is also possible that an outlying supercenter will attract enough customers away from a more centrally located supermarket to cause it to shut down. In this case, in addition to the vacancy problems described [earlier], there will be a shift of economic activity to the periphery, which may be a catalyst for hastened development of the outlying area." "Supercenters and the Transportation of the Bay Area Grocery Industry: Issues, Trends, and Impacts," January 2004, p. 55. See http://www.bayeconfor.org/pdf/PPRSCscreen11.2.pdf

[128] "Once attending a child's performance in a play or sporting event was a pleasurable part of life; now it requires a level of scheduling that characterizes a military campaign," writes Anton Nelessen in Visions for a New American Dream.

[129] Travel and Environmental Implications of School Siting, U.S. Environmental Protection Agency, October 2003. See pp. 2 and 3. Visit http://www.epa.gov/livablecommunities/pdf/school_travel.pdf

[130] See Chris Kouri, Wait for the Bus: How Low Country School Site Selection and Design Deter Walking to School and Contribute to Urban Sprawl. South Carolina Coastal Conservation League, Duke University Terry Sanford Institute of Public Policy, Durham, N.C., November 1999, p. iv.

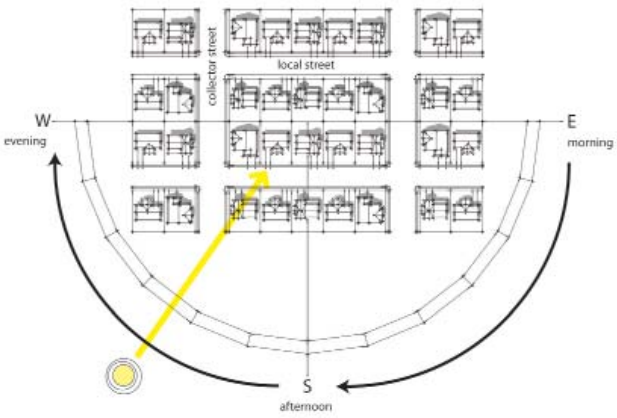
[131] See "Barriers to Children Walking to or From School—United States, 2004", Journal of American Medical Association, Vol. 294, No. 17, November 2, 2005 at http://jama.ama-assn.org/cgi/content/full/294/17/2160. See also Children and Transportation: Identifying Environments that Foster Walking and Biking to School at http://swutc.tamu.edu/publications/technicalreports/473700-00031-1.pdf.

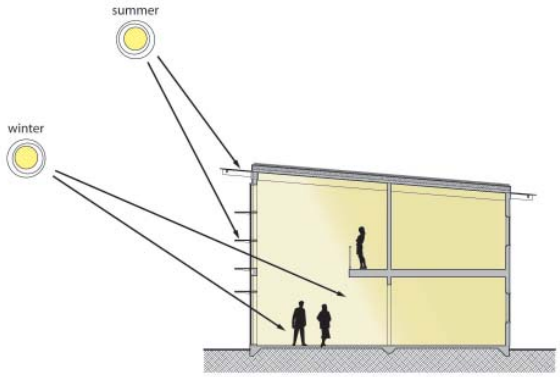
[132] April 13, 2010 e-mail communication from Brian Reeder, Assistant Superintendent, Analysis & Reporting, Oregon Department of Education, to Constance Beaumont
[133] ORS 327.013(3)a)
[134] See http://news.prnewswire.com/DisplayReleaseContent.aspx?ACCT=104&STORY=/www/story/08-11-2009/0005075500&EDATE
[135] http://www.americantrails.org/2008/RJJackson_Nov08.ppt#3347,46,Outdoor Physical Activity
[136] BC Sprawl Report: Walkability and Health, 2009, by Ray Tomalty, Ph.D., et al, for Smart Growth British Columbia. http://www.smartgrowth.bc.ca/Portals/0/Downloads/sgbc-sprawlreport-2009-final-web%20(2).pdf. See p. 2.
[137] "Active Transportation for America: The Case for Increased Federal Investment in Bicycling and Walking," Bikes Belong and Rails-to-Trails Conservancy. Bikes Belong and Rails-to-Trails Conservancy, 2009, p. 31, at http://www.railstotrails.org/resources/documents/whatwedo/atfa/ATFA_20081020.pdf.
[138] "The Built Environment: Designing Communities to Promote Physical Activity in Children," Committee on Environmental Health, Pediatrics, American Association of Pediatrics, Biomedical Library, May 27, 2009. See http://www.pediatrics.org/cgi/content/full/123/6/1591
[139] Travel and Environmental Implications of School Siting, U.S. Environmental Protection Agency, October 2003. See 26 at http://www.epa.gov/livablecommunities/pdf/school_travel.pdf
[140] While there are no Oregon State or federal standards requiring school site sizes, many school districts continue to rely on old guidelines previously recommended by the Council of Educational Facilities Planners International (CEFPI). These guidelines formerly called for a minimum of 10 acres plus one acre for every 100 students for an elementary school, 20 plus one acre for every 100 students for a middle school, and 30 acres plus one acre for every 100 students for a high school. However, these standards were widely criticized for promoting school sprawl and were removed from CEFPI's school facility planning manual in 2004.
[141] LEED 2009 rating system for Neighborhood Development at http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148 (see, p. 76). LEED stands for Leadership in Energy and Environmental Design. Larger sites may qualify for LEED certification if a joint use agreement is executed to allow ball fields, multi-purpose centers, and other school facilities to be shared with others in the community.
[142] "The Resurgence of Local Shops Is a Great Strategy for Fighting Global Warming," by Stacy Mitchell. Posted on Alternet, August 24, 2009. See http://www.alternet.org/story/142129/the_resurgence_of_local_shops_is_a_great_strategy_for_fighting_global_warming/
[143] See Stacy Mitchell, Big-Box Swindle: The True Cost of Mega-Retailers & the Fight for America's Independent Businesses. Boston: Beacon Press, 2006, p. 112. Citing Pat S. Hu and Timothy R. Reuscher, Summary of Travel Trends: 2001 National Household Travel Survey Washington, D.C.: U.S. Department of Transportation, December 2004, 16. Visit http://nhts.ornl.gov/2001/pub/STT.pdf
[144] http://www.bigboxtoolkit.com/images/pdf/HowBig.pdf

16 Green Your Buildings

Land-use planning, transportation planning, and architecture traditionally have been considered three separate fields. Complex problems such as climate change, however, pay no respect to such traditions. Solutions to such problems therefore require a more holistic approach – an approach that gets planners, engineers, and architects working together.

Consider, for example, the layout of streets in a residential subdivision. If collector streets that serve the subdivision are laid out in a north-south pattern, then local streets in the subdivision will generally lie perpendicular to the collectors, along an east-west line. This enables houses built in the subdivision to have their longer axis running east to west, with the main windows facing south. In middle latitudes such as the Pacific Northwest, this orientation is most conducive to energy-saving passive solar architecture. When the mid-day sun is low in the southern sky during winter, sunlight can penetrate deep into the house, warming it naturally and thereby reducing heating costs. Conversely, the mid-day sun of summer is almost directly overhead and does not penetrate south-facing windows at all. The house thus remains cooler, and less energy – perhaps no energy at all – is needed to cool it.





In the winter, low mid-day sun penetrates deep into the house. In summer, overhangs shade the house from the high mid-day sun.

This type of energy-efficient, environmentally friendly construction is known as "green building." Partly in response to global warming and other climate change phenomena, this type of architecture and design has grown dramatically in recent years. Many public agencies, nonprofit organizations, and businesses have developed programs or taken measures to advance green building.

For example, the State of Oregon has a policy "requiring all new state buildings to meet, at a minimum, the U.S. Green Building Council's Leadership in Energy and Environmental Design ("LEED") program's silver equivalency status, with major renovations also requiring LEED Certification." [145]

Building prior to renovation.

The "greenest" building may be the one that already exists. This LEED certified gold century-old building has been rehabilitated for a second century.

Images: Venerable Properties

Can green design really reduce a nation's greenhouse gas emissions? Recent evidence suggests that it can. Buildings in the United States account for over 40 percent of our nation's carbon dioxide emissions. Their heating systems, air conditioners, lighting systems and appliances are powered mostly by combustion of fossil fuels (natural gas, for example) or by electricity generated by such combustion. [146]

If buildings could be constructed more efficiently, they would use much less fossil fuel. They can be – and indeed many of them are being built for much greater efficiency. For example, the number of new LEED-certified buildings built in the United States doubled in 2008. [147] Portland, a national leader in such certification, now has 63 LEED buildings. Likewise, the number of new buildings certified under the Environmental Protection Agency's "Energy Star" certification program also doubled. [148]

A variety of local policies and programs work to encourage or facilitate green building. We already described how street and subdivision design can help builders construct more energy-efficient houses. Likewise, local policies and ordinance provisions on solar access, parking, bicycle and pedestrian access, landscaping, stormwater runoff, building orientation, and transit all can be written in such a way as to further – or hinder – green building.

The details and nuances of green building go beyond the scope of this handbook. The important points for now are these:

- Green building is an essential tool for reducing carbon emissions.
- Green building, land-use planning, and transportation planning are inter-related.
- There are many steps a local government can take to encourage green building.
- There are many publications and resources available to those with an interest in green building.

Publications and Resources

Some good examples of green building Publications and Resources are listed below:

- The American Institute of Architects offers a three reports on green building at the local level under the title AIA Local Leaders in Sustainability Reports by Brooks Rainwater, 2007, at http://www.aia.org/advocacy/local/index.htm

  The first AIA report, "A Study of Green Building Programs in Our Nation's Communities," examines the current state of green building laws in American cities as of 2007. The report contains local green building case studies on Portland, San Francisco, Scottsdale, Chicago, Austin, and Atlanta. The second focuses on "Green Counties." The third report, "Green Incentives," deals with incentives to green building such as density bonuses, fee reductions, and permit expediting.

- Developing Green Building Programs: A Step by Step Guide for Local Governments, a simple but useful guide on how your community can create a strategy for greening its buildings. Global Green USA, undated, at http://www.globalgreen.org/docs/publication-71-1.pdf

- Playbook for Green Buildings + Neighborhoods: Strategic Local Climate Solutions, an on-line resource that provides guidance and resources on ways to advance green buildings, neighborhoods and infrastructure. See http://www.greenplaybook.org/

- Residential Buildings: An Evaluation of Waste Prevention Practices Using Life Cycle Analysis, by the Oregon Department of Environmental Quality, at http://www.deq.state.or.us/lq/sw/wasteprevention/greenbuilding.htm#Reports and http://www.deq.state.or.us/lq/pubs/docs/sw/LifeCycleAssessmentReportPhase01.pdf

- Towards a Climate-Friendly Built Environment, an overview of green building as a means of dealing with global warming, Marilyn A. Brown, Frank Southworth, Therese K. Stovall. Pew Center on Global Climate Change (2005), at http://www.pewclimate.org/docUploads/Buildings_FINAL.pdf

- Whole Building Design Guide's section on sustainable design – for information on design features and details for green buildings. See http://www.wbdg.org/design/sustainable.php

Re-milled wood used in Venerable Properties office space.

Images: Venerable Properties

[145] Executive Order 06-02, "Sustainability for the 21st Century"

[146] Marilyn A. Brown, Frank Southworth, Therese K. Stovall, Towards a Climate-Friendly Built Environment, Pew Center on Global Climate Change, 2005, p. ii, at http://www.pewclimate.org/docUploads/Buildings_FINAL.pdf

[147] For an explanation of the LEED certification program, see the US Green Building Council's website at http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1988

[148] The EPA certifies buildings for efficient use of energy in much the same way it certifies appliances. Buildings that meet EPA standards are given an "Energy Star" rating. Learn more about that rating at http://www.energystar.gov/index.cfm?c=business.bus_bldgs

17 Plant Trees in Your Town

The planting of street trees is one of several well-known urban-design techniques for enhancing streetscapes, softening the impact of parking lots, and making walking more pleasant and comfortable. We single it out for special attention here because of its significance with respect to climate change.

Planners have long known that cities are significantly warmer than their surrounding countryside. The condition is called the "urban heat island." It happens for two reasons. First, tall buildings are exposed to more solar radiation in the course of a day than are surfaces at ground level. Second, most urban surfaces are impervious and often dark: the asphalt and concrete of city streets, parking lots, and sidewalks absorb more solar radiation than do the rural fields, farms and forests.

The urban heat-island is a localized phenomenon and is not thought to be a significant factor in global warming. The IPCC looked at the subject and concluded: "In summary, although some individual sites may be affected, including some small rural locations, the UHI [urban heat island] effect is not pervasive, as all global scale studies indicate it is a very small component of large scale averages." [149]

The additional urban heat does, however, cause buildings to run their cooling systems for longer periods. Because most of those systems run on electricity generated by coal- or gas-powered electrical plants, they contribute to greenhouse gas emissions.

Street trees moderate the temperatures of the urban heat island, reducing the need for cooling, and thereby reducing greenhouse gas emissions:

> Asphalt and concrete streets and parking lots are known to increase urban temperatures 3-7 degrees. These temperature increases significantly impact energy costs to homeowners and consumers. A properly shaded neighborhood, mostly from urban street trees, can reduce energy bills for a household from 15-35%. [150]

The street trees also absorb carbon dioxide, a major culprit among the greenhouse gases that cause global warming. In the words of

climatologists, such trees are a "carbon sink" that "sequesters" carbon – carbon that otherwise would remain in the atmosphere.

California researchers at the Center for Urban Forest Research have developed two software programs (STRATUM and EcoSmart) that evaluate costs and benefits of street trees. In their words,

> Many of the benefits that trees provide are directly related to climate. These include energy conservation, air quality improvements, atmospheric carbon dioxide reductions and rainfall interception. [151]

The researchers go on to describe the results found by their evaluation of a tree-planting program in Davis, California:

> The STRATUM analysis approach was used in Davis, CA (pop. 65,000), where the results were integral to development of a Community Forest Management Plan), [152] the first for the city. Findings from the benefit-cost analysis increased awareness of city council members and the public regarding return on investment in tree care. Information on management needs helped the local Tree Commission and urban forester prioritize funding for tree planting, young tree care, mature tree care, hazard tree removal, and program administration. In San Francisco, trained volunteers from Friends of the Urban Forest sampled 2,600 trees and STRATUM was used to estimate that the street tree population (about 100,000) contributes $7.5 million annually in benefits. Results are being used by the city's Urban Forest Council to develop a Management Plan.

In Oregon, Lincoln City has set a goal of planting 1,000 trees a year as part of its sustainability campaign. [153]

Publications and Resources

- Green Streets: Innovative solutions for stormwater and street crossings (Metro, 2002) at: http://www.oregonmetro.gov/livablestreets.
- Trees for Greenstreets (Metro, 2002), a handbook on the role of street trees in managing stormwater. It includes detailed color drawings of the trees that best perform this function, at: http://www.oregonmetro.gov/livablestreets.
- Urban and Community Forestry, a U.S. Forest Service resource providing information, technical assistance, and some grants for communities to develop urban forest programs. (See http://www.fs.fed.us/ucf/treesforpeople.html) Oregon's Department of Forestry manages this program in our state. You can learn more about it in the ODOF publication, Urban and Community Forestry in Oregon, at http://www.oregon.gov/ODF/URBAN_FORESTS/docs/Other_Publications/ucfOR.pdf

Note that ODOF also works with the National Arbor Day Foundation to enroll Oregon cities in the foundation's Tree City USA program. Fifty-two cities in Oregon participate in the program. In 2009 ten Oregon cities – Baker City, Beaverton, Corvallis, Eagle Point, Echo, La Grande, Lebanon, Medford, Tigard, and Wilsonville – had the additional honor of receiving the foundation's special Tree City Growth Award. For more information about the Tree City USA program, visit ODOF's website at http://www.oregon.gov/ODF/privateforests/ucfTreeCity.shtml

[149] IPCC Fourth Assessment Report, p. 244, at http://www.ipcc.ch/ipccreports/ar4-wg3htm
[150] Dan Burden, Senior Urban Designer, Glatting Jackson and Walkable Communities, Inc., 22 Benefits of Urban Street Trees May, 2006,at http://www.msmj.org/documents/22BenefitsofUrbanStreetTrees_000.pdf
[151] James R. Simpson, E. Gregory McPherson and Scott E. Maco, Center for Urban Forest Research, Pacific Southwest Research Station, USDA Forest Service, Davis, California Tools for Quantifying Climate-Related Effects of Trees on Urban Forest Benefits (not dated), http://ams.confex.com/ams/pdfpapers/79780.pdf
[152] http://www.cityofdavis.org/pcs/trees/cfmp.cfm
[153] September 10, 2009 e-mail to Constance Beaumont from Alison Nelson, city staff representative, Lincoln City Community Sustainability Committee

Part III Taking Action

Part Two of this handbook presented a variety of community design strategies that local governments can use to help slow climate change. Part Three discusses the process of developing a climate change work program, key elements of a climate action plan, and ways to measure the effectiveness of such a program.

The Caufield House
The Verdict Bar & Grill
OPEN
Coffee • Espresso
Wifi
Ice Cream • Desserts
The Verdict

Image: Otak

18 Steps to Develop a Climate Action Plan

Let's assume your community is ready to move forward and write a climate action plan. Now you face an array of questions: Where do we start? How do we go about developing a plan and building support for it? Who are the stakeholders? What does our plan aim to achieve? How will we put our plan into effect? The purpose of this chapter is to describe the process by which we get answers to those questions – the planning process – and to share some lessons from communities that already have done such planning.

In developing a climate action plan, you will want to consider at least seven things:

- A baseline inventory of greenhouse gas emissions [154]
- Goals
- Education and outreach
- Analysis of alternative growth scenarios
- Cleaning house
- Monitoring progress
- Leadership
- Learning from others

A baseline inventory of greenhouse gas emissions

"The first step in most any analysis is to determine where you are today." So says the City of Chattanooga, Tennessee in its climate action plan. In a similar vein, the International Council of Local Environmental Initiatives (ICLEI) recommends that communities begin the process of creating a climate action strategy by establishing a baseline inventory of their local GHG emissions.

The data collected for the inventory should help to:

- provide a solid basis for any policies and actions recommended in the plan;
- educate the public, decision makers, and opinion leaders; and
- serve as a foundation for future monitoring of the plan.

A first order of business is the collection and analysis of information that is locally relevant and specific to the community's goals.

In compiling data, use as much information as possible that is already on hand or readily available. For example, traffic inventories, building permits, land use data, auto registration and licensing information may provide valuable information about the community's travel behavior, population, land uses, densities, and consumption, etc.

In Oregon, the state collects much information that communities may not realize is available to them. To obtain this information, contact the state agency responsible for the data you need. If the agency cannot give you what you need, it may be able to identify another credible source. Look also to local non-profits that may collect data to see whether they have information of value to your planning process. Finally, identify needed information that is not readily available, and collect it as necessary. Your community may find it equally helpful to continue collecting data for the purpose of monitoring the progress of new programs over time.

Throughout the data collection phase, be sure to record and cite all your sources. Bear in mind that you may be questioned or challenged later regarding your assumptions, so be diligent in supporting and documenting any assertions or facts.

Also tabulate the data in a manner that allows the next person to use them without having to recreate the data. Most importantly, analyze the data in a fair and objective manner so that local decision makers are aware of all views related to the matter.

In preparing community-scale GHG inventories, local governments should recognize that the standards for such inventories are rapidly evolving; no single model or protocol has been agreed upon yet. Many cities have used the Clean Air and Climate Protection (CACP) software developed by ICLEI to estimate and report their greenhouse gas emissions. [155] CACP provides a reasonable estimate of local transportation-related emissions, according to the Oregon Department of Environmental Quality. However, CACP may provide an incomplete picture of some other local activities that contribute to emissions. For example, CACP counts the emissions associated with consumption of electricity but not the emissions associated with consumption of materials. Yet in some communities, the consumption of materials may contribute more to emissions than consumption of electricity. For this and other reasons, a growing number of jurisdictions are calling

for the establishment of a standard greenhouse gas inventory protocol that more accurately reflects each community's GHG emissions. In the absence of such a protocol, local governments may wish to use ICLEI's software, but they should understand these points.

The GHG emissions inventory completed by Eugene in 2007 found, among other things, that Eugene has a relatively low level of per capita emissions (8.6 metric tons per capita) compared to Oregon and the nation, thanks to the city's access to clean electrical energy. On the other hand, the inventory revealed that a relatively large share of Eugene's emissions – 51 percent – comes from the transportation sector. Eugene's Inventory Report recognizes the value of this assessment:

> Understanding the overall mix of Eugene's GHG emissions provides information on the relative importance of different activities as sources of greenhouse gas emissions. Knowing the specific sources and activities related to GHG emissions in the community will establish a basis for selecting emission reduction strategies. [156]

Goals

Another early step in the process of developing a climate action strategy is the establishment of clear goals for the community. Because the climate change issue seems overwhelming to many people, it's good to identify attainable objectives that are within the power of local residents to achieve. That said, it's equally important to aim high enough. Business-as-usual practices – or even somewhat better-than-usual practices – will not enable a community to reach the kinds of goals necessary to make a difference on climate change. As the City of Portland and Multnomah County state in their climate action plan, "dramatically more ambitious actions" will be required to mitigate the most extreme impacts of the changing climate.

The identification of goals should occur through a public process. The aim of this task is to get participants involved in ranking and prioritizing the objectives. This is also a good time to begin brainstorming potential solutions with the community.

One pitfall to avoid: too often, a community sets laudable goals but fails to support its action plan with an adequate budget. An example of a city that has aligned its budget with a policy of expanding "low-carb" transportation choices is Boulder, Colorado, which devoted 49 percent of its transportation budget to bicycle, pedestrian, transit and transportation demand management projects during 2007 and

2008. [157] The results of such a commitment to alternative modes are beginning to show: The city's latest survey reveals that the percentage of work-related trips made by Boulder residents in single-occupant vehicles (SOVs) has fallen from 65 percent to 53 percent. [158] The national average for SOV commutes is 77 percent. [159]

Education and Outreach

Communities can use the goal-setting step to educate local residents not only about the science of climate change and the risks associated with it (drought, flooding, and wildfires, etc.), but also about the benefits of climate action strategies: protection against future gas price hikes, less traffic congestion, cleaner air, and so on. Draw on respected professionals to explain the climate change issue to decision-making bodies, business organizations, neighborhood associations, and others. Work with your local media (newspapers, TV, and radio stations), schools, the faith community, and business and civic groups to reach the public and to encourage public participation in developing the local climate action plan. Use radio and TV ads (or public service announcements). Develop and distribute videos. Set up peer-to-peer forums.

Sometimes the messenger is as important as the message. Business people may be more inclined to listen to business leaders; developers, to developers; realtors, to realtors, and so forth. The goal-setting process is also a prime time to bring affected parties who may not feel affected by the problem on board (i.e. sportsmen, farmers, outdoor enthusiasts, etc.). Outreach to lower-income and disenfranchised communities is also important. Given that many people living in poverty pay disproportionately large shares of their income on transportation, they stand to benefit from the expansion of transportation options needed to reduce greenhouse gas emissions.

Education and outreach are critical to the successful implementation of a local climate action work program. It's hard to galvanize a community into action, change travel habits, garner support for key policy changes, or secure funding for necessary initiatives if people don't understand the issue or believe they can make a difference. Many people are uninformed about climate change, unsure what they can do, or believe that their actions are insignificant. [160] Robust marketing and education are critical to the success of a program, as is information on specific actions ordinary people can take.

For example, Chattanooga, Tennessee's plan prescribes an extensive environmental curriculum for use by churches, businesses, civic organizations, and local media. The plan also directs the city to partner with local organizations and businesses and to place quarterly "green" inserts into the newspaper. Berkeley, California's plan envisions a marketing campaign to inform community residents of their alternative transportation options. Through door-to-door canvassing and phone calls, the plan proposes to give interested residents information and incentives to incorporate more walking, biking, public transit and carpooling into their daily routines.

Missoula, Montana, has used interactive, participant-driven "visioning" exercises to engage local residents and determine their preferences. The city has also used electronic "key-pad" polling to elicit preferences for various land-use scenarios. [161]

Eugene, Oregon, is engaged in a year-long community involvement process. It will bring community leaders together at seven public events to identify local solutions to Eugene's energy and GHG challenges. Transportation and land use received special attention at one of these events.

Sacramento used a combination of regional forums, in which more than 5,000 participants used the city's interactive modeling software to study how the region might look under different land use scenarios. The city also conducted a 1,300 person public opinion telephone poll and invited city and county elected officials throughout the region to a regional summit to discuss a proposed "Blueprint Scenario." [162]

Analysis of Alternative Growth Scenarios

Scenario planning, used by Sacramento to develop the region's blueprint for growth, is becoming an increasingly popular tool. Through the scenario planning process, local governments, citizens, and organizations can visualize different growth alternatives for their community and then select the one that works best.

Scenario planning studies yield useful information on the extent to which transportation, land use, and community design strategies can reduce carbon footprints. These studies typically involve computer simulations that predict – and depict – the impact of alternative growth patterns or development concepts. Using different assumptions regarding residential and commercial density, land use mix, and other variables, planners create different versions of the

future so communities can evaluate them according to certain criteria. The studies help government officials and citizens visualize, quantify, and compare the VMT and associated greenhouse gas impacts of alternative urban growth scenarios.

The number and type of scenarios used in scenario planning vary from one community to another, of course. But almost all such planning includes one scenario often referred to as the "base case" or "business as usual." This scenario will show how a community is likely to look if current growth patterns continue. Other land use scenarios typically evaluated include:

- compact development in downtowns or designated centers ("growing up");
- more dispersed development patterns along corridors ("growing out");
- specific proposals for more intense, transit-oriented development along key transit corridors.

The scenarios can provide timely information and feedback, which local officials and citizens can react to and discuss at local planning meetings or other forums.

Here are several examples of scenario planning tools and their use around the country:

- I-PLACE3S, used by the Sacramento Area Council of Governments for its award-winning Preferred Blueprint Scenario. Different scenarios developed were evaluated against established regional smart growth principles. The process showed how the Sacramento region could reduce the number of car trips by 10 percent and per-capita CO_2 emissions by 14 percent.[163] The I-PLACE3S software can be used free of charge by local metropolitan planning organizations, but there are costs for use of the servers that host and run the database.[164]
- Envision Tomorrow Scenario Builder, an ArcGIS-based modeling and evaluation tool developed to evaluate growth scenarios ranging from the neighborhood to the regional scale. When applied to the Superstition Vistas area in Pinal County, Arizona, near Phoenix, this tool found that a higher-density land use pattern could lead to a decrease in transportation carbon emissions of 45 percent compared to those in a low-density scenario.[165]

Steps Individuals Can Take

Evanston, Illinois, provides a list of 13 steps people and businesses can take to reduce their GHG emissions. The list accompanies an on-line, "Zerofootprint Evanston" calculator that city residents can use to calculate their personal carbon footprints. Evanston's Climate Action Plan envisions a public information campaign with ads and poster displays that motivate the community to reduce local GHG emissions by 13 percent by 2012. The plan also calls for a speaker's bureau and public surveys to assess local knowledge, attitudes, and behavior. Visit http://calc.zerofootprint.net/calculators/evanston/

Portland Metro's "drive less, save more" campaign highlights the personal financial benefits that go with less driving. An on-line "driving cost calculator" helps people see how much they could save by taking more trips by modes other than the private automobile. In developing their climate action plan, Portland and Multnomah County conducted a community-wide public engagement campaign to promote carbon reductions. Visit http://www.drivelesssavemore.com/

- INDEX is a GIS (Geographic Information System) tool from Criterion Planners of Portland that allows users to sketch land-use and transportation scenarios and evaluate them in real-time with sustainability indicators, including VMT, energy use, and CO_2 emissions. In a recent analysis of five Portland-area smart growth projects, INDEX found a 28 percent reduction in per capita CO_2 emissions compared to regional averages. INDEX has been used by Portland Metro to evaluate high-capacity transit stations areas, and is supporting comprehensive planning for the city of Eugene and Lane Council of Governments. [166]

A review of 23 scenario planning studies conducted by Keith Bartholomew, Assistant Professor of Urban Planning at the University of Utah, found that compact land use scenarios generate up to one-third fewer miles driven than business-as-usual scenarios. [167]

Cleaning House

At this point, it's wise to revisit current policies, plans, and ordinances to make sure they support the new climate-friendly goals. Two short-term actions can be especially useful now in building a sense of momentum for the plan:

1. Revisit existing plans. Start by reviewing downtown and neighborhood plans that already allow or call for smart growth. Many communities have previously adopted excellent plans that are on the shelf and ready to go. Good ideas contained in these plans may have gone unimplemented due to a lack of resources. An important first step, then, is to reexamine these plans to identify infill, redevelopment, and other opportunities. This approach can save time and enable the community to move forward quickly.

2. Conduct an audit of existing codes. Get rid of regulations that prevent people from doing the right thing. Many local codes are riddled with provisions that inadvertently encourage sprawl and thereby drive up VMT and GHG emissions. [168] Eliminate regulatory barriers to achieving climate-friendly objectives. You can begin this house-cleaning process by conducting an audit of your plans and development codes. In doing so, ask yourself the questions in the sidebar.

Cleaning House: Key Questions for a Climate-Change Audit

- Does the code allow higher-density developments where appropriate? Does it encourage good design in such developments so that they fit in well with surrounding neighborhoods? Does the code encourage the provision of amenities – e.g., parks, open space, landscaping – to enhance livability as well as the prospects for local acceptance of higher-density development?
- Does the code allow for different housing choices, including townhouses, duplexes, triplexes, and accessory units, on smaller lots?
- Does the code permit mixed land uses – e.g., upper-floor housing and/or offices above street-level shops?
- Does the code encourage well-designed, compatible infill and redevelopment in centers, such as downtowns, Main Street areas, or designated town centers? Or does it undercut the economic vitality of centers by zoning for more commercial space than the local economy can absorb – especially in outlying areas?
- Do policies support the market for, and development of, local retail and other services in "20-minute neighborhoods"?

continued

Monitoring Progress

Imagine setting off to sea in a sailboat that has no instruments with which to determine its speed, direction or location. Without such aids to navigation, you soon would have no idea where you or where you are going. The same is true of a climate action plan: without some method of monitoring your progress, you cannot know whether you are achieving the plan's goals or even moving in the right direction. Monitoring thus is one of the most important (but often the most neglected) steps in the planning process. For that reason, we have devoted a separate chapter to the subject: Chapter 21, Tools for Measuring a Plan's Effectiveness.

For now, we'll just say that it's important when preparing your plan to consider how progress in meeting its goals will be monitored and reported. In the interviews of experts conducted for this handbook, the respondents emphasized the importance of including adequate funding for monitoring in the program. The information that a jurisdiction gains from such monitoring is one of the single most essential factors in making the climate action program effective. Pinpointing emission sources, volumes, and trends helps a community select the most effective GHG reduction methods.

Leadership

Local leadership is critical. Without it, success in reducing GHG emissions takes more time and is more difficult than necessary. The leadership may come from various quarters: the mayor, county commissioners, city councilors, business and civic leaders, or individual citizens. It's best when leadership comes from the top, but it needs to come from somewhere.

In Eugene, Oregon, the spark for the city's new campaign to reduce energy consumption and CO_2 emissions came from a sustainability commission created in early 2008. Made up of business leaders, a city councilor, and community leaders, the commission persuaded the city council to create a comprehensive climate and energy plan that will include a detailed list of actions to guide work by city leaders. The city hired a coordinator to manage this initiative.

Learning from Others

Along the way, build on lessons learned by others as you draft your plan. Contact other communities that have adopted climate action plans or are actively planning for climate change and sustainability. Build a network so that you can learn from others, and never fail to share your community's experiences with others who contact you.

Many communities, especially those that have developed climate action plans or conducted transportation-related greenhouse gas inventories, have assembled a treasure trove of useful facts and insights that are embodied in plans and other documents easily available on line. Examples include: Portland, Multnomah, and Eugene, Oregon; Fort Collins and Boulder, Colorado; Chattanooga, Tennessee; Vancouver, British Columbia; Evanston, Illinois; Sacramento, Berkeley, Chula Vista and Napa County, California; Tacoma, Seattle, and King County, Washington; and Madison, Wisconsin.

Many smaller cities have become members of ICLEI, the International Council of Local Environmental Initiatives-Local Governments for Sustainability. [169] This is a membership association of local governments and national, regional, and local government associations that have made a commitment to sustainable development. The organization provides information, delivers training, organizes conferences, facilitates networking and city-to-city exchanges, carries out research and pilot projects, and offers technical services and consultancy.

Some cities have taken local leaders and citizens on tours (virtual or real) to neighborhoods that embody climate-wise community design principles. Still others have used visual preference surveys and computer-based visual simulations, through which alternative development concepts and their GHG impacts can be shown.

- Does the code require excessive front and side yard setbacks?
- Do parking policies contribute to the fragmentation of an otherwise walkable, compact center? Is the parking supply well-managed? Priced right?
- Does the code encourage pedestrian-friendly development and design, such as street-level shops with display windows and buildings that come up to the sidewalk instead of standing behind an asphalt moat?
- Do local policies encourage the construction of workforce housing near job centers? Is there a good jobs-to-housing ratio in the community?
- Are narrower streets allowed in residential neighborhoods? Or are unnecessarily wide streets required?
- Must new streets be connected to other streets? Or does the code impair connectivity by allowing too many dead ends and/or culs-de-sac?
- Does the code encourage buildings in new subdivisions to be oriented to the south to capture solar heat?
- Does the code encourage tree planting to reduce the heat-island effect in parking lots and elsewhere?

Oregon cities that have signed the US Mayors Climate Protection Agreement:

- Ashland
- Beaverton
- Bend
- Corvallis
- Eugene
- Gresham
- Hillsboro
- Lake Oswego
- Lincoln City
- Oregon City
- Portland
- Vernonia

A growing number of Oregon cities have signed the U.S. Mayors Climate Protection Agreement. [170] Signing that agreement commits the cities to "strive to meet or exceed Kyoto Protocol targets for reducing global warming pollution by taking actions in our own operations and communities." The agreement goes on to list a dozen such actions, including these two:

- "Adopt and enforce land-use policies that reduce sprawl, preserve open space, and create compact, walkable urban communities;
- Promote transportation options such as bicycle trails, commute trip reduction programs, incentives for car pooling and public transit." [171]

In 2007, several counties organized a comparable program called the Cool Counties Climate Stabilization Initiative. The initiative creates an agreement similar to that of the US Mayors, in that it commits its signatories to reducing greenhouse gas emissions. Two Oregon counties, Clackamas and Multnomah, have signed the agreement. [172]

[154] While this handbook focuses on community design, land use, and transportation, it should be noted that a baseline inventory would normally address waste, water, building energy consumption and other issues in addition to VMT and transportation-related emissions.
[155] For helpful information on ICLEI's inventory methodology, see the Berkeley Climate Action Plan at http://www.berkeleyclimateaction.org/docManager/1000000266/BCAP%20Chapters.pdf See p. 10-12
[156] Eugene Community Greenhouse Gas Emissions Inventory Report, July 2007, p. 1, 8, 12 and 20., at http://www.oregon.gov/ENERGY/GBLWRM/docs/Eugene.pdf
[157] See. http://www.walkinginfo.org/library/details.cfm?id=4299
[158] See "Development of Boulder's Multimodal System," by Martha Roskowski et al, at http://www.walkinginfo.org/library/details.cfm?id-4299
[159] "Most of us still drive to work – alone," news release from the US Census American Community Survey of June 13, 2007, at http://www.census.gov/Press-Release/www/releases/archives/american_community_survey_acs/010230.html
[160] See August 7, 2009 press release by the American Psychological Association on the release of "Psychology and Global Climate Change: Addressing a Multi-faceted Phenomenon and Set of Challenges," a report by the American Psychological Association's Task Force on the Interface Between Psychology and Global Climate Change. See http://www.apa.org/science/about/publications/climate-change.aspx
[161] State-of-the-Practice Alternative Land Use and Transportation Scenario Development, Cambridge Systematics, Inc. October 2009. p. 8-4, at http://www.oregon.gov/ODOT/TD/TP/docs/HB2186page/USScenarios.pdf
[162] Special Report: Sacramento Region Blueprint: Transportation & Land Use Study, June 2007, at http://www.sacregionblueprint.org/sacregionblueprint/the_project/BP_Insert_JUN_2007.pdf
[163] Special Report: Sacramento Region Blueprint: Transportation & Land Use Study, June 2007, p. 9, at http://www.sacregionblueprint.org/sacregionblueprint/the_project/BP_Insert_JUN_2007.pdf. King County, Washington, has also used the I-PLACE3S tool. See "Seattle Area Looks at How Walkable Community Design Can Cut Global Warming," by Lawrence Frank and Sarah Kavage, New Urban News, June 2009, p. 10-11.
[164] State-of-the-Practice Alternative Land Use and Transportation Scenario Development: A Review of Eight Metropolitan Planning Organization Case Studies, prepared by Cambridge Systematics, Inc., for ODOT. October 13, 3009, p. 2-5, at http://www.oregon.gov/ODOT/TD/TP/docs/HB2186page/USScenarios.pdf
[165] Superstition Vistas Scenario Report: A Sustainable Community for the 21st Century, September 2009, p. 18, at http://superstition-vistas.org
[166] See "Managing Regional Growth to Fight Climate Change," New Urban News, March 2009, p. 13.
[167] Cited in Growing Cooler at p. 7.
[168] A comprehensive list of possible local actions is found in a paper by the California Attorney General's office: "The California Environmental Quality Act: Addressing Global Warming Impacts at the Local Agency Level." Visit http://www.ag.ca.gov/globalwarming/pdf/GW_mitigation_measures.pdf.
[169] www.iclei.org
[170] Nationwide, 935 cities have signed the agreement.
[171] http://www.usmayors.org/climateprotection/agreement.htm
[172] See http://www.kingcounty.gov/exec/coolcounties.aspx

19 Elements of a Climate Action Plan

In the preceding chapters, we discussed the process of developing a climate action plan, insofar as it relates to community design, as well as the alignment of local policies and public investments with climate-wise goals. Here, we examine a sampling of plan elements that relate specifically to transportation, land use, and community design. These elements, drawn from plans adopted around the country, illustrate a variety of goals, recommendations, and insights that local governments in Oregon might wish to consider.

One caveat: Climate action plans typically include several major sections – buildings and energy, consumption and solid waste, and local government operations, to name a few common ones. But as noted at the outset of this handbook, the focus of this publication is limited to greenhouse gas emissions affected by community design, land use, and transportation. A good climate action plan will address all sources of greenhouse gas emissions.

Key elements

Key elements in climate action plans include:

- an explanation of climate change science and the greenhouse effect
- baseline data – i.e., an inventory of local greenhouse gas emissions at the time the climate action plan is adopted – to use for measuring a community's progress in meeting its goals
- greenhouse gas reduction goals
- a statement on the need for action on climate change – i.e., an explanation of economic and environmental consequences of inaction
- a statement on the benefits of climate action strategies (economic, social, health, financial, fiscal, mobility, environmental, etc.)
- the community's vision for a climate-wise future
- a list proposed actions and policies and their probable effects. (These may be set forth in issue-oriented chapters – e.g., sections on sustainable transportation and land use, buildings and energy, community outreach and empowerment, etc.)

- a description of implementation, monitoring, and reporting activities

Below are some examples of communities that have integrated provisions relating to community design and smart growth in their climate action plans:

Ambitious Goals: Portland and Multnomah County

The City of Portland and Multnomah County aim high in the climate action plan they adopted jointly in 2009. Consider these goals:

- an increase from eight to 25 percent in the number of commute trips taken by bicycle;
- an increase from 15 to 25 percent in the number of commute trips taken by transit; and
- a reduction from 66 to 30 percent in the number of drive-alone work commutes. [173]

The plan also states that in order to reach aggressive GHG reduction goals set for 2050, the per capita daily passenger VMT must decline by about 30 percent from 2008 levels by 2030. "This reduction must occur in addition to vehicle fuel efficiency improvements and the development of cleaner fuels," the plan observes.

Recognizing the importance of urban form to the reduction of GHG emissions, the Portland-Multnomah County plan devotes an entire section to this topic. Among other things, this section sees the creation of "20-minute neighborhoods" as critical to success in reaching GHG reduction goals. Twenty-minute neighborhoods are "complete neighborhoods" in which at least 80 percent of the residents can fulfill daily, non-work needs within a 20-minute walk.

As evidence of the fact that local policies can make a difference, the plan notes that "urban form and mobility policies [in the Portland region] have resulted in almost no increase in emissions from transportation since 1990," despite population growth of more than 18 percent. This record contrasts sharply with conditions elsewhere in the U.S. Nonetheless, transportation accounts for 40 percent of Multnomah County's carbon emissions. The plan therefore asserts that coordinated land use policies and the development of infrastructure for low-carbon modes of transportation will be critical to a reduction in transportation emissions. [174]

Link between Transportation Options and Economic Resiliency: Berkeley, California

Berkeley, California's Climate Action Plan links better transportation options to the city's economic resiliency and to the ability of the city's older citizens to get around:

> Transit-oriented, walkable, bikeable communities are…more resilient to a volatile economy. For example, housing values in transit-rich areas…are more stable than in the outlying areas…As gas prices inevitably increase, Berkeley residents [will be] better able than most in the region to hop on transit, walk or ride their bike to fulfill their mobility needs…By 2035 one quarter of the Bay Area population will be over 65 years of age. It [will be] important for older people who would rather not or who are unable to drive to still get around town without having to get behind the wheel.

Motor vehicle trips today account for 47 percent of Berkeley's total GHG emissions, but the city's Climate Action Plan envisions a dramatic change:

> Transportation modes such as public transit, walking, and bicycling must become the [emphasis added] primary means of fulfilling our mobility needs…More active modes of transportation will become mainstream when they are as convenient and cost effective as driving. [175]

A Push for Infill: Chattanooga, Tennessee

Chattanooga's climate action plan includes a section entitled Built Environment and Smart Growth. "The benefits of smart growth over sprawl are many," states the plan, "but most of them are the result of driving less. They include shorter commutes and therefore more time to spend with family, fuel savings, better air quality, more preservation of natural areas, improved public health because people walk or bike more, and most relevant to this Climate Action Plan: a reduction in greenhouse gas emissions."

Chattanooga calls for more infill development in established communities, where infrastructure already exists. It recommends incentives to encourage reuse and renovation of existing buildings as well as new infill development that is compatible with the architecture of existing homes and businesses. Also recommended: accessory housing units, such as garage apartments on single-family lots; density bonuses to encourage developers to provide affordable housing; and assistance to developers in overcoming liability barriers to reclamation of brownfields.

Climate Protection – A Blueprint to Grow the Economy: Tacoma, Washington

The City of Tacoma, where transportation now produces 53 percent of local greenhouse gases, sees its climate action plan as "a blueprint to grow our local economy, sustainable for the long term." The plan highlights the importance of compact centers:

> A commitment to concentrate development rather than encourage suburban sprawl is critical. Land use planning must drive investment in the downtown core and existing multiple-use centers. Livable, walkable, compact cities are vital to curbing climate change because [they] fundamentally reduce driving distances for our most common activities. [176]

Climate Change and Insurance: Chula Vista, California

Warming:
NW storms could make insurers wary

A headline from The Oregonian of December 6, 2007.

In the preface to its climate action plan, the City of Chula Vista cites the insurance industry's belief that an unprecedented series of hurricanes, floods, and fires may be the first real effects of human-induced climate change. "These companies are spending millions of dollars on climate studies because of the millions of dollars in insurance claims paid, resulting from weather-related disasters," states Chula Vista. "The insurance industry is interested in climate change because in the last 100 years, the worst natural disasters and largest insurance claims [have] occurred in just the last six years. 1995 was the hottest global year on record and it follows a string of record-breaking years…" [177]

Reasons for Fewer Transportation GHG Emissions: Cambridge, Massachusetts

In many cities, transportation-related emissions account for more than half of the community's total emissions. As noted earlier, for example, such emissions represent 51 percent of the City of Eugene's greenhouse gas emissions. By contrast, in Cambridge, Massachusetts, transportation generates only about 12 percent of the city's GHG emissions. The national average for such emissions is about 33 percent.

Cambridge's Climate Action Plan explains why transportation emissions account for such a low percentage of the city's total CO_2 emissions:

> Trips tend to be relatively short because the city is geographically small and dense, mostly with mixed-use development, and destinations tend to be close to each other. Most people, for example, do not need to travel more than a mile to buy groceries or go to a movie. An unusually large percentage of people walk or bike in Cambridge … [T]he streets are bicycle and pedestrian-friendly, and the public transportation system provides an easy way to get to many destinations. [178]

In short, many local governments have joined the campaign against global warming. Your community can, too, by using the smart-growth practices described in this handbook.

Publications and Resources

- Climate Protection Manual for Cities, posted by Natural Capitalism Solutions, includes helpful advice on baseline inventories, local action plans, monitoring results, and other relevant topics. See http://www.climatemanual.org/Cities/Chapter1/index.htm
- Climate Protection Strategies and Best Practices Guide, published in 2007 by the Mayors Climate Protection Center to provide examples of actions being taken by various cities. [179]
- Database on State and Local Climate Action Plans and Strategies, American Planning Association, at http://www.planning.org/research/energy/database/
- Other Oregon communities have begun or completed local greenhouse gas inventories. For an example of one such inventory, see Greenhouse Gas Inventory of Springfield, Oregon, January 2007, at http://www.oregon.gov/ENERGY/GBLWRM/docs/Springfield.pdf
- Springfield's neighbor, Eugene, has one, too: Eugene Community Greenhouse Gas Emissions Inventory Report, July 2007 http://www.eugene-or.gov/portal/server.pt/gateway/PTARGS_0_2_252312_0_0_18/GHG%20Inventory%20Final%20070801.pdf

[173] Climate Action Plan 2009, City of Portland and Multnomah County, p. 42.
[174] Portland and Multnomah County Climate Action Plan 2009, p. 10, 19, 21, 38, 39 and 42 at http://www.portlandonline.com/bps/index.cfm?c=41896
[175] See Berkeley Climate Action Plan, p. 19, at www.BerkeleyClimateAction.org
[176] Tacoma's Climate Action Plan, Green Ribbon Climate Action Task Force, July 1, 2008, p. 5, at Tacoma's Climate Action Plan, Green Ribbon Climate Action Task Force
[177] Chula Vista CO_2 Reduction Plan, p. 9, at http://www.chulavistaca.gov/City_Services/Development_Services/Planning_Building/documents/CO2.pdf
[178] City of Cambridge Climate Protection Plan, p. 5-1, at http://www.cambridgema.gov/cdd/et/climate/
[179] http://www.usmayors.org/climateprotection/documents/2007bestpractices-mcps.pdf

20 Tools for Measuring a Plan's Effectiveness

When it comes to measuring the effectiveness of a community's climate action plan, there is no "silver bullet." The metrics that are used will vary from place to place. Moreover, a community may find that there are several different ways to measure the effectiveness of its programs. This chapter discusses methods that communities in Oregon and elsewhere are using to measure their own achievements and to identify successes and shortcomings in their programs.

When preparing your jurisdiction's response to climate change, one of the most important steps to consider is how the progress of the individual program will be monitored and reported. In the interviews of experts conducted during preparation of this handbook, the respondents emphasized the importance of including funding for monitoring into the program. The information that a jurisdiction gains from such monitoring is one of the single most important factors in making the climate action program effective.

Choosing the Right Tools

The costs of monitoring and reporting will vary depending on the tool selected to document the success of the community's programs and actions. Tools that can be used to measure progress range from complex computer modeling and traffic surveys to simple surveys conducted by staff or community stakeholders. There are many ways to monitor the progress of a plan, but often the community will need to tailor a method specific to the objective.

There is a host of tools communities can use to monitor a program's progress. Fortunately, most of these tools already are likely to already be in your community's "tool box." They range in price and complexity, and their accuracy depends on the quality of the data collected and provided by the individual communities.

Walkability Index

Some measures, such as a "walkability index," can serve dual purposes.

The "walkability index" or "score" shows how "friendly" (safe, convenient, and accessible) an area of the community is to pedestrians. A "walkability index" can also help a community know how compact it is, identify where mixed uses could be beneficial, or identify key locations for infrastructure improvements. Communities can choose

What's your carbon footprint?

If you would like to estimate your contribution toward global warming, several organizations have devised on-line tests to measure your performance. Their chief value probably lies in pointing out areas you might not have realized were contributing so much to global warming.

Here are links to three online calculators:

Oregon Department of Environmental Quality's Carbon Footprint Calculator at http://www.deq.state.or.us/programs/sustainability/carboncalculator.htm

The Nature Conservancy's "Carbon Footprint Calculator" at http://www.nature.org/initiatives/climatechange/calculator/

EPA's Greenhouse Gas "Household Emissions Calculator" at http://epa.gov/climatechange/emissions/ind_calculator.html

to create their own "walkability index" based on specific desired outcomes.

Walk Score, a website for analyzing the walkability of American cities is just one example of a walkability index provided free of charge on the internet. Check your community's rating at: www.walkscore.com Note, however, that WalkScore relies on broad measures of each community's walkability. It provides a sketch, not a detailed analysis, of any given city's walkability.

D-Variable Analysis

Many climate action plans will be written in accordance with the smart growth principles discussed in Chapter 3. Some communities may choose to evaluate their progress by assessing growth with reference to the "D" factors. These include Density, Design, Diversity, Destinations, and Distance to Transit as well as Parking Management and Centeredness. Such analysis can provide a broader, more comprehensive look at the effectiveness of a community's land use and transportation plans.

The resulting "D" indices can help to measure the effectiveness of a plan in reducing trip generation. Usually applied in spreadsheet form, the "D" indices can be applied to a number of different variables. "D" indices are expressed in terms of "elasticities" – statements describing how a change in one variable affects another. If a small change in one variable – say, density – causes a big change in a second variable – VMT, for example – we would say that VMT is elastic with respect to density. In everyday English, we would just say that a small reduction in density brings a big reduction in VMT. Elasticity measurements are precise ways of measuring and describing such cause-and-effect relationships. The greater the elasticity, the stronger the relationship.

Surveys

Surveys are a valuable tool in assessing the progress of programs and actions. They provide an excellent way of getting specific, current information from a cross-section of stakeholders and residents that can be used to measure the success of a program. Surveys can be community-wide or specific to a location. An additional benefit of surveying a community is that it helps to inform the public about the program and provides an avenue by which the public can relay information to those who set policy. Communities can track school bus ridership, transit ridership, bicycle use, etc., through community-wide surveys to help determine what alternative modes are being used to reduce VMT.

Focus Groups and Interviews

A focus group is a small group of people (fewer than a dozen) who discuss selected topics in a relatively unstructured meeting. Their discussion usually is led by a moderator who keeps the group on topic, encourages participation by all group members, and tries to elicit the group's opinions. For example, a focus group of pedestrians and cyclists might be used to evaluate the effectiveness of a community's measures to encourage walking and cycling as alternatives to driving.

Focus groups and interviews of professionals in the specific disciplines that relate to a policy (e.g., large employers on Transportation Demand Management (TDM) or planners on community design) can be used to gain a deeper understanding of what works best in new policies and programs, as well as to help generate ideas for improving and refining those policies.

Audits

There are other means by which a community can measure progress that may be considered untraditional but are sometimes more cost-effective. For example, if one of the community's objectives is to reduce VMT by promoting pedestrian activities, then it can track the progress toward objective by teaming with major traffic generators (e.g., schools, churches, theaters, large employers, big box stores) to conduct audits of how people travel to them. When preparing your community's plan to reduce VMT and GHG emissions, include some way to monitor the effectiveness of your strategies. Use indicators such as travel time during peak hours on a specific cross-town or commuter route, traffic volumes at major intersections, or transit ridership.

Other Methods/Indicators

One of the least costly methods of monitoring the success of a program to reduce carbon emissions for a community is to monitor data that others have already collected. For example, data related to carbon emissions are routinely collected at Department of Environmental Quality (DEQ) testing facilities. These facilities also track mileage on vehicles tested in the facility, so a community could partner with DEQ to track emissions and mileage from year to year on a large sample of vehicles to learn the trend in VMT and GHG emissions. This information should be available to every community in Oregon.

Another measure of emissions is an analysis of fuel consumption within a community by analyzing local fuel tax revenues collected each year. Records on such tax revenues are kept by the state's Department of Revenue. Finally, building permits and other development review records may provide data for analyzing the effectiveness of a community's climate action plan. For example, such data will show trends in key areas such as infill development, density of town centers, and mixed used development.

The key point here is to not limit your analysis to a single method. Use a variety of methods to gauge the effectiveness of your community's efforts, and use the resulting information to refine its objectives.

Final Thoughts

> We live at a pivotal moment in the story of humankind. For thousands of years, we have [used] the earth's abundant resources to meet our needs. But now…we are starting to see the limits of what the earth can provide. The signs are all around us. We can choose to ignore these signs and wait until we are forced to react. Or we can seize this opportunity to work together to create a sustainable world.
>
> Betty Griffiths and Annette Mills, Co-Facilitators
> Corvallis Sustainability Coalition

The sense that we are at a pivotal moment in history is the motivation for this handbook and countless community initiatives aimed at reducing greenhouse gas emissions. Just one of many signs of widespread interest in seizing the opportunity to work together to create a sustainable world: "When the City of Corvallis launched its sustainable planning effort, more than 600 residents turned out for a town-hall meeting. The plan ultimately adopted by Corvallis includes, among other things, a goal to achieve a per capita reduction of 50 percent in gasoline consumption by 2020. [180]

As in Corvallis, citizens across the country are turning out for community forums focused on ways to cut greenhouse gas emissions, and local governments throughout the U.S. are taking the kinds of actions described in this handbook. They are re-examining their zoning codes to eliminate provisions that make it impractical for people to take short trips by foot or bicycle. They are filling gaps in local bicycle and pedestrian networks. They are providing incentives to encourage the revitalization of walkable downtowns and main streets. They are revising local parking policies that have had the unintended effect of increasing the distances between local destinations. They are challenging travel demand models and mobility standards that are rooted in auto-centric environments and that inhibit efforts to reduce auto dependence. They are conducting greenhouse gas inventories to determine where best to focus their attention. Finally, they are writing climate action plans to help communities identify the most effective ways to cut greenhouse gas emissions.

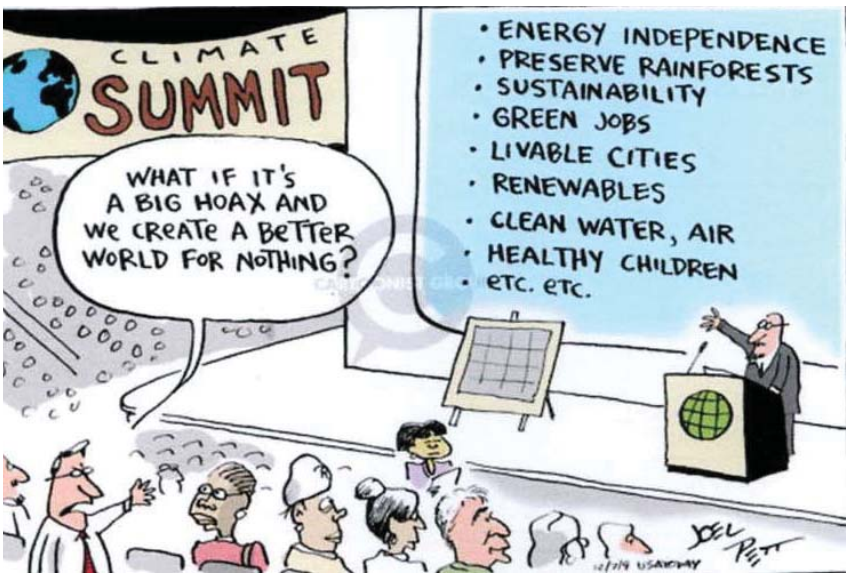
While these and other actions will reduce transportation-related greenhouse gas emissions, they promise economic, national security, and health benefits as well. Among these:

- insulation against future gas price hikes,
- energy independence,
- less reliance on foreign oil,

- retention of local dollars – versus the exportation of wealth to out-of-state, multi-national corporations or to foreign countries hostile to American interests,
- lower transportation costs and more money available for housing, education, etc., and
- "active transportation" opportunities, such as walking and biking, to improve physical fitness and deter obesity-related health problems.

In short, the benefits of cutting transportation-related greenhouse gas emissions redound not only to the environment but also to our economy, national security and health.

This brings us to the conclusion of this handbook about methods and techniques by which Oregon cities and towns and counties can use local community design, land use, and transportation planning strategies to reduce their carbon footprints. Here, we could write "The End." But it will take more than reading a handbook to meet the challenge of climate change. It will take leadership, hard work, and cooperation by citizens and communities across Oregon to meet that challenge. And so we close with these two words instead: The Beginning.



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[180] http://www.sustainablecorvallis.org/SustainabilityActionPlanFinal12_15_0.pdf?attredirects=0 (click on Community Action Plan and see pp. 1 & 33

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