Low Carbon Green Growth Roadmap for Asia and the Pacific

[Background Policy Paper]

Urban Planning and Design:
Policy recommendations for the development of eco-efficient infrastructure
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Policy recommendations for the development of eco-efficient infrastructure

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<td>BRT</td>
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1. Current Trends in City Development in Asia and the Pacific

1.1 Introduction

Over the course of the last century, development patterns throughout the world have become increasingly inefficient and unsustainable, driven by both economic and population growth. Development worldwide has evolved into a cycle of sprawl – both vertical/urban and suburban – reinforced in many countries by increasing highway and road capacity to support the pattern. This cycle has created vast suburban regions and urban environments characterized by unsustainable development, traffic congestion, and a lack of cohesion or community. These practices have failed to establish cities, towns, and neighborhoods capable of sustaining themselves without a damaging dependence on automobiles, freeway systems, and fossil fuels – in other words, “brown growth”. The lack of serious strategic planning, with little consideration given to sustainable development, has resulted in complex negative impacts to environmental quality, social equity and land use planning as a whole.

Today countries around the world, particularly in Southeast Asia, face the challenge of overcoming years of inefficient, sprawling development, while attempting to reverse some of the environmental ramifications. As the region moves forward, it is the responsibility of planners, designers, governments, and development agencies to develop and integrate practical planning strategies and policies. These planning principles utilize the lessons learned by developed and developing countries alike, to create sustainable developments capable of supporting continued economic growth. These principles can help to guide our decisions to promote more efficient, attractive and self-sustaining communities.

In this section we will outline the need for strategic and regional planning practices, with an emphasis on revitalizing cities, towns and suburban areas and planning for future, sustainable development.

1.2 Current Trends in City Development in the Asia Pacific

Issues Addressed in this Section:

• Fractured development
• Vertical sprawl
• Automobile and oil dependence
• Reduced environmental quality
• Negative social consequences

Worldwide trends continue to separate the places where people live, work and socialize. Multiple forces are at work beneath the surface of these trends: antiquated zoning, or a complete lack of planning or zoning; business as usual development practices; inadequate mass transit and alternative transportation modes; and multiple and overlapping street and building design codes create “fractured development.”

Fractured development can be defined as development that separates residential uses, employment centers, commercial, retail, and entertainment districts, and other uses into distinct and disparate “zones”. These zones are often not linked by mass transit, and are too far apart to travel as a pedestrian or cyclist, necessitating the use of the automobile. These areas offer little street life or activity, and are often merely multi-lane expressways fronted by parking lots or the blank façades of high-rise buildings.

As this type of growth continues in disparate and disconnected patterns, vehicle volume and vehicle miles traveled (VMTs) increase, to move people from place to place. These zones may be intentional or haphazard, but they create negative ripple effects that include the detrimental dependence on vehicles and fossil fuels, as well as increasing congestion, traffic, and pollution.

A signature example of unsustainable planning is the sprawling, auto-dependent suburbs throughout the United States. These communities have created barriers to social connectivity, while forcing people to drive between a
Strategic planning, in this context, is the proactive development and implementation of policies to encourage and support more effective and sustainable urban design. Rather than developing communities on a reactionary basis, designing streets and buildings that do not adequately complement each other, strategic planning provides a framework for development. This framework will help to guide the future of a community, taking into consideration the needs and goals of its leaders and citizens, and implementing government policies and design strategies to support the future growth and development.

These impacts are complex and widespread, but include the following:

- The average household generates 13 car trips per day.
- Since 1950, roadway investment has often robbed neighborhoods of their economic value by degrading the environment.
- Government subsidies for highways and parking alone amount to between 8 to 10 percent of the US gross national product.
- Eighty percent of all suburban automobile trips are short drives to places that used to be accessible on foot.
- The typical American spends four times as much on transportation as its European counterpart.

Likewise, many developing countries with densely populated cities, particularly those in Asia and the Middle East have experienced different, but equally unsustainable development patterns, evidenced in vertical sprawl. The disregard of strategic planning principles has resulted in streets lined endlessly with large single-use high rise buildings, creating a different type of fractured development. Although much denser than traditional suburban sprawl, these offer little opportunity for incorporating a mix of uses or encouraging connectivity, separating housing, office and retail destinations. These disconnects are often far enough apart that they still encourage traffic congestion, parking constraints and lack of community. These trends and patterns have resulted in the automobile-dependent, disconnected communities, similar to those found in the United States.

Recent development trends have created street designs and layouts that focus on the perceived need and convenience for the automobile, including wider street widths, faster speed limits and elimination of “barriers” such as on-street parking and landscaping features. To create more sustainable urban environments, this focus must shift to implement street (and city) design to address the needs of pedestrians. One strategy to create this shift is the prioritization of on street uses by pedestrians, cyclists, transit, and automobiles. If cities do not design streets that create a safe, convenient and pleasant atmosphere for pedestrians, citizens and visitors will continue to depend on their automobiles to bring them to their destinations. An unintended and more damaging consequence can be the impact to those unable to afford or drive a vehicle, who must walk at greater risk on streets not well-adapted to the pedestrian.

Street design plays an important role in the success of sustainable communities, as it is often the primary factor (along with access to mass transit) exerting influence on commuting choices and alternative modes of transportation. Providing safe, interconnected, and convenient street layouts and pedestrian-scale development generate more activity on streets and create a more attractive environment. This strategy further reduces the need to drive to multiple destinations, which reduces carbon emissions and Vehicle Miles Travelled (VMTs).

We have provided additional information related to street design recommendations in Section 3 – Policy Overview and Section 4 – Policy Recommendations.

Today governments from all corners of the world face the challenge of overcoming years of inefficient and environmentally harmful development, while attempting to reverse some of the damage. Considering the previously discussed issues with population growth and growing energy and oil demands, as well as the resulting automobile dependence, a lack of public transit options, and development patterns not focused on the pedestrian, it would be very easy for developing countries in the ESCAP region to fall into the same unsustainable development practices seen throughout the west.
All stakeholders, from government policy makers and elected officials, to planners and designers, as well as communities and their citizens, can grasp the relevance of these concepts and take advantage of urban planning and practical strategies. These planning strategies, often viewed as “passive”, transform communities - urbanized environments in particular - and become more powerful when combined with “active” strategies such as technology and economic policies.

These strategies can guide our decisions as influencers and policy makers to promote more eco-efficient, self-sustaining communities that form the physical environment to fuel low carbon green growth.

1.3 Looking Ahead: Accommodating Population Growth and Rapid Urbanization

Issues Addressed in this Section:

• Impact of rapid population growth in Southeast Asia
• Implication of fossil fuel dependence and automobile development

Population growth, one of the most important considerations in planning and development, will have far-reaching and complex impacts not only in Asia and the Pacific, but globally. Over the next 20 years, nations will face the challenge of accommodating dramatically increasing urban populations in both large and mid-range cities and metropolitan areas.

Urbanization is driven in part by access to jobs and economic resources, as well as municipal and private services and the conveniences of city life. While cities in their current form serve as a valuable economic and social destination, governments, planners, developers, institutions and other stakeholders must identify opportunities to accommodate this significant shift toward urbanization, while creating more sustainable, dynamic places.

By 2030, over 2 billion of the world’s people will be living in newly urbanized areas. This number is additive to the approximately 3 billion people who live in urban areas today. ii

Southeast Asia in particular follows this global pattern with rapidly growing urban populations. According to the paper Climate Change and Urban Planning in Southeast Asia (Yeun and Kong, 2009), the urban population of Southeast Asia is growing at 1.75 times faster than the urban population of the rest of the world. In 2008, more than 45 percent of people in Southeast Asia lived in urban areas. Further, by 2030, this proportion is projected to increase to 56.5 percent. Specifically, in countries such as Brunei, Indonesia, Malaysia and the Philippines, urban populations may increase to over 60 percent. This growth will have a significant impact on the already vulnerable ecosystems and communities in this region, as well as existing infrastructure. Likewise, many of these countries’ urban cities have significantly developed with little consideration given to proper planning. iii

In the Philippines, one of the fastest urbanizing countries in Southeast Asia, more than 60% of the population lives in cities, with dramatic increases projected. Unfortunately, this rapid urbanization has resulted in unsustainable development, leading to significant traffic congestion, air pollution and traffic accidents. The population in Manila, the country’s largest city, accommodates approximately 11.5 million, and growing. Other major cities such as Cebu, Davao, and Iloilo City are moving in the same direction. iv

Planners in the ESCAP region should consider this anticipated population growth as they begin to implement planning strategies to alleviate the potential impacts. The unsustainable development patterns of recent decades cannot be viewed as an acceptable option as populations continue to grow at such a rapid pace. Planning trends that promote automobile use, fossil fuel dependence and significant energy use must be replaced by strategies and practices that develop compact, eco-efficient cities.

Promoting density will be one of the most important factors in accommodating population growth. The region must implement planning policies that limit sprawl by implementing eco-efficient strategies such as incorporating mixed-use, reducing the need for automobiles and creating self-sustaining communities. These compact
cities will be better equipped to accommodate the needs of a rapidly growing population, while helping to reduce the environmental impacts of sprawl.

To accomplish this goal, governments in the ESCAP region must increase their investment in eco-efficient building and infrastructure practices. For instance, implementing policies promoting density and reducing dependence on automobiles and fossil fuels will have a positive impact on the sustainability of these environments, and will contribute to the infrastructure required to support green growth. The policies include reinventing and revitalizing cities, and in some cases transforming current development patterns into walkable environments, anchored by mass transit and a healthy mix of uses in every community. Further, investment in renewable energy technologies will result in significant cost savings over time, helping to contribute to the economic vitality of the region, and provide additional financial resources to support the growing populations.

1.4 Need for strategic regional and urban planning

Issues Addressed in this Section:

- Planning strategies to accommodate growth
- Need to promote density
- Increasing mobility through all modes of transit
- Importance of streets serving pedestrians

Increased urbanization and population growth in Southeast Asia and the Pacific will undoubtedly impact demand for energy and fossil fuels. The ESCAP region is currently one of the highest users of energy in the world, as well as one of the highest importers of oil. These statistics demonstrate some of the issues the ESCAP region is dealing with due to inefficient development, and possible results if more sustainable practices are not implemented:

- In 2005, the ESCAP region imported about 930 million tons (Mt) of crude oil, representing 38% of the world’s total imports.
- By 2030, it is estimated that Asia and the Pacific will account for half the world energy demand of 17.7 billion TOE.
- By 2030, electricity generation among Asia and Pacific countries will require an investment of US$6 trillion.
- Between 2006 and 2030, energy demand in the Asia Pacific region is projected to grow by about 2.75% per year from 5,380 to 8,936 Mtoe.

ESCAP Region Energy Demand and Oil Equivalent: Baseline vs. Sustainable

Another noteworthy trend that will continue to impact development is automobile dependence. While the development of the automobile has undoubtedly been an engine of prosperity, opening doors that would have otherwise been impossible, the continued reliance on the automobile and increasing number of cars purchased by the emerging middle class in Asia and beyond represents one of the greatest challenges to low carbon green growth.

Automobile dependence has contributed to creating the brown growth and resulting impacts in developed countries. This dependence reduces the opportunities for alternative transportation options. High-speed roadways and increased traffic make walking or biking impractical and even unsafe in most regions. This effect may be amplified in urban environments in developing nations, such as India and China. The dependence on automobiles requires the continuing investment and expansion of highway and road systems, lessening the financial and political capital to support public transit alternatives. In auto-dependent communities with heavily-subsidized public transportation, low demand often leads to low infrastructure and service quality, further decreasing the likelihood of use, and further profitability and support. vi

As a whole, Asia has traditionally not had the same level of automobile dependence as other developed countries. While the United States and Australia lead the world in vehicle ownership per 1,000 people, with 556 and 475 respectively, the ratio of vehicle ownership in Asian cities is far lower. Hong Kong has the lowest ratio of vehicle ownership per 1,000 people with 47, while Bangkok has the highest of all the Asian cities with 296, putting it just behind the average of European cities of 341. vii

However, due to inefficient planning strategies in the highly urbanized cities in Southeast Asia, and an increasing desire for vehicle ownership, these cities still struggle with major issues such as traffic congestion and carbon emissions caused by automobile use. Cambodia’s capital city Phnom Penh is facing a large increase in traffic congestion due to significant population growth. Traffic congestion in this city has caused a reduction in economic productivity, and has had a damaging impact on the livability of its communities. According to a report conducted at the Toyohashi University of Technology, traffic congestion has led to urban sprawl as residents seek to relocate outside of the city’s congested communities. This has also led to a rapid decrease in the city’s air quality. viii

Another example is Bangkok, Thailand. As stated, Bangkok currently has the highest level of vehicle ownership in Asia. In spite of the introduction of a sky train and underground transit lines, the city still has one of the worst problems with traffic congestion in the world. Residents have found both of these transit lines to be too expensive, and too limited in their destinations. Further, in Thailand car ownership has become a significant status symbol, and every year more people choose car ownership over public transit. This has resulted in constantly worsening traffic congestion, resulting in losses in productivity and increases in carbon emissions. ix

While we understand that strategic planning efforts are unlikely to eliminate private automobile use, there are opportunities to develop cleaner fuels, electric vehicles, and reduce carbon emissions from the single occupant vehicle. Leveraging technology, and investing in new research to develop cleaner technology and vehicles, is an important step in mitigating climate change and preventing future emissions. The implementation of policies that promote technologies such as the development of cleaner and more efficient cars is a significant competitive advantage.

1.5 Opportunities and Benefits from Sustainable Urban Planning and Design

Although Asian cities overall are traditionally less car-dependent than American cities, the region and its nations have a window of opportunity to implement efficient urban planning strategies and slow the rate of increase of vehicle ownership, carbon emissions and sprawl in Asia, rather than following in the footsteps of the US, Europe, and Australia.
1.5.1 Livability

The design of regions, cities, and towns - the physical framework of where people live, work, and play - impacts the way people commute and travel to daily activities as well as destinations.

The integration of sustainable planning and design concepts will help to enhance the livability of new and existing regions and cities. It is important that the ESCAP countries consider each of the following concepts as they seek to transform their landscape into a more sustainable and eco-efficient system. These concepts include:

- Creating city “centers” to maximize density and enhance economic productivity
- Creating density through a mix of uses (housing, retail, offices, entertainment, etc.)
- Promoting walkability and mobility through pedestrian-centric street layouts and adequate and affordable public transit options
- Effective integration of buildings and public and green spaces such as plazas and parks
- Providing affordable housing options
- Generating activity to create more active and attractive communities

These concepts can shape, or re-create, the physical framework of communities. Many of these policies focus on reducing the necessity of the single occupancy vehicle, increasing the use of mass transit, and enhancing walkability. Each of these goals, worthwhile in its own right, can be combined to create successful and livable places, cities and regions.

1.5.2 Competitiveness

Sustainable urban planning is a competitive advantage in itself, providing economic and social benefits not available in unsustainable cities and regions. For instance, cities and regions which incorporate the livability principles defined earlier will prove to be more attractive not only to potential residents, but to businesses as well, resulting in population growth, and greater economic stability and resource efficiency. This can prove to be a reinforcing cycle of economic development, fostering additional productivity, job growth, and housing within planned, sustainable, urban environments. Providing an environment where people want to live, and which also attracts potential employers, will no doubt serve as an economic competitive advantage, while providing an attractive and enjoyable community for residents as well.

In addition, the development and enhancement of technologies cannot be underestimated when it comes to gaining a stronger competitive advantage in the global marketplace. For instance, research and implementation of cleaner and more cost-effective renewable energy systems such as solar energy, wind power, hydro-power, geothermal energy, and the like is key to gaining a competitive advantage in the global marketplace. The ESCAP region has an opportunity to become a global leader in the development and enhancement of these technologies. These will not only help to create more sustainable systems and buildings, but will eventually result in significant cost savings for institutions, both public and private.

1.5.3 Energy Efficiency

Energy efficiency will be an important factor in the successful development of sustainable cities in the ESCAP region. Significant energy use has damaging impacts not only on the sustainability of communities, but on economic prosperity as well. Any progress that the region can make regarding the integration of energy efficient systems will go a long way in helping to remain competitive in the world market, while improving livability for residents. By implementing policies that require, encourage, or provide resources to develop energy efficient and net-zero buildings, communities will be able to conform to more a more sustainable existence. Some possible energy efficiency strategies include:
Development of Net-Zero Buildings.

Buildings are by far the primary users of energy in all cities. A net zero building is one that is optimally efficient, and generates energy onsite, using clean renewable resources, in a quantity equal to or greater than the total amount of energy consumed onsite. The development and implementation of net-zero building technologies will help to contribute to both livability as well as competitiveness. Net-zero buildings are still a relatively new concept, and there is significant opportunity for the ESCAP region to capitalize on this market. ESCAP countries may consider the regenerative building movement, as defined by the Living Building Challenge, where buildings create a positive net effect on the environment, rather than a net-zero or negative impact.

Solar Energy Technologies.

Solar energy is another opportunity available to power commercial buildings and homes, while limiting the impact on the environment. Southeast Asia has an opportunity to capitalize on this market given its high levels of solar insulation, as well as a large number of potential users. Solar technology will be most beneficial if it can be produced and sold relatively inexpensively so more can afford it. With that, solar has the opportunity to bring electricity rural communities who still live off the grid, bypassing the need to install expensive grid lines. This market represents an economic generator as well, to provide such technology throughout and beyond Asia and the Pacific.

Waste to Energy.

As the Asia Pacific region continues to grow and industrialize, one consequence is increased quantities of waste. Landfill disposal and incineration create space and environmental problems, and countries are increasingly turning to waste to energy (WTE) as a single solution for the dual objectives of waste disposal and energy creation. By recovering energy from waste, countries can get rid of their waste and compensate for their diminishing natural sources of energy. There are also opportunities for cities to provide tax allowances and exemptions for those private and public entities that institute waste to energy programs.
2. Policy Objectives

As discussed in Section 1, the implications associated with rapid urbanization, population growth, automobile dependency and unsustainable urban planning continue to have negative impacts on cities and communities throughout Southeast Asia. The expected rapid population growth in the ESCAP region over the next few decades calls for significant development of new buildings and infrastructure.

However, planning and government officials must seek to carefully plan and strategically implement new development oriented toward three primary objectives:

1. Livability
2. Access and Mobility
3. Resource Efficiency

Each of these principles is critical to the successful development and growth of the ESCAP region over the course of the next few decades. The physical framework of cities, including streets, buildings, roadways and infrastructure, must incorporate strategies to provide a high quality of life for residents, focusing on policies such as increased walkability and access to mass transit. Further, cities must begin to encourage more "cellular development" which provides access to vital needs such as grocery stores, quality education and healthcare, as well as social destinations including cafes, retail, and entertainment venues.

Finally, it is important to recognize the importance of resource efficiency in the continued successful development of cities and communities in the ESCAP region. Governments must implement adequate provisions for issues such as water and waste management in order to maintain and improve the environmental sustainability of these regions, as well as improve quality of life for citizens. Careful, comprehensive planning that the regional, city and community levels provides the vision and essential physical framework for economic development, growth, and the opportunity to reduce poverty in both urban and other areas.

The following are a number development concepts which the ESCAP region can seek to implement in the planning and design of its communities to promote eco-efficiency efforts, while creating vibrant and self-sustaining cities.

2.1 Smart Growth Principles

The overall framework for these developments is replicable and has proven successful in cities and neighborhoods worldwide. From reductions in carbon emissions and traffic congestion, to the improvements in human health, there are significant opportunities to begin to reverse the damage from the inefficient and ineffective planning and policies.

A good example of smart planning strategies that cities can implement is the “Smart Growth Principles” developed by the Congress for New Urbanism. These principles go hand in hand with the concept of cellular development, as they seek to create more sustainable and vibrant communities.

Smart Growth is defined as anti-sprawl development that is environmentally, fiscally and economically smart. Demographic shifts, a greater focus on environmental responsibility, and community efforts toward more sustainable planning and design strategies are what originally inspired the advancement of Smart Growth principles. Some of these principles include:

- **Creating a range of housing opportunities and choices** – provide quality housing for people of all income levels with access to education, transportation, and other necessary amenities and services
- **Creating walkable neighborhoods** – locate housing, offices and retail within convenient walking distances and with pedestrian access throughout
While these ideas can help to create the physical framework for development of sustainable cities, they provide a “big picture” view of what governments and economic development agencies must pursue in their planning processes. Another important factor is the development of key sustainable infrastructure to accommodate these sustainable planning principles.

Infrastructure creates the foundation for the physical framework of cities and regions. Governments, planners and developers must examine infrastructure as it is planned and built within these development types, and identify opportunities to integrate sustainability. Infrastructure for energy, water, and transportation should not be examined within individual silos.

The infrastructure built today, including buildings, roadways and transit systems, as well as water, waste, and energy technology systems, will often last into the next century. Planners and policy makers in Asia and the Pacific must take a holistic approach to strategic planning of neighborhoods and cities, including big picture items such as buildings, street networks, transit systems, and water and waste management.

It is important that these systems be implemented in an eco-efficient manner so that people today, and future generations, can utilize them effectively. For instance, over its life cycle, infrastructure must be developed, built, maintained and taken out of service in a manner which meets present needs, but does not hinder the ability of future generations to meet their economic, social and environmental resource needs. This must be integrated into the overall planning framework.

The combination of sustainable infrastructure with effective planning is pivotal in creating sustainable communities. In the short term, these concepts can transform existing cities and towns to consume less energy, reduce carbon emissions, and provide additional opportunity for human capital. In the longer term, these concepts can help establish physical frameworks for new cities, or the re-planning of existing ones, with the goal of further climate change mitigation and true low carbon green growth.

2.2 Mixed-Use Town Center Development

Metropolitan regions in Europe, the United States, and throughout the world, have begun to implement these cellular development and smart growth trends, creating communities known as “town centers” with the goal of increasing density, while reduce traffic congestion, encouraging walkability, and creating more attractive and vibrant communities. Hundreds of new, small-scale urban and suburban infill projects are underway to establish more walkable streets and neighborhoods.

The Annapolis Towne Centre is located in Parole, Maryland in the United States serves the Washington, DC/Baltimore, Maryland area. Serving as a model of specialized mixed-use development incorporating a variety of uses and demographics, it provides those who live and work there with an inviting sense of community, and
the convenience of a walkable mixed-use neighborhood, complete with adequate and convenient parking options.

The Towne Centre incorporates a number of public areas throughout, creating an exciting and unique community for residents and visitors. Plazas, courtyards and outdoor cafes present a charming “downtown” atmosphere for the neighborhood, encouraging more street level vibrancy and creating a greater sense of security. The development has generated regional tourism, providing additional economic vitality.

Parking has and will continue to play a critical role in the success of the development, providing essential infrastructure to support the increasing growth and density of the site. The center includes two parking structures which feature mixed-use space and blend seamlessly into the fabric of the surrounding buildings. The garages serve as a “gateway” to the center, providing an attractive, comfortable, and convenient experience as residents, visitors, and employees come and go.

By integrating residential properties with substantial mixed-use, the Annapolis Towne Centre reduced the need and incentive for residents to drive to other areas for shopping and dining, and also provided tourism opportunities. This has helped to reduce vehicle trips, and consolidate multiple uses in structured parking. The Annapolis Towne Centre provides those who visit, live and work there with a sense of community within a walkable mixed-use neighborhood.

While town center developments are a viable model for the combination of a variety of uses to spark revitalization and promote activity and economic development, another vital element to consider here is the integration of mass transit options. The effective integration of transit will to play a significant role in making these communities more sustainable, while providing opportunities for people to be less dependent on their vehicles. Convenient access to transit will have a positive impact on the growth and development of the overall community. The integration of transit into town center development will also promote greater environmental awareness and help to reduce the emissions from vehicle trips replaced as a result of transit use.

2.3 Cellular Development

Keeping all of these issues in mind, we believe the most effective strategy for development is termed the “cell” or “village” concept. This concept focuses on creating replicable, eco-efficient developments that seek to reduce sprawl and encourage density in smaller areas. The cell, or village, integrates a variety of destinations, including housing, retail, office and entertainment, as well as educational, cultural and religious destinations in one place. This model will help to produce communities capable of sustaining themselves, and resulting in more active, vibrant and walkable environments.
As governments and policy makers continue to move forward in the planning and design of sustainable communities in urban cores, the concept of “cellular” development will have an extremely positive impact on the many facets of development. This concept has the potential to transform the mindset of urban and suburban planning, seeking to create communities which will promote walkability, reduce energy consumption and carbon emissions, decrease traffic congestion and driving, and create more economically and socially successful cities.

The primary goal of the cellular development concept is to incorporate many of the destinations and amenities one would access on a daily or weekly basis into one place, or a much smaller, denser area. Locating residences, offices, restaurants, entertainment venues and convenient mass transit options - all within walking distance - is the most effective strategy for creating a pedestrian-friendly urban neighborhood, as well as generating more street level vibrancy. Coupled with proximate access to transit, and complete streets for walkability and alternative modes of transit, this development framework contains the components for creating successful, self-sustaining communities. The convenience and enhanced walkability will also help to reduce aspects of the environmental hazards realized as a result of sprawl, including reduced air quality and human health impacts, traffic congestion and even automobile accidents.

The applicability of the model does not change, whether in a large metropolis or smaller town center or suburban setting. The model draws its strength from the characteristics of being both replicable, and scalable. In addition, the model can be applied to both new planned development and infill projects. Many existing urban centers have strong residential, or retail, or office markets and infrastructure. This model allows for nearby development to supplement the existing core to create more livable, and walkable communities.

The cellular concept integrates a short walking radius from a center point, and development radiates around the center point to include a careful mix of uses and building types. The concept can be constructed around a large transit oriented development or mass transit hub, and it is ideal to have the cells in a city, region or community linked by transit to allow better access for all its residents. This radius may range from a quarter-mile to a half mile depending on the urban environment and walkability as well as climate. Within that range, the mix of uses allows citizens to walk or bicycle to many of their daily destinations and the services that they require.

To further extend this walkability and complement the compact city, neighborhood, street, and block design becomes essential elements of the physical framework. This framework ideally should be characterized of small blocks, narrow streets, and the mix of uses as described. Although planning plays a critical role in laying out cities, blocks and streets, the cellular development model can be organic in nature. The development of a successful “cell” will help to spur the development of further cells, by showcasing the increased walkability, and livability of such places.

The model applies many of the concepts of “smart growth” and the best practices of new urbanism, with one key change. One of the primary drivers of economic development in this model is the centralization, and utilization of structured parking to create density. The model leverages the success of shared parking strategies, reducing the number of spaces that need to be built by concentrating development within walkable cells. The application of this model may be able to reduce car ownership from 1.0 or 1.5 spaces per unit to .7 per unit, possibly even less intense urban environments. The valuable land, significant cost, and long-term maintenance of structured parking is reduced, allowing for higher and better uses of land within the cell and beyond.

By creating these pockets of additional density, and reducing the need for the single occupancy vehicle, the cell concept can reduce pressure on green fields and open space as well as agricultural land and rural areas. These developments will provide additional housing, job opportunities, and services for the anticipated population increases in urban environments, and can assist in the reduction of further horizontal or vertical sprawl and the associated costs and negative environmental impacts. Combined with the careful preservation of open space as well as habitat and rural areas, the cell and infill development allows for the maximization of land use in cities and towns.
As urban populations increase and available land decreases, these strategies take on even more pressure to ensure the quality of life and sustainability of cities, and even entire countries well into the future. It is important to implement these strategies carefully, considering not only environmental impacts, but also the effects of smart planning strategies to create active and vibrant communities that provide residents with the quality of life that we all desire.

**Town Center Master Planning**
- Strategic sites create economic activity in urbanized areas
- Neighborhood scale mixed-use with structured parking develops urban core
- Integrates pedestrian activity, minimizing car use
- Incorporates variety of mass transit options and stops to reduce vehicle use
- Program elements generate economic and social activity
- Feature public spaces – plazas, walkable connections and greenways
- Requires structured parking to serve mix of uses
- Allows for smaller scale and infill development
- Located within walking distance to create connections

**Cell Concept: Large Scale Master Planning**
- Mixed-use developments converge to create dense urban hub
- Integrate pedestrian and mass transit activity, minimizing car use
- Often constructed near or adjacent to mass transit hubs
- Program elements generate economic and social activity
- Feature prominent public spaces
- Create vibrant live-work-play environment
- Structured parking to serve multiple uses
- Reduction in parking resources due to proximity of transit and dense amenities
"Creating Replicable, Self-Sustaining Communities"

The World Bank Eco² Cities Program is founded on four key principles: increase in popularity, the concepts of sustainable urban planning and design will continue to improve, creating efficient, livable cities where people can live, work and play in more dense and walkable communities. Ecocities incorporate the policies of cellular development, smart growth and sustainable design to create more smarter, greener building stock in these forms. Just as these individual buildings address the need for alternative energy sources as opposed to fossil fuels, so should the cellular development or Ecocity address the development and provision of clean energies in the form of solar, wind, tidal, geothermal, biomass and other alternative energy sources. The concept of self-sustaining communities, either as cellular development or entire Ecocities, is enhanced by smarter, greener building stock in these forms. Just as these individual buildings address the need for alternative energy sources as opposed to fossil fuels, so should the cellular development or Ecocity address the development and provision of clean energies in the form of solar, wind, tidal, geothermal, biomass and other alternative energy sources.

Ecocities incorporate the policies of cellular development, smart growth and sustainable design to create more efficient, livable cities where people can live, work and play in more dense and walkable communities. Currently, there is little research as to the success and effectiveness of ecocities. However, as they continue to increase in popularity, the concepts of sustainable urban planning and design will continue to improve, creating more vibrant and sustainable communities and positively impacting the environment.

2.4 Ecocities

"Ecocities" offer another large-scale planning and development pattern currently advanced internationally. Ecocities are often also referred to as "smart cities" or "sustainable cities". The World Bank Eco² report defines Ecocities as those that “enhance the wellbeing of citizens and society through integrated urban planning and management that fully harnesses the benefit of ecological systems, and protects and nurtures these assets for future generations.”

The World Bank Eco² Cities Program is founded on four key principles:

1) city based approach
2) expanded platform for collaborative design
3) one system approach
4) investment framework that values sustainability and resiliency.

These cities often include targets for carbon emissions reduction and resource efficiency, goals for economic development, and designs to promote healthy, socially and environmentally sustainable communities.

While this program is relatively new (currently there are eight ecocity initiatives in development), significant efforts have advanced the concept of sustainable cities, including eight early experiments in ecocities.

The concept of reducing carbon emissions from building stock under rating systems like LEED, BREAM, and KGBCS pairs well with the concept of cellular development and Ecocities. Although not the subject of this section of the roadmap, these programs can work hand-in-hand with urban planning efforts to mitigate greenhouse gas emissions. Net zero building design, and regenerative building concepts, exhibit similarities to the Ecocities program albeit on a much smaller scale.

The concept of self-sustaining communities, either as cellular development or entire Ecocities, is enhanced by smarter, greener building stock in these forms. Just as these individual buildings address the need for alternative sources of energy as opposed to fossil fuels, so should the cellular development or Ecocity address the development and provision of clean energies in the form of solar, wind, tidal, geothermal, biomass and other alternative energy sources.
2.5 Resource Efficiency

The following narrative outlines some of the most significant considerations and the opportunity to integrate resource management within the urban planning context.

2.5.1 Water Management

Water is one of the most vital resources to the survival of human populations and environmental ecosystems. However, it is projected that by the year 2025, 2.4 billion Asians will suffer from water stress. Therefore, it is important to develop efficient and sustainable water management infrastructure so that water can be reserved and distributed to residents for generations.

There are a number of opportunities for promoting eco-efficiency in water management, while developing necessary infrastructure as well. For instance, appropriate water pricing can help increase access to water, while generating the capital to finance necessary infrastructure. Metering water consumption will help to ensure that water resources are available for all citizens, but that it is priced in an affordable manner as well. Water pricing systems also provide incentives for efficient water use, as well as water quality protection. The funds generated from water pricing will help to finance the infrastructure needed to protect and enhance water quality.

Another valuable water management strategy is water use reduction. Policies designed to encourage water savings in residential and commercial areas will help to preserve much needed water supplies for years to come. Many countries implement strategies to raise public awareness by educating communities about rainwater collection and storage, rainwater harvesting systems and water use reduction techniques. These methods help to reduce strains on public water supplies and the demands on wastewater facilities.

One example of government policy initiatives designed to implement effective water management strategies is the Phnom Penh Water Supply Authority (PPWSA), Cambodia’s government-owned water supply utility. In 1993, after a 20-year civil war, most of the country’s buildings and infrastructure were destroyed. However, external funding agencies such as the Asian Development Bank (ADB), and a number of internal reforms, the PPWSA transformed itself into a more efficient, self-financed agency, and implemented a number of water management reforms including:

- Employee salary and management incentives
- Installation of meters for all connections
- Computerized billing system
- Cutting off non-payers
- Hiring of locals rather than international consultants
- Manual identification of all water pipes
- Establishment of inspection teams to monitor, stop and penalize all illegal connections
- Increased water tariffs to cover maintenance and operating costs

As a result of these policies, the PPWSA now provides reliable and safe water service to 100% of inner city of Phnom Penh. According to the ADB, this service is also being expanded to surrounding districts, with priority given to poor urban communities. The PPWSA also helps to subsidize tariffs, connection fees, and installment connection fees.

Another example of efficient water management is the reuse and recycling of wastewater to increase water use efficiency. For instance, the Tokyo government recently implemented a wastewater reuse program which utilizes a dual water distribution system to deliver drinking-quality water and treated wastewater separately. In the Shinjuku area of Tokyo, this system brings sand-filtered water from the Ochiai Municipal Wastewater Treatment Plant, and is used as toilet-flushing water in 25 high rise buildings in the area. This system has operated successfully since 1984, and supplies supplying treated wastewater up to a maximum 8,000 m3/day. In addition, a small, on-site system recycles building greywater, reclaiming water for use in toilet flushing, car washing, steam augmentation and landscaping.
2.5.2 Waste Management

Another important element when implementing eco-efficient infrastructure strategies is effective waste management. Most developing countries do not have established waste collection systems, creating unsanitary and ecologically damaged environments, particularly in urban areas. According to a 1999 report by the World Bank, the total volume of municipal solid waste generated in Asia and the Pacific will more than double, far exceeding the capacities of existing waste treatment facilities. Collection and transport of waste is often cost prohibitive or infeasible, and those cities that do have collection systems often do not extend them into non-urban or poor areas.

As with water management, governments can also implement waste management systems which implement fee structures, while educating citizens as to the benefits of recycling. Enforcing volume-based fees for waste generation will provide the funding capacity to pay for more eco-efficient and innovative waste collection systems and treatment facilities. This will also educate citizens as to the value of waste reuse and recycling, and give them the incentive to incorporate these habits into their everyday lives.

For instance, the Ministry of Environment in the Republic of Korea implemented a volume-based waste fee system in 1995 with the aim of changing patterns of disposal to reduce waste and motivate people to recycle. As a result, the amount of recycling significantly increased by 213%, from approximately 8,927 tons per day to 27,900 tons per day. Further, the amount of waste produced per person fell from 1.33 kg per day in 1994 to .99 kg per day in 2006. xxiii

2.5.3 Policy Frameworks Introduced

The following section outlines a series of policy recommendations that the ESCAP region should consider as it seeks to implement strategies to create a more sustainable environment for its cities and regions.

These principles and policies should serve as a guide to implement sustainable planning and design practices to ensure effective community development. Each of these policies complement the various planning principles mentioned (smart growth, cellular development, etc.) and should be incorporated into each of these planning ideas as methods for improving the community design process.

These policies highlight the strategies and resources necessary to creating a more sustainable region and improving the livability of its citizens.

Below is a brief introduction for each policy framework:

Transit-Oriented Development

The successful integration of transit into development is critical, as it helps to connect people to the places they need to go while helping to reduce the need for automobiles. Government policy makers have a responsibility not only to integrate public mass transit systems into their cities, but also to provide connections between destinations to make transit convenient and effective for users. This section highlights best practices for the successful integration of transit-oriented development.

Effective Parking Management

Early consideration of parking during planning will identify opportunities for integrating parking, and create potential opportunities to incorporate mixed-use. Parking plays an important role in encouraging pedestrian movement at street level, as well as sparking further growth in surrounding areas. This section will outline the many considerations required for effective parking planning in urban development.

Compact Development

Compact development is essential to the implementation of smart growth and sustainable planning strategies.
Compact development increases land efficiency, while promoting walkability and reducing the need for driving. It includes a variety of strategies including promoting urban density over decentralization, open space protection, mixed land uses, integrating downtowns and central business districts with a high percentage of residential uses rather than strictly commercial spaces and promoting public transit versus automobile use.

“Cellular Development”

This concept focuses on creating replicable, eco-efficient developments that seek to reduce sprawl and encourage density in smaller areas. The cell, or village, integrates a variety of destinations, including housing, retail, office and entertainment, as well as educational, cultural and religious destinations in one place. This model will help to produce communities capable of sustaining themselves, and resulting in more active, vibrant and walkable environments.

Promote Walkable Neighborhoods

Encouraging walkability and reducing the need for automobile use assists in the creation of sustainable urban development. Places that encourage walking and cycling encourage both building community as well as physical human health. Planners should focus on the overall pedestrian experience when designing the layout and character of urban street and infrastructure.

Preservation of Green and Open Spaces

Green and open spaces are important components of a community fabric. Planners must consider the need to preserve space for neighborhood parks and plazas in urban development. Parks and plazas with attractive landscaping, water features, or even entertainment destinations improve the appearance of an urban development and create a greater sense of security.
3. Policy Recommendations

3.1 Transit-Oriented Development

Key Message:

Transit infrastructure will continue to play a fundamental role in the continued development of eco-efficiency practices in Asia and the Pacific. Public transit, including heavy rail, light rail and bus rapid transit provide viable alternatives to automobile use, and as a result, alleviate issues such as traffic congestion and carbon emissions.

The availability of mass-transit is a key decision-making factor when people make choices where to live and work. Many of the most successful cities throughout the world have developed around their public transportation system, which provides the resources needed to travel in and around the region. As a result, getting around such cities often does not require an automobile, and can decrease trends toward car ownership. The availability of public transit is a significant advantage – in terms of both economic development and public health.

According to the Worldwatch Institute, a freeway carries only 2,500 people per hour, a bus lane carries 5,000-8,000. Light rail transit (LRT) or BRT can carry 10,000-20,000, and heavy rail transit can carry 50,000 people per hour. Most car dependent cities require up to five to eight parking spaces for each car. This is a significant dedication of land that could be used for much more productive purposes and higher land uses and densities. Integrating public transit systems with the capacity to carry thousands more people, while taking up significantly less space, is a far more sustainable and eco-efficient utilization of land.

Fluctuating and increasing fuel costs, roadway congestion, public smart growth policy and the increasing desire to live, work, shop and dine in a mixed-use environment have made Transit Oriented Development (TOD) an adaptable, effective and transformative development model.

Description:

Transit Oriented Developments are mixed-use communities that include residential, retail office, and other complementary development within a five to ten minute walk of mass transit stations. Although typically constructed near train stations and other transit hubs, TODs can incorporate a number of mass-transit combinations, including Bus Rapid Transit (BRT), local buses, subways, trolleys, light rail, rapid rail and commuter rail. TODs include convenient pedestrian connections to transit and between buildings, as well as outward-oriented buildings which serve as destinations for pedestrians. As a result, TODs that apply best practices such as creating walkable connections, pedestrian scale, and appropriate street design often become drivers for economic development as well as dynamic city and town centers.

How it Works:

Transit-oriented development planning includes both the actual planning and development of transit stations throughout an area, as well as the specific planning of transit districts and the integration of various uses. The following concepts are vital to TOD planning:

- Arrangement of land uses organized to concentrate activity near transit and the mix of land uses to generate transit ridership through housing and employment uses, as well as support transit riders through retail and other destinations.
- Incorporating a mix of uses within walkable distances of transit stations to promote walking, as well as bicycling. This includes integrating street designs that accommodate pedestrians and bicyclists.

The success of TOD is contingent upon the ability for a region to support such infrastructure, and the resulting costs. According to the report Public Transportation and Land Use Policy, the success of transit depends on the following:

- High population density in the region
- Large downtown
Strengths/Benefits:

- Quality and convenience of the transit service
- Growing populations to increase transit ridership
- Increasing funding for transit
- Cities and governments increasing favor towards smart growth concepts and place making
- Decrease in single-occupant vehicle trips and potential reductions in car ownership
- Opportunities for economic development and job creation through business opportunities in the TOD, as well as access to local employees
- Opportunities to reduce traffic congestion, resulting in a more pleasant environment
- Opportunities to reduce carbon emissions which are a detriment to public health

Weaknesses:

- Population sprawl may result in lower ridership
- TODs can become destinations in their own right, increasing vehicle trips
- Insufficient political support

Potential Barriers to Implementation:

- Costly infrastructure
- Difficult to construct within existing cities
- Continued perception of automobiles a status symbol of independence and success

Implementation Strategies:

Focus on integrating urban development in conjunction with transit to create more walkable, sustainable communities with a reduced focus on the automobile. However, with this comes the responsibility to incorporate strategies to maintain safety and convenience for all. Transit patrons have basic needs such as safety, security, and comfort at waiting areas. They also must be able to cross streets efficiently and conveniently to access transit stops.

Utilize parking to shape and direct pedestrian and vehicle patterns. It has the ability to enliven a plaza or streetscape, creating a positive impression and contributing to the development. Further, the combination of parking with transit can serve as a catalyst for revitalizing an area, drawing people wanting to live and work in an area with a variety of destinations, convenient access to transit and a reduced need for driving.

Intentionally plan for economic incentives at TOD locations or districts, and build in opportunities for small business and accompanying job creation. Incentives may include reductions in taxes for development that meets TOD standards, streamlined/advanced permitting and approvals at the government level, assistance with project financing or grants and studies to foster TOD. When creating a TOD plan, create opportunities for local companies to locate in the immediate area, incentivizing desired locations. Create residential housing to accommodate a variety of economic levels, to ensure that local employees have the opportunity to locate near employment and transit.
3.2 Effective Parking Management

Key Message:

Parking is critical to the success and vitality of any development. Planners should consider parking as early as possible, and identify opportunities to promote density, incorporate mixed-use, encourage walkability and implement shared-parking principles to reduce the number of spaces constructed.

Although it is important to develop strategies and establish infrastructure to encourage walking and increase transit use, the issue of parking is also one that policy makers should give careful consideration. Cities need to provide safe, convenient and adequate parking options to support the needs of their communities.

Description:

Parking is often the “front door” to a destination, as it is the first and last thing experienced by residents, visitors and commuters. Therefore, it must create a pleasant place that attracts people, but it must also create a secure environment. Each of these elements will help to ensure a positive experience, encouraging patrons to return. Returning patrons contribute to the ongoing economic success of the destination or development.

Often, cities employ excessive parking zoning requirements that necessitate unnecessary amounts of parking based on population numbers, regardless of density, walkability or transit proximity. This not only encourages car ownership and driving, but it also disincentives the integration of transit and walkability. Successful development should include “right-sized” parking, avoiding an “over-build” that is costly, and results in empty lots and garages, and an “underbuild” which creates conditions that may be crowded.

How it Works:

Planners should consider parking as early as possible to take full advantage of the opportunities created by these important assets. The central location of parking amongst a variety of destinations including residential housing, office buildings and restaurants will create more convenient access for all. This will help to reduce the number of vehicle miles travelled (VMT’s) to numerous destinations. Further, cities and regions should price parking effectively to generate the capital needed to support the infrastructure, as well as effectively manage parking assets, and enforce parking policies and pricing.

There are also a number of sustainable design strategies that can be integrated into the design to create eco-efficient parking facilities while supporting the parking needs of the surrounding communities. Some of these strategies include:

- Shared parking strategies to reduce amount of land required for parking
- Development near mass transit stations to increase mobility and reduce individual automobile use
- Mixed-use space including office, retail, restaurant or residential space to create street-level activity and more effectively utilize land
- Attractive architecture, streetscapes and landscaping to improve pedestrian experience and promote walkability
- Energy efficient lighting
- Stormwater collection and reuse
- Renewable energy technologies, including photovoltaic panels, wind power, bio-fuels, etc.
- “Cool” roof or green roof to reduce heat island effect
- Recharging stations for electric vehicles
- Priority parking for carpools and low-emitting and fuel-efficient vehicles
- Bicycle storage areas

Strengths/Benefits:

- Parking can play an important role not only in encouraging more pedestrian movement at street level, but also in sparking further growth in surrounding areas.
• Early consideration of parking will create the potential for incorporating mixed-use to utilize potentially limited space more effectively.
• Structured parking can reduce the need to build spaces by applying shared-use principles, and encouraging turnover. Careful planning for shared-uses allows a development to take advantage of arrival and departure patterns to maximize facility use, allowing for the construction and maintenance of less parking spaces, saving valuable natural resources, land, and capital.
• Structured parking can serve as an inviting “gateway” to a neighborhood or development, as it creates opportunities to integrate mixed-use space.

Weaknesses:

• The cost to build parking infrastructure can be prohibitively expensive when compared to surface parking.
• There may not be enough political will power, human capital or financial resources to enforce parking policies and pricing for effective management at the town or city level.
• People may contest parking pricing requirements, especially if there is a precedent and expectation of free parking.

Potential Barriers to Implementation:

• Planners often leave parking as an afterthought, not considering it until development plans are well under way, leaving few options to incorporate parking effectively.
• Parking not considered early enough in the planning process may be difficult or even impossible to implement in a safe, convenient and cost-effective manner. “Building” in parking assets at the outset of planning can lower the cost to build by best utilizing land resources.
• The integration of parking and mixed-use requires significant planning to determine the most appropriate use and scale of mixed-use space, and to solicit interest from potential tenants and partners.

Implementation Strategies:

• Consider parking as early as possible to take full advantage of the opportunities created by these important assets.
• Centrally locate parking among a variety of destinations (retail, residential, office, etc.) to create more convenient access, promote walkability and reduce vehicle miles travelled (VMT’s) to multiple areas.
• Integrate mixed-use parking facilities to accommodate parking needs, while utilizing limited space through ground level retail or residences above.
• Consolidate parking into structured parking to promote density and preserve land for further development or green space.
• Implement shared parking through the utilization of the same parking spaces for different user groups (offices during the day, residents at night). Shared parking saves costs through reducing parking capacity needed, while preserving land for other uses.
• Parking can generate significant cash flow, and officials should take advantage of this opportunity to generate capital.
3.3 Compact Development

Key Message:

Compact development may be an inevitable trend, as a result of increasing construction costs, demographic shifts, population growth and the need for more sustainable methods of city and regional planning and design. Yet how compact development is integrated into the fabric of a city or community will determine whether this style of development contributes to the human and natural environment, or detracts from it. Compact development, well executed, integrates a complementary mix of uses to create vibrant, walkable communities achieving higher densities and more attractive, successful communities (than typical single use urban development and buildings).

Description:

Compact development is a key factor in implementing smart growth and sustainable planning strategies. Compact development is a more efficient use of land by building in a more compact way through higher density planning and mixed-use development to incorporate a variety of infrastructure (housing, offices, retail, etc.) while promoting walkability and reducing the need for driving. Compact development must integrate a mix of uses, as opposed to blocks of high rise residential towers within a segregated district.

How it Works:

Compact development includes a variety of strategies including promoting urban density over decentralization, open space protection, mixed land uses, integrating downtowns and central business districts with a high percentage of residential uses rather than strictly commercial spaces and promoting public transit versus automobile use. Compact city strategies are varied and include compact growth strategies, as well as national transportation and location policies. Compact strategies include a city structure or comprehensive plan that gives clear priority to compactness.

Strengths/Benefits:

- Compact development, along with public transit integration, will encourage people to be less reliant upon vehicles, reducing greenhouse gases, traffic congestion and dependence upon fossil fuels.
- Compact development can relieve pressures from population growth, and create more vibrant and livable communities.
- Dense, infill developments make use of vacant and underused properties in already developed areas.
- Economic benefits are compounded through access to employment, transit, and housing.

Weaknesses:

- Increasing density in already developed areas may not be logistically or financially feasible.
- Increased cost of living in dense urban cores may contribute to gentrification, dispersion of low income residents, and the creation of impoverished areas with insufficient resources and infrastructure.

Potential Barriers to Implementation:

- Communities and citizens’ continued accommodation of low density development and sprawl, and encouraged dependence upon the automobile.
- Existing comprehensive plans that identify competing priorities and codify single use development.
- While urban infill is a great strategy for reducing the negative environmental impacts of development, local codes and regulations can often make it difficult, particularly for higher-density infill. Local governments should create policies to support increased density and avoid roadblocks created by inefficient zoning ordinances.
Implementation Strategies:

- Adopt and enforce ordinances that encourage cluster development, high density and mixed-use.
- Develop planning strategies which provide necessary infrastructure to support compact development such as street and highway design, water and wastewater systems, and altered utility installation.
- Redeveloping brownfield sites, like infill development, provides opportunities to reuse both the land and the existing infrastructure, including roads, underground utilities, and street lighting, rather than developing greenfields.
- Create economic programs to incentivize compact development, and discourage development that does not meet desired criteria.

3.4 Cellular Development

Key Message:

As governments and policy makers continue to move forward in the planning and design of sustainable communities in urban cores, the concept of “cellular” development will have an extremely positive impact on the many facets of development. This concept has the potential to transform the mindset of urban and suburban planning, seeking to create communities which will promote walkability, reduce energy consumption and carbon emissions, decrease traffic congestion and driving, and create more economically and socially successful cities.

“Cellular Development” seeks to create communities which will promote walkability, reduce energy consumption and carbon emissions, decrease traffic congestion and driving, and create more economically and socially successful cities.

Description:

The primary goal of cellular development is to incorporate a variety of destinations into a smaller, denser area. Locating residences, offices, restaurants, entertainment venues and more within walking distance or easily accessible via transit and consolidated, shared parking will be effective at creating more pedestrian-friendly and vibrant cities, while generating activity and enhancing economic development and smart growth planning. These components will also help to reduce some of the environmental hazards realized as a result of sprawl, including reduced air quality and human health impacts, traffic congestion and even automobile accidents.

The cellular concept integrates a short walking radius from a center point, and development radiates around the center point to include a careful mix of uses and building types. The concept can be constructed around a large transit oriented development or mass transit hub, and it is ideal to have the cells in a city, region or community linked by transit to allow better access for all its residents. This radius may range from a quarter-mile to a half mile depending on the urban environment and walkability as well as climate. Within that range, the mix of uses allows citizens to walk or bicycle to many of their daily destinations and the services that they require.

To further extend this walkability and complement the compact city, neighborhood, street, and block design becomes essential elements of the physical framework. This framework ideally should be characterized of small blocks, narrow streets, and the mix of uses as described. Although planning plays a critical role in laying out cities, blocks and streets, the cellular development model can be organic in nature. The development of a successful “cell” will help to spur the development of further cells, by showcasing the increased walkability, and livability of such places.

How it Works:

The concept of the cell, or village development, can be applied in a variety of situations and environments. The applicability of the model does not change, whether in a large metropolis or smaller town center or suburban setting. The model draws its strength from the characteristics of being both replicable, and scalable. In addition, the model can be applied to both new planned development and infill projects. Many existing urban centers have strong residential, or retail, or office markets and infrastructure.
This model allows for nearby development to supplement the existing core to create more livable, and walkable communities.

**Strengths/Benefits:**

- Cellular development has the potential to transform the mindset of urban planning, by examining existing towns, city centers, TODs, and main streets and adding the elements necessary to create a functioning "cell".
- Cellular development promotes walkability, reduction in energy consumption and carbon emissions, decreases in traffic congestion and driving, and creating more economically and socially successful cities.
- By creating these pockets of additional density, and reducing the need for the single occupancy vehicle, the cell concept can reduce pressure on green fields and open space as well as agricultural land and rural areas.
- These developments will provide additional housing, job opportunities, and services for the anticipated population increases in urban environments, and can assist in the reduction of further horizontal or vertical sprawl and the associated costs and negative environmental impacts.
- Combined with the careful preservation of open space as well as habitat and rural areas, the cell and infill development allows for the maximization of land use in cities and towns.

**Weaknesses:**

- Cellular development does rely on the premise that car use and ownership will decrease with successful implementation – difficulties may exist in phasing these developments. Results from these developments may not be evident for a longer cycle, perhaps two to five years, depending on the pace and scale of development.

**Potential Barriers to Implementation:**

- Continued reliance upon the automobile and an unwillingness to transform to more dense and walkable communities from a more auto-oriented lifestyle.
- Inefficient zoning ordinances can hinder the opportunity for mixed-use and transit-centered communities.

**Implementation Strategies:**

- Many existing urban centers have strong residential, or retail, or office markets and infrastructure. Cellular development allows for nearby development to supplement the existing core to create more sustainable communities.
- The cellular concept integrates a short walking radius from a center point, and development radiates around the center point to include a careful mix of uses and building types.
- The concept can be constructed around a large transit oriented development or mass transit hub, and it is ideal to have the cells in a city, region or community linked by transit to allow better access for all its residents.
- Incorporate a variety of uses into one area to generate activity and increase density.
3.5 Promote Complete and Green Streets

Key Message:
Getting people out of their cars and onto sidewalks is an important part of creating vibrant and sustainable communities, while reducing traffic congestion and resulting carbon emissions. Places that encourage walking and cycling encourage both building community as well as physical human health.

Complete Streets enable safe, attractive, and comfortable access and travel for all users, including pedestrians, bicyclists, motorists and public transport users of all ages and abilities, through careful design and operation. “Incomplete streets,” designed only for vehicles, all too often discourage walking, bicycling, and taking mass transit, making these options problematic and even dangerous.

Description:
Planners should focus on the overall pedestrian experience when designing the layout and character of urban street and infrastructure. Good urban planning and design starts with strategies to create a safe, vibrant and attractive experience for pedestrians.

How it Works:
Designing with an emphasis on walkability not only helps to significantly reduce the need for driving, but it also has positive impacts on public health. Pedestrian-friendly communities experience less traffic congestion and lower levels of carbon emissions. Further, residents experience a unique lifestyle which is not centered around the automobile and where they can conveniently walk to a variety of destinations to meet their basic needs.

The urban environment integrates significant impervious surfaces including roads, sidewalks, surface parking, and roofs. Each of these impervious surfaces contributes to stormwater runoff and accompanying pollutants. By design most roadways have impervious surfaces – these roads present a significant opportunity to create green infrastructure to treat stormwater, improve water quality, and utilize natural processes and landscaping to increase infiltration.

Green Streets seeks to accomplish these goals through a number of practical methods that integrate storm water management within the right-of-way and reduce volume discharged into natural water bodies. Green Streets policies often integrate aesthetic improvements as well as an improved pedestrian experience.
Strengths/Benefits:

- Street-level activity creates a more attractive and vibrant neighborhood
- A more safe and secure environment
- Overall positive impacts on community and human health
- Greater focus on pedestrian connectivity and convenience
- Reduction in vehicular emissions
- More energy efficient buildings and technologies
- Water use reduction
- More sustainable use and development of land
- Cleaner, healthier buildings
- Operating cost savings
- Reduction of materials use and waste

Weaknesses:

- It may be challenging to implement sidewalk and street design changes on already established roadways.
- Strategy may be particularly difficult to overlap on multi-lane and elevated highways that often bisect neighborhoods and even cities.

Potential Barriers to Implementation:

- Requires a holistic approach and overhaul of traditional street design, including consideration of not only pedestrian connectivity, but speed limits, street widths and more to ensure safety of increased numbers of pedestrians.

Implementation Strategies:

- Planners must focus on a number of issues to encourage people to walk instead of drive. Some of these issues include:
  - Design sidewalks lined with trees and benches
  - Create safe pedestrian crossings with short crossing distances
  - Wide sidewalk widths
  - Adequate bicycle storage
  - Appropriate vehicle speed limits on surrounding streets
  - Pedestrian and transit route signage
  - Minimize opportunities for pedestrian and vehicular path conflicts
  - Integrate curb cuts to provide accessibility at street junctions, mid-block crossings, and other areas where elevated walkways are edged with curbing
  - Provide curb extensions and restrict parking near crossings to improve visibility between motorists and pedestrians
  - Curb ramps with detectable warning strips

- While the end-result of these pedestrian-focused communities is often a success, it requires serious consideration of a number of factors early in the planning process. Key elements include:
  - Locating a variety of important destinations within close proximity including schools, grocery and retail stores, office buildings, places of worship, entertainment venues, restaurants and more complementary services.
  - Integrating wider sidewalks, seating areas and shelter from the elements to more effectively accommodate pedestrians.
  - Efficient street networks which allow for greater route choice.
  - Enhanced safety features including increased lighting, reduced vehicle speeds and effective traffic signals and crosswalks.
- Include convenient access to mass transit options.
- Creating space for urban greenery such as street trees and bioswales, linking right-of-way and urban pathways to greater sustainability.

- Planners must consider signage in all of its various forms, including:
  - Identification signage – indicates particular destinations and orients patrons to their location.
  - Directional signage – guides patrons along designated travel patterns.
  - Information signage – Provide more detailed information about the local environment including maps, hours of operation, listings of services, etc.
  - Regulation signage – Communicate laws and regulations, primarily regarding traffic requirements.

- Planners must also integrate signage and wayfinding elements in an organized manner. Signage must maintain a consistent design in terms of materials, scale and readability to provide a reliable theme for patrons to follow, as well as enhance their overall experience. The following are some effective signage installation standards:
  - Avoid interfering with pedestrian travel
  - Minimize sign clutter
  - Avoid conflicts with underground utilities
  - Provide for flexibility or necessary changes as needed

3.6 Preservation of Green and Open Spaces

Key Message:

Green and open spaces serve as important components of a community fabric. Planners must consider the need to preserve space for neighborhood parks and plazas in urban development.

Description:

Urban green and open spaces can take a variety of forms including parks, playing fields, playgrounds and walkable squares or plazas. Parks and plazas with attractive landscaping, water features, or even entertainment venues help to significantly improve the appearance of an urban development or neighborhood and even create a greater sense of security. Walk-to parks with benches, playground equipment and pedestrian-friendly sidewalks serve as inviting gathering places and build a more social and close-knit community.

How it Works:

The quality of a city or community’s parks and open spaces directly reflect its sense of community and quality of life. When a community sets out to plan its parks system, it should reflect anticipated neighborhood uses, as well as how these areas fit into the city as a whole. A successful park plan will adequately consider the park’s users, identify the range of needs, and be adaptable to social, economic and environmental changes.

Strengths/Benefits:

- These areas greatly enhance the quality of life for the community.
- Potential residents are more inclined to pay higher prices for housing in an area with close proximity to parks and open space.
- Green spaces can reduce heat island effect by combatting the high temperatures put off by pavement and buildings.
• Green spaces can easily absorb rainwater, preventing soil erosion and improving drainage.
• Green spaces can help to mitigate pollution. For instance, trees can absorb pollutants – as few as 20 trees can offset the pollution from a car driven 60 miles per day.
• Parks and open areas serve as gathering places, and contribute to the vitality and attractiveness of a community.

Weaknesses:

• Land is often scarce, expensive and difficult to obtain from existing communities.
• Parks and open space can be difficult to add into already existing or developed neighborhoods.
• Parks and open spaces require regular and specific maintenance for proper care and continued safe use by the public.

Potential Barriers to Implementation:

• Parks and green spaces can be costly to maintain, and cities often do not make an adequate commitment of finances and resources that it does to buildings, roads and other infrastructure.

Implementation Strategies:

• Create a permanent advisory group, such as a parks board, implement the necessary steps toward the creation, management and maintenance of public parks system.
• Develop a strong marketing campaign to inform residents and visitors of these public assets and encourage their use.
• Provide for a dedicated source of funding to support the continued improvements and maintenance of public green spaces. This money can also go toward the development of new parks when needed.
• Funding can and should be obtained both through private corporate sponsorship, as well as public budgetary reserves.
• Building rooftops can also serve as urban green spaces when land available for park is scarce. Green roofs can contribute to reducing the heat island effect, while serving as open spaces for residents and/or employees of the buildings.

3.7 Miscellaneous Policies

There are numerous additional policies which can serve as valuable complements to the policies listed above. While these may not necessarily fit directly into the aforementioned strategies, they do offer opportunities to create important complements to the successful implementation of these principles. Some additional policies include:

Proactively manage and maintain infrastructure assets

It is critical to implement plans to maintain the quality of all infrastructure assets from streets to buildings and their systems, not only to increase their useful life, but to reduce the costs associated with maintenance of neglected or damaged property. From as early as design, through construction and continued operation and maintenance of infrastructure, it is important to implement plans to keep them in the best condition possible.

• The costs associated with correcting the problems that come as a result of poor maintenance, as well as those associated with the potential liability of neglecting these issues, are outstanding compared to the costs of prevention.
• An effective maintenance program is a relatively inexpensive way to proactively approach parking structure issues.

Roadways, transit infrastructure, buildings and even sidewalks must be adequately maintained to increase their useful life. If not, they may become unsafe or even useless, and require significant financing and resources to
restore. This is not only an unsustainable practice, but cost prohibitive as well.

Government agencies should implement proactive asset management and maintenance strategies as early as street or building design and construction. Planning for and managing infrastructure early on can drastically reduce costs in the future, as well as the liabilities associated with street, building and systems management. However, it is still important to appropriately budget for these preventive tasks.

Establish Policies to Reduce Vehicle Miles Travelled (VMTs)

Compact land use patterns result in fewer overall vehicle miles travelled (VMTs), in terms of both the length and the number of vehicle trips versus sprawling land use patterns. Planners should design urban communities with the goal of reducing VMTs through creating more walkable streets, compact dense development and opportunities for transit use.

As the amount and quality of compact development increases, VMT reduction accelerates. With that, this reduction in VMT results in a permanent reduction in green house gas emissions.

Effective strategies for VMT reduction include:

- Interconnected street networks for safe pedestrian and bicycle travel
- Wide ranging and affordable public transportation options
- Car-sharing opportunities
- Compact and dense mixed-use development
- Provide incentives for auto use reductions

Implement Effective Security Standards

Safety is a major concern in all areas, particularly in urban settings. It is extremely important to incorporate the highest level of security features into every aspect of planning and design including streets, buildings and parking areas.

Some of the most common safety strategies include:

- Active measures
  - Monitored cameras
  - Guards and patrols
  - Effective signage
  - Increased lighting levels
- Passive measures
  - Maximize visibility and openness
  - Open lobbies and common areas
  - Safe and inviting appearance
  - Glass stair and elevator towers
- Generating activity
  - Incorporating people places
  - Hub of activity
  - Pedestrian-friendly environment
  - Integration of mixed-use
- Written policies and procedures
  - Well-defined written policies
  - Guidelines for response
**Provide Access to Quality Education**

Access to good educational opportunities is a key part of any successful development.

Where kids live can play a strong role in determining the quality of their education. If a community does not offer access to good, affordable (or free) education, growth and diversity will be limited, as families will move to areas with better schools.

Investing money for schools in communities where families already live, and creating neighborhoods that have a diversity of housing types and income levels, can make good educational opportunities accessible to more children. This will result in more diverse and successful communities with significant opportunities for future growth and development.

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4. Case Studies

4.1 Sino-Singapore Tianjin, China

**Problem:**
The countries of Singapore and China realized that rapidly growing populations and the urbanization of countries would result in detrimental economic and environmental impacts if they did not take measures to implement more sustainable practices.

By 2030, it is anticipated that China’s cities will have added 350 million people – more than half of the entire population of the United States. In addition, the country’s urban population will reach 926 million by 2025, and exceed 1 billion by 2030.

China’s cities already faced significant social, economic and environmental challenges due to its growing urban population, including:

- Polluted fresh water per person exceeds that of developed countries.
- Arable land is less than 40% of the global average level.
- Government estimates growth rate of 8% is necessary to avoid social unrest.
- Sprawl continues to take over agricultural land and claim farmers’ livelihoods.
- With economic success, cities and towns have been exposed to increased water and air pollution.
- As the growing and more prosperous urban population demands more cars, homes and electricity, conditions will get worse as they burn more gasoline and coal.

**Solution:**
The governments of China and Singapore collaborated to develop a resource-conserving and environmentally friendly city in China. Designed to be replicable and scalable, the Tianjin Eco-city is a model for sustainable development, combining the concepts of environmental protection, resource and energy conservation, and sustainable development.

The Tianjin Eco-city is centered on a set of 26 Key Performance Indicators (KPIs) which dictate the desired results of the city’s environmental performance. These KPIs include:

- All buildings should meet green building standards
- Air quality should meet at least China’s National Ambient Air Quality Grade II standard for at least 310 days
- Renewable energy should account for at least 15% of the energy use by 2020
- At least 50% of the water supply from non-traditional sources such as desalination and recycled water by 2020
- At least 90% of trips within the city should be green trips by 2020. Green trips are non-motorized modes including walking, biking and public transportation

**Results:**
Expected to be fully operational by 2020, the Tianjin Eco-city is located 150 km from Beijing. Prior to development, the Eco-city was one-third salt pan, one-third deserted beach, and one-third water.
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Results:
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In addition, nearly half of Tianjin Eco-City’s received investments in 2010 came from Singapore clean-tech companies planning to manufacture green products and provide all environmentally friendly services, such as recycling materials in urban waste, for instance.

Benefits:

<table>
<thead>
<tr>
<th>Type of Benefit</th>
<th>Result</th>
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</table>
| Environmental   | • The Tianjin Eco-city includes the preservation of existing wetlands and biodiversity. The city includes a series of green spaces interspersed throughout.  
• A light-rail system is the main mode of transportation in the Eco-city, supplemented by a secondary network of trams and buses. This will dramatically reduce carbon emissions.  
• The Eco-city will implement an integrated waste management system, with emphasis on the reduction, reuse and recycling of waste.  
• All buildings will feature adequate insulation and double glass windows to save energy.  
• Planners have established a goal for a fifth of the city’s power to be emission-free, from solar, wind and geothermal sources. |
| Social          | • Social harmony is a key feature. Subsidized public housing will help to meet the needs of the lower and lower-middle income sector of society, enabling people of different income levels to live closely and interact.  
• The Eco-city will be barrier-free, catering to the needs of the elderly and mobility impaired.  
• Public social and recreational facilities will be located within convenient access to residential areas. |
| Economic        | • A goal of the Eco-city is to generate jobs for at least 50% of the Eco-city’s residents, to minimize the need for them to commute on a daily basis from their home. This will not only improve the economy by providing jobs, but it will also reduce the financial burden of commuting costs for residents.  
• Planners are preparing for a mixed society rather than green living for the rich. To accomplish this, the Chinese government will subsidize a fifth of the homes and sell them at 20 percent lower than market price.  
• For renters, apartments targeted for blue- and white-collar workers are under construction and located just outside factories to minimize need for automobiles. |

Financing:

In 2011, the Singaporean government formed a Ministerial Committee to improve the coordination and support among its agencies for the project.

In addition, nearly half of Tianjin Eco-City’s received investments in 2010 came from Singapore clean-tech companies planning to manufacture green products and provide all environmentally friendly services, such as recycling materials in urban waste, for instance.
Barriers:

The Eco-city faced a number of environmental issues xxxvi, including:

• Infertile soil too salty to grow crops
• Significant pollution deterring potential residents
• Lack of adequate fresh water supply

How Barrier Was Overcome:

Developers of the city have spent years enriching the soil, cleaning up polluted waterways and covering the land with lush, green plants.

• Planners have implemented strategies to increase availability of water, including monitoring pipeline leakage, harvesting rainfall, and collecting gray water to reuse for toilets.
• Planners have rejected carbon-intensive industries, despite promises to support clean tech research and development.

4.2 Abu Dhabi Street Design Manual

Problem:

Abu Dhabi has experienced serious traffic, congestion, and pollution issues with residents’ reliance on automobiles and the resulting impacts from carbon emissions, as well as public health and safety issues due to unsafe roadways and pedestrian routes, as well as carbon emissions. The city sought to implement measures for better street designs to create safer, more comfortable and attractive street environments throughout the emirate.

Solution:

Abu Dhabi’s recently developed Urban Street Design Manual, created by the Abu Dhabi Urban Planning Council, aims to reduce the Emirate’s reliance on automobiles by implementing a network of public transit to include high speed rail and rapid transit options such as trams and buses. In addition, a new system of streets and redesigned streets will emphasize high quality urban design and cater to all modes of transportation, making Abu Dhabi a better and safer place to walk, cycle, and take public transit. xxxvii

The Urban Street Design Manual emphasizes streetscapes, giving designers the tools to ensure that all elements that sidewalks, from the curb to the buildings, are designed, placed and sized appropriately for their surroundings. For example, retail corridors will include wider sidewalks with more shade, buffers from traffic lanes, and sidewalk cafes and tree linings. Similarly, low density residential streets will be designed for low traffic speeds, and incorporate safe pedestrian connections to encourage walkability. xxxviii

Results:

The manual will serve as a guide for Abu Dhabi urban street designers to create street designs that embody the principles of Vision 2030, Abu Dhabi’s 25-year urban development plan. The manual applies to all streets in the emirate, including those parts scheduled for urbanization by 2030.

The manual pays particular attention to streetscapes and gives designers the tools to ensure that all of the elements that make up the area between the curb and building fronts are in the right place and are the right size for the context.

Unobstructed pedestrian walkways are required and the proper placement of street lights, traffic sign poles, utility boxes, benches and plantings are now mandatory for designers of new or redesigned streets. xxxix
The first application of the manual is underway with a redesign of Khalifa Street in the Abu Dhabi City Centre set for commencement of construction this year.

**Expected Benefits:**

<table>
<thead>
<tr>
<th>Type of Benefit</th>
<th>Result</th>
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| **Environmental** | • The manual will help to create new streets and retrofit existing streets which will promote walkability and reduce the dependence on automobiles.  
• This will also help to reduce carbon emissions, contributing to overall public health.  
• The manual also includes the addition of significant landscaping, which will contribute to the overall environmental quality of the Emirate. |
| **Social** | • Creating safer streets which more adequately accommodate pedestrians will profoundly benefit the communities in which these strategies are implemented.  
• Not only will quality of life be improved through safer streets, but increasing walkability and creating more gathering places such as outdoor cafes and plazas will help to promote community within the Emirate. |
| **Economic** | • Getting people out of their vehicles and onto the streets will help to generate additional business for retail establishments located along the streetscapes. Rather than driving by these destinations at high rates of speed, people will be walking by them and more likely to patronize these businesses.  
• Implementation of the manual’s policies will also enhance the value of the properties located along them, contributing to quality economic development. |

**Financing:**

The Abu Dhabi Urban Street Design Manual has been developed, implemented and funded by the Abu Dhabi Urban Planning Council, with assistance from the Department of Transport, the Department of Municipal Affairs, the Traffic Police and other relevant government agencies.

**Barriers:**

The most significant problem faced in the attempt to implement the Urban Street Design Manual is the issue of retrofitting already existing streets that create unsafe environments for pedestrians through unaccommodating sidewalk networks and high-speed, auto-focused roadways.

**How Barrier Was Overcome:**

The Urban Street Design Manual is a complement to the existing Vision 2030 plan. The emirate is already planning to update roadways to be in accordance with the requirements of the 2030 plan, and therefore these redesigned roadways will incorporate the strategies and requirements outlined in the manual.
4.3 Urban Redevelopment of Curitiba, Brazil

Problem:

From the 1950s to the 1980s, cities across Brazil experienced rapid growth with the migration of people from rural to urban areas as a result of agricultural mechanization. Curitiba, the capital of the State of Paraná, experienced some of the highest growth, with its population increasing at an estimated 5.7% per year.

This uncontrolled population growth resulted in the need for more effective city planning. As a result, the city constructed a consolidated public transportation system to move people easily throughout the metropolitan area and its surrounding municipalities. xli

Solution:

In 1966, the City of Curitiba developed a city-wide Master Plan which established guidelines to restructure the city’s development to accommodate urban expansion. In the 1970s, the City implemented zoning laws to direct linear growth by attracting residential and commercial density along a mass transit system.

Results:

Today, Curitiba is considered one of the best examples of urban planning worldwide. The city’s urban planners recognized that while population growth cannot be controlled, the effective development of infrastructure can guide the city’s expansion.

The Curitiba Master Plan adopted in 1968, focused on strict controls on urban sprawl, a reduction of downtown traffic, preservation of the city’s historic district, and a convenient and affordable public transit system. The plan included new road design to minimize traffic, as well as a series of landscaped parks.

The City’s planners also recognized that a transportation system can serve as the foundation for development and growth of the city. The city planned the transit system with the intent of dictating growth in the city, rather than allowing the rapidly growing population to creating inefficient growth.

Today, 85% of Curitiba’s population utilizes the bus rapid transit system. Curitiba’s transportation system is made up of three complementary levels of service that includes feeder lines, express lines and inter-district routes. The feeder lines pass through outlying neighborhoods, making the system easily accessible to lower density areas. These feeder lines connect with the express system along the structural corridors. The express system operates like a surface subway system, transporting large numbers of passengers to locations along the structural corridors. Finally, the inter-district routes allow passengers to connect to the axis of the express lines without going into the city.

Benefits:

<table>
<thead>
<tr>
<th>Type of Benefit</th>
<th>Result</th>
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<tbody>
<tr>
<td>Environmental</td>
<td>• An effective and well-planned bus transit system has helped to significantly decrease the dependence of residents on driving, resulting in lower carbon emissions.</td>
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<td></td>
<td>• Sparked by the focus on sustainability through the bus transit system, the city has also focused on preserving and caring for its green areas, boasting 52 square meters of green space per resident.</td>
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</table>
| Social          | • The Integrated Transport Network allows transit between any point in the City by paying just one fare.  
|                | • The City also started a project known as the Lighthouses of Knowledge, which are free educational centers that include libraries, internet access and other cultural resources.  
|                | • The City also coordinates job training, social welfare and educational programs, which often supplies labor to improve the city’s amenities, as well as education and income.  
|                | • The City also developed a “green exchange” program, which focuses on social inclusion benefiting those in need, as well as the environment. Through this program, low-income families living in unreachable shantytowns bring their trash to neighborhood centers where they can exchange them for bus tickets and food. This results in less litter, pollution and disease, while providing a better life for the poor.  
| Economic       | • The City provides tax breaks for builders whose projects include green space.  
|                | • The city developed the “capacity building job line” which is an economic development initiative that provides transit links to the southern and eastern regions of town, Entrepreneurial Sheds, business incubators designed to help small companies, and a program that trains people for marketing and finance professions. The goal is to provide jobs and income for the 400,000 unemployed residents living in the towns surrounding Curitiba. To date, the program has created about 15,000 new jobs, with an additional 15,000 expected. |

**Financing:**

The City of Curitiba has been a leader in the successful implementation of sustainable planning strategies. As a result, the majority of the City’s projects are led, implemented and funded by the city government.

**Barriers:**

1. Prior to development, Curitiba had major problems with flooding. Further, waterways had been canalized, which made the flooding worse.

2. The City also faced issues with figuring out what to do with the buses that could no longer run on the transit system. Since the system utilizes buses so much, their average life is only about 3.5 years.

3. Finally, as is true in many cities, Curitiba also faced major problems with waste disposal.

**How Barrier Was Overcome:**

1. The City transformed the waterways and low-lying land prone to flooding into parks. It also encouraged residents to plant trees, and required that residential developments have gardens and permeable open space.

2. Today, “retired” buses are used as mobile job training centers, schools, clinics soup kitchens and food markets.
3. In 1989, the City implemented an initiative known as “Garbage That Isn’t Garbage,” a program which has resulted in recycling 70% of the city’s trash. Once a week, a truck collects paper, cardboard, metal, plastic and glass from residents who have sorted the materials in their homes. The money raised from selling these materials goes toward social programs. \(^{xlv}\)

4. **Masdar City, United Arab Emirates**

**Problem:**

The UAE and Abu Dhabi realized that economic growth based on the region’s oil production is unsustainable in the long term, due to limited reserves and growing international concern about climate change. Should countries around the world shift away from fossil fuels to more renewable sources, the Abu Dhabi economy as it currently exists will suffer dramatically.

**Solution:**

Masdar is intended to be the world’s first zero carbon, zero waste, zero car city. The project has four goals:

1. To diversify the economy of Abu Dhabi.
2. To expand Abu Dhabi’s position in global energy markets.
3. To position the UAE as a developer of sustainable technologies.
4. To make a meaningful contribution toward solving the world’s most pressing problems.

Masdar will use the most advanced renewable energy technologies and will establish the Masdar Institute of Technology to foster local innovation and expertise.

**Results:**

The Masdar Initiative is the first of Abu Dhabi’s efforts to diversify its economy and take advantage in the global shift from a dependence on fossil fuels, to a focus on more sustainable and renewable energy sources. \(^{xlv}\)

**Benefit:**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Environmental</td>
<td>• Masdar employs cutting edge renewable technologies and sustainable design elements which have significantly reduced its ecological footprint.&lt;br&gt;• Compared to the average urban city, Masdar’s net energy demand is reduced by 70%, net water by 300%, and net waste production by 400%.&lt;br&gt;• Masdar relies solely on renewable energy to support 100% of its electricity, with solar providing over half of the city’s total.&lt;br&gt;• In addition to several photovoltaic power plants, solar panels will be integrated into the majority of buildings and outdoor spaces.&lt;br&gt;• Additional alternative energy sources include solar thermal power, wind turbines, geothermal ground-source heat pumps and waste-to-energy technologies.&lt;br&gt;• Planners oriented the city north-east to south-west to provide an optimum balance of sun and shade.</td>
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</table>
Financing:

The Abu Dhabi Future Energy Company is funding the $22 billion project through oil revenues.

Barriers:

Critics of Masdar question how useful it will be as a model for other cities. Critical analysis also suggests that building a brand new city in a desert may not be the most effective way to promote sustainable city planning strategies.
How Barrier Was Overcome:

To verify the environmental accomplishments of the city, developers are partnering with the World Wildlife Fund and BioRegional to make Masdar an official One Planet Living Community, based on ten unique principles of sustainability. This will help to ensure and confirm the sustainable achievements of the City, while identifying a few, if not many specific traits which can be replicated for future city development.

Issues:

Critics have questioned Masdar City’s commitment to sustainability, as it involves constructing a brand new city in a resource intensive area such as the desert. The project, although carbon neutral, will require significant levels of energy, land and water and develop and maintain. Its location in the desert will have a negative impact on its ability to maintain building temperatures, and the limited supply of water is a concern as well.

Another issue is that of funding. While the $22 billion from the Abu Dhabi Future Energy Company is a good investment, it is funded entirely through oil and gas exports. Critics have concerns that this diminishes the sustainable contribution of the city. xvi

4.5 Annapolis Towne Centre, Parole, MD, USA

Problem:

The Annapolis Towne Centre in Parole, MD is a mixed-use development serving residents and visitors between the major cities of Washington, DC and Baltimore, MD. The project site, a former strip mall and expansive surface parking lot, languished vacant for over a decade prior, creating an unsafe and unattractive appearance in the area.

Solution:

Developers sought to create a more vibrant and attractive destination for nearby residents and visitors, including retail, residential units, restaurants and entertainment destinations.

The Annapolis Towne Centre at Parole, a signature example of this type of development, is located on 34 acres near the Chesapeake Bay town of Annapolis, Maryland. The large, mixed-use development incorporates over 350 luxury apartments and condominiums, numerous restaurants, a high end grocery store, and retail shops.

The Towne Centre also includes two new parking structures which provide parking for the large number of visitors from surrounding areas, as well as for the residents who call the development home. The garages integrate mixed-use spaces, and create convenient pedestrian connections to many exciting destinations.

Results:

The Annapolis Towne Centre serves as a model for town center developments, providing those who live and work there with an inviting sense of community, and the convenience of a walkable mixed-use neighborhood, complete with ample parking. The two mixed-use parking structures are vital to the success of the development, and will continue to be a valuable and important asset throughout future growth and expansion.
Benefits:

<table>
<thead>
<tr>
<th>Type of Benefit</th>
<th>Result</th>
</tr>
</thead>
</table>
| **Environmental** | • The Annapolis Towne Centre features a number of destinations and an efficient street and sidewalk layout, promoting walkability and reducing the need for driving.  
• During construction, the project team discovered that a dry cleaning store once stood on the site and had leaked chemicals down into an underground stream bed. To guarantee the cleanliness and safety of this site, the team installed monitoring wells in the building, coordinated with the drive lanes, to monitor the existence of any sub-grade pollutants over time. |
| **Social** | • The Towne Centre serves as an attractive and vibrant community for residents and visitors, creating an enjoyable social experience for all.  
• The Towne Centre includes a number of active public areas which create an exciting and unique community for visitors and residents. Plazas, courtyards and outdoor cafes present a charming “downtown” atmosphere for the Towne Centre. |
| **Economic** | • The Towne Centre has helped to transform what was once an abandoned parking lot into a vibrant and economically thriving asset. |

Financing:

The Annapolis Towne Centre project was funded primarily through developer investment.

Barriers:

1. During construction, the project team discovered that a dry cleaning store once stood on the site and had leaked chemicals down into an underground stream bed.
2. Locating so many uses in one place posed a number of challenges, especially with regard to essential infrastructure, namely parking.
3. The site did not have transit running to it, which required all visitors and residents to use automobiles to get to and from the development.

How Barrier Was Overcome:

1. To guarantee the cleanliness and safety of this site, the team installed monitoring wells in the building, coordinated with the drive lanes, to monitor the existence of any sub-grade pollutants over time.
2. The developer worked with residential and retail to integrate a mixed-use destination including retail, restaurant and entertainment destinations, supported by office and residential users.
3. While transit is still minimal to the site, there is now bus service running to the site from various locations throughout the area.
5. References


xiv Figure produced with permission from Timothy Haahs & Associates, Inc., 2010.


