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## Introduction and Overview

# Integration of Land Use and Transport Planning



The World Bank



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ESMAP  
Energy Sector Management Assistance Program



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PUBLIC-PRIVATE INFRASTRUCTURE ADVISORY FACILITY

### Cluster 1/Module 4 (C1/M4): Integration of Land Use and Transport Planning

This presentation is one of the support materials prepared for the capacity building program ***Building Leaders in Urban Transport Planning (LUTP)***.

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- The World Bank,
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## Objective

The presentation objectives are to discuss:

- How land use and transport decisions affect each other
- How land use considerations can be considered in transport planning




A good understanding of land use is essential in understanding: 1) the likely demands on the transport system, and 2) planning cost-effective public transport investments. Land use and transport are closely interrelated in urban areas. Any changes in land use affect the demands on the transport system. Conversely, any changes in the transport services offered affect land values and its use.

First, we will look at how land use and transport decisions affect each other. We will use an accessibility model to help us think about these decisions.


Second, we will examine the ways in which land use can be considered in transport planning.

## Opening Exercise

### Urban Transport Affects on Land Use



- **A city (population 2.1 million) has bad congestion**
  - Limited arterial street system, with no expressways
  - Informal transport system of small vans, no metros
  - Travel times to center city range from 45-90 minutes for low-income people living in outer parts of city
- **New mayor decides to build 3 metro lines**
  - Lines go from center city to outer parts of city
  - New travel times will be consistently 35 minutes
- **What will be affects on land use after the metro lines are built?**
  - Center city? Outer city? Area beyond city boundaries?



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This module is about the two-way interaction between urban transport and land use. This exercise is designed to get you to start thinking about how transport investments impact long-term land use patterns.

A city with a population bad congestions. It is getting worse as more people migrate from the rural areas to city in search of jobs.

The city has a limited arterial street system, with no expressways. The public transport system is an informal network of private operators who use small vans. There is no public bus or metro system.

Most of the low-income population live in the outer parts of the city. Travel times to the center city for these people range from 45-90 minutes.

A new mayor has been elected based on promises to fix the congestion problem and to help the low-income population. He decides to build 3 metro lines. They will go from the center city to key outer population centers. It is projected that the travel times on the metros will be consistently 35 minutes for low-income commuters to the center city.

What do you think will be the affect on land use after the metro lines are built on:

- Center city?
- Outer city?
- Area beyond city boundaries?

Take about 5 minutes to do this exercise.

## What Do We Mean by “Land Use?”

- **Human development, land management**
- **Characteristics**
  - **Macro-level**
    - **Size, shape, location, pattern of land uses across city and metropolitan area**
  - **Micro-level**
    - **Type of uses**
      - e.g., **residential, commercial, industrial, agricultural, parkland,**
    - **Diversity**
      - **Mix of uses in an area**
    - **Density**
      - **Activity per unit of land area (e.g., residents/square KM)**
    - **Design characteristics**
      - **Buildings (e.g., heights, setbacks)**
      - **Sites (e.g., percent impervious surface area)**

First, let us define “*land use*”. *Land use* refers to any human development activity that changes the land and vegetation cover from its natural state. This includes changes in use such as the change from agriculture to residential, as well as the related construction of buildings and facilities.

Land use patterns can be described at both *Macro* and *Micro* levels.

1. *Macro* Level characteristics include:
  - The size, shape, location, and other form characteristics of a particular area
  - The pattern of land uses across a city
2. *Micro* Level characteristics
  - Many different *types of land uses*, including residential, commercial, and industrial
  - *Diversity* or mixture of land uses in an area
  - *Density* or intensity of use (e.g., residents, jobs) per unit of land area
  - *Design Characteristics* refer to buildings (e.g., heights, setbacks), the sites on which they are built (e.g., percent impervious surface area), and their relationships with surrounding sites

## What is the Fundamental Transport Problem in Many Cities?

- **Rapid growth in many cities**
  - Produced massive land consumption
  - Built extensive transport network to meet demands
- **Sustainability problem**
  - Insufficient public resources to expand/maintain the network to meet increasing transport demands



Rapid population growth has encouraged and continues to drive massive land consumption and often sprawl (expansion into suburban/rural areas). In response to this growth, cities have often expanded their road and public transport networks. However, the population growth and resulting travel demands are too great. These cities often do not have the financial ability to meet the demands.

The fundamental problem in these cities is that current approaches for addressing congestion problems is that they are not sustainable. There are Insufficient public resources to expand and maintain the transport network to meet increasing transport demands. These cities need approaches that are affordable and address the travel needs of their residents.

## Integrated Land Use and Transport Planning May Be a Better Approach

- Land use patterns affect travel demand
  - Number of trips made
  - Travel distance
- Addressing land use patterns can reduce demands on road and public transport systems
  - Smaller number of trips, shorter distances
  - In effect, reverse current transportation trends
- Need understanding of land use/transport relationship



**“Trend is Not Destiny”**  
~ Lewis Mumford

Integrated land use and transport planning may be a better approach. Land use patterns affect travel demand in two ways: 1) the number of trips made between areas and 2) the distances of these trips.

If these land use patterns can be changed, then it is possible to reduce the number of trips made and distances traveled. In effect, addressing land use patterns could reverse current transportation trends of longer and more frequent trips

Some people may argue that trends cannot be changed. However, many believe in the wise words of famed city planner Lewis Mumford: “trend is not destiny.” Making good land use choices can affect our destiny.

This presentation will provide you with a basic understanding of the land use and transport relationship. It will review issues that must be addressed to integrate land use and transport planning.

Let us now look at mobility and accessibility and how accessibility is the link between transportation and land use.

## Mobility versus Accessibility



- **Mobility**
  - Ability to travel



- **Accessibility**
  - Ability to reach desired destinations or activities



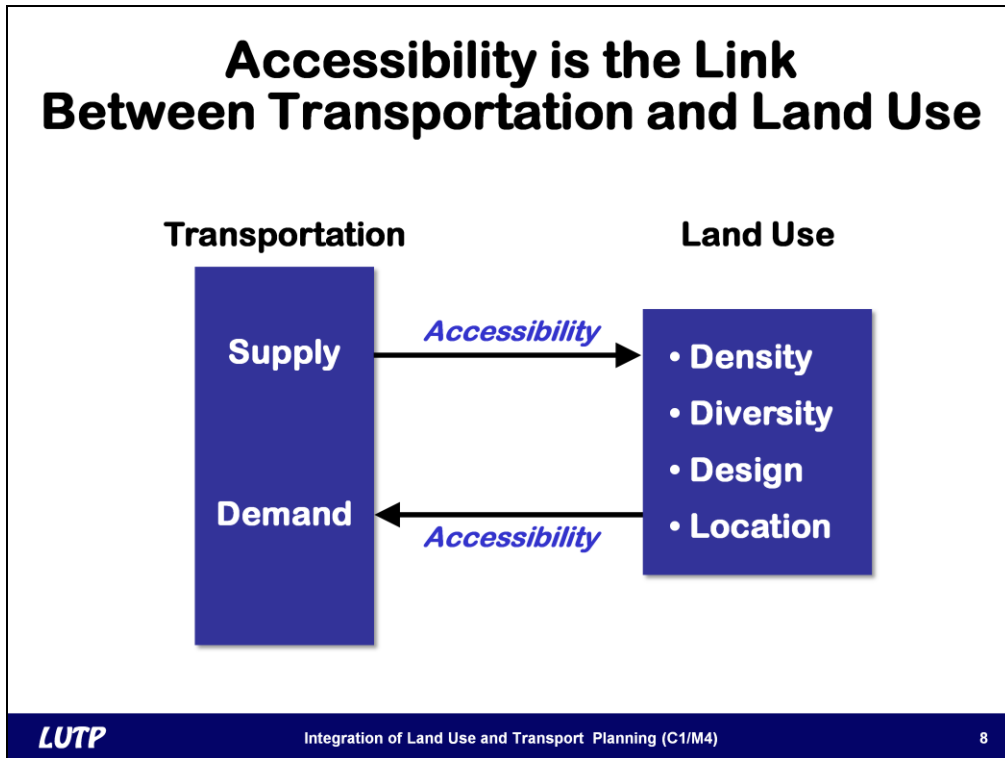
$$\text{Accessibility} = \text{Mobility} \times \text{Land Use}$$



Mobility and accessibility are the two fundamental benefits transportation is meant to achieve. Let us look at these related, but slightly different benefits.

- Mobility is defined as the *ability to travel*.
- Accessibility is defined as the *ability to reach desired destinations or activities*.
- Accessibility can be considered to be a combination of mobility and land use patterns.
- Mobility is improved by making travel faster, cheaper, and more convenient.
- Accessibility can be improved in two ways:
  1. Transportation investments that improve mobility, and/or
  2. More compact land use patterns that locate origins and destinations closer together

Accessibility is the more important benefit. We travel not for its own sake, but to engage in activities, such as employment and education. This is the reason that accessibility is more important than mobility.

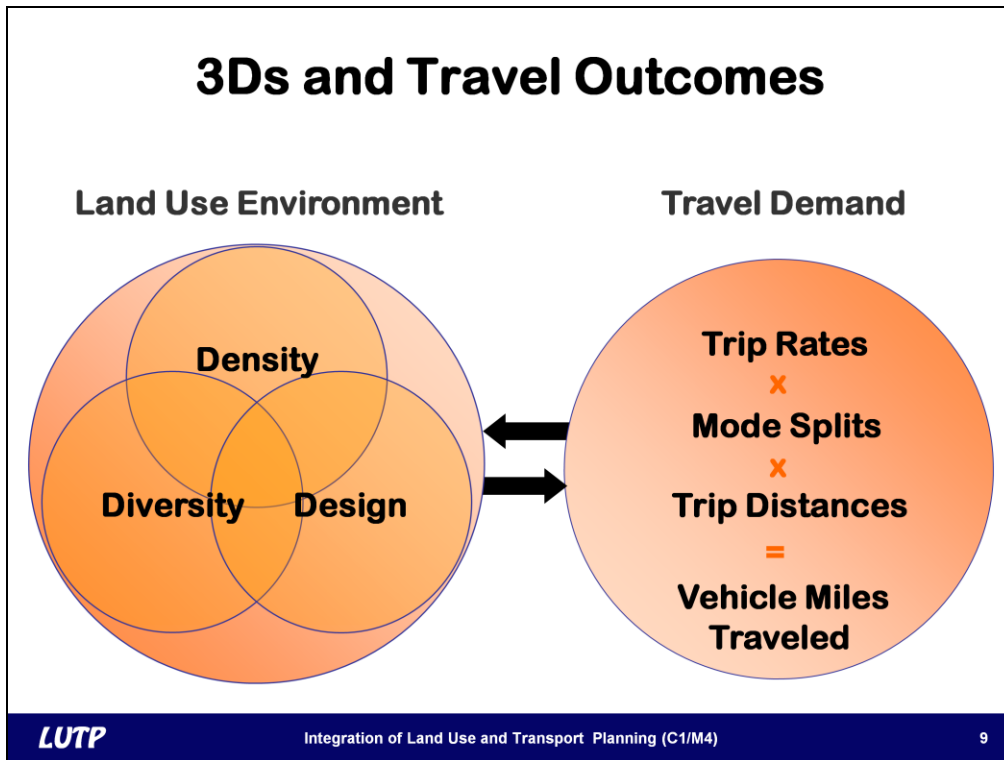


Accessibility is the two-way link between transportation and land use. The transportation system, or *supply*, makes some areas more accessible than others which affects how people choose to locate their homes and businesses. This is referred to as *land use patterns*. There is an old saying: “there are three things that matter in property: location, location, location.”

Land use patterns make some areas more attractive as activity centers than others. This affects transportation demand in terms of how many people want to travel to specific locations and which travel modes (e.g., bus, two-wheeler, auto, walking) they choose.

Some people like to think about land use’s impact on transportation using a “3D” approach. Let us look at this approach next.





The 3 Ds are:

- Density
- Diversity
- Design

These collectively affect travel demand and its related factors:

- Trip generation rates
- Mode splits
- Trip distances

Multiplied together, these factors produce vehicle miles traveled (VMT) by motorized vehicles.

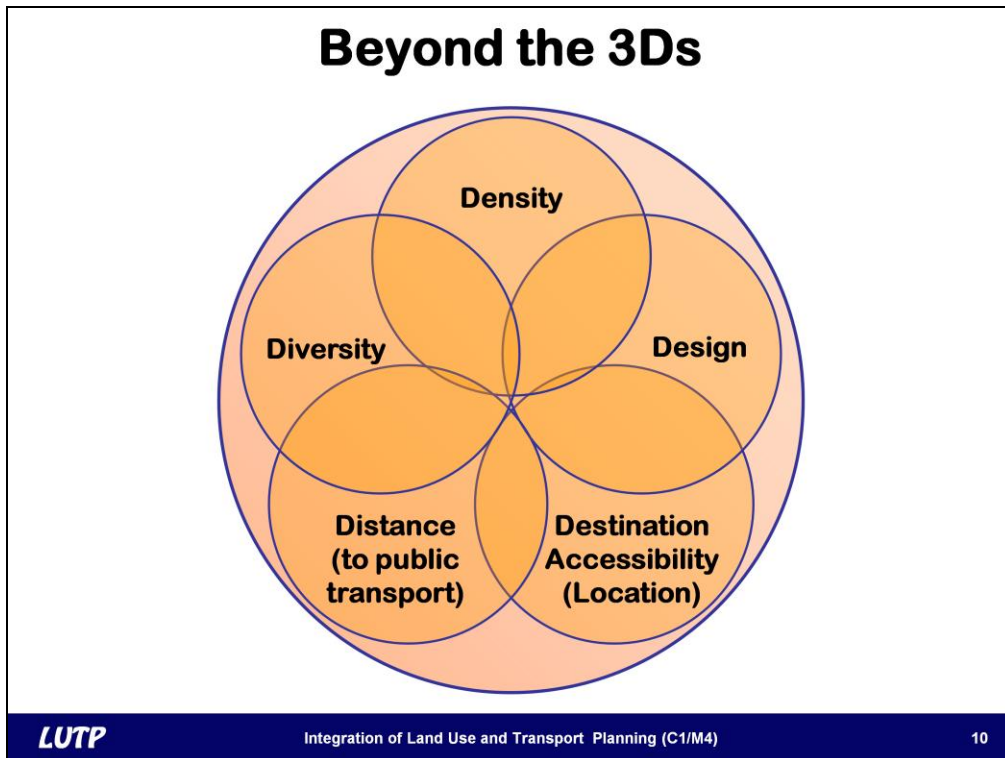
VMT is a widely- used single index of sustainability. The factor definitions are:

- Trip rates = Number of trips taken by a person in a given unit of time (e.g., trips per day)
- Mode split = Percentage of people traveling by any given mode (e.g., car vs. public transport vs. walk)

How do each of the 3 Ds affect the travel demand factors?

- **Greater densities** may reduce trip distances because destinations are closer together. Greater densities also make alternative modes such as walking, bicycling, or public transport more viable because trips are shorter.
- **Greater diversity of land uses** may lead to shorter trip distances and higher use of alternative modes because different destinations are closer together.
- **Land use design** can also encourage alternative mode use (mode splits) by creating a more pedestrian-friendly environment.

These land use policies are alternative ways of addressing congestion and increasing travel demands.

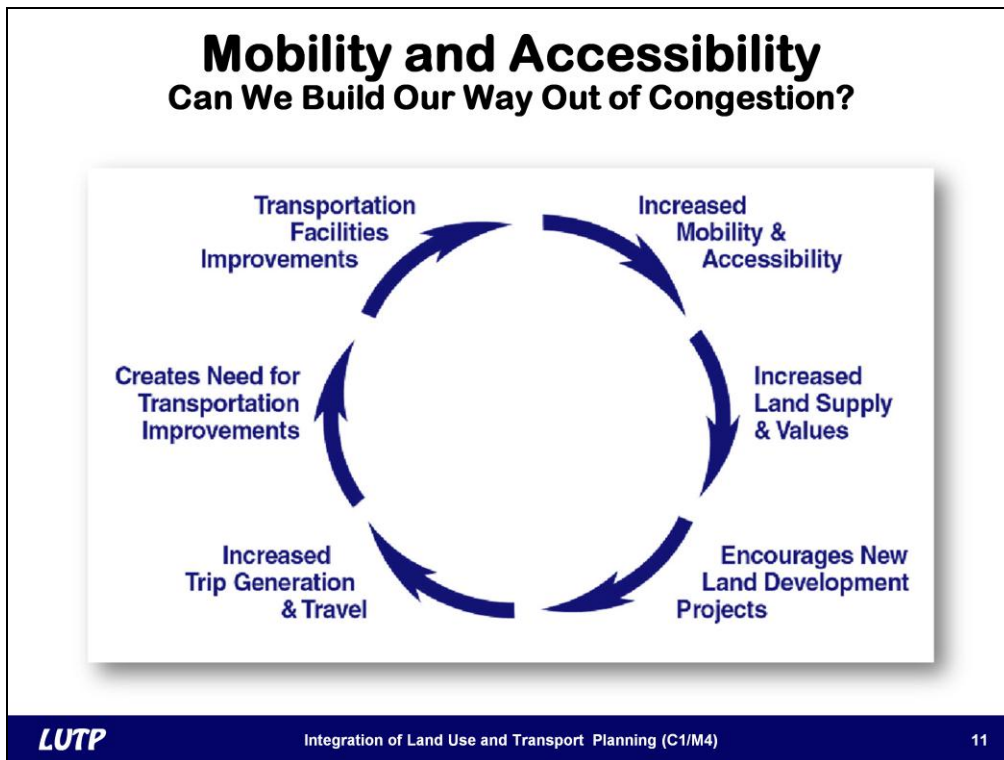


Some people think we should add two more Ds to our thinking —*Destination Accessibility* and *Distance to Public Transport*.

*Destination Accessibility* (4<sup>th</sup> D) is related to location and is important at a regional scale. If destinations are closer together, trip distances will be shorter. Destination accessibility is related to density at a neighborhood scale, since a more densely developed *region* will tend to have higher-density *neighborhoods*.

The actual *presence* of public transport is also important (5<sup>th</sup> D). It should be recognized that the other Ds affect the *viability* of public transport.

The 5 D model is a way of looking at how land use affects transportation use. It may seem theoretical, but it is a good way to organize your thinking and experiences.



Now let us look at mobility and how it affects accessibility. Does improving mobility **always** improve accessibility? Or, said another way, can we build our way out of congestion?

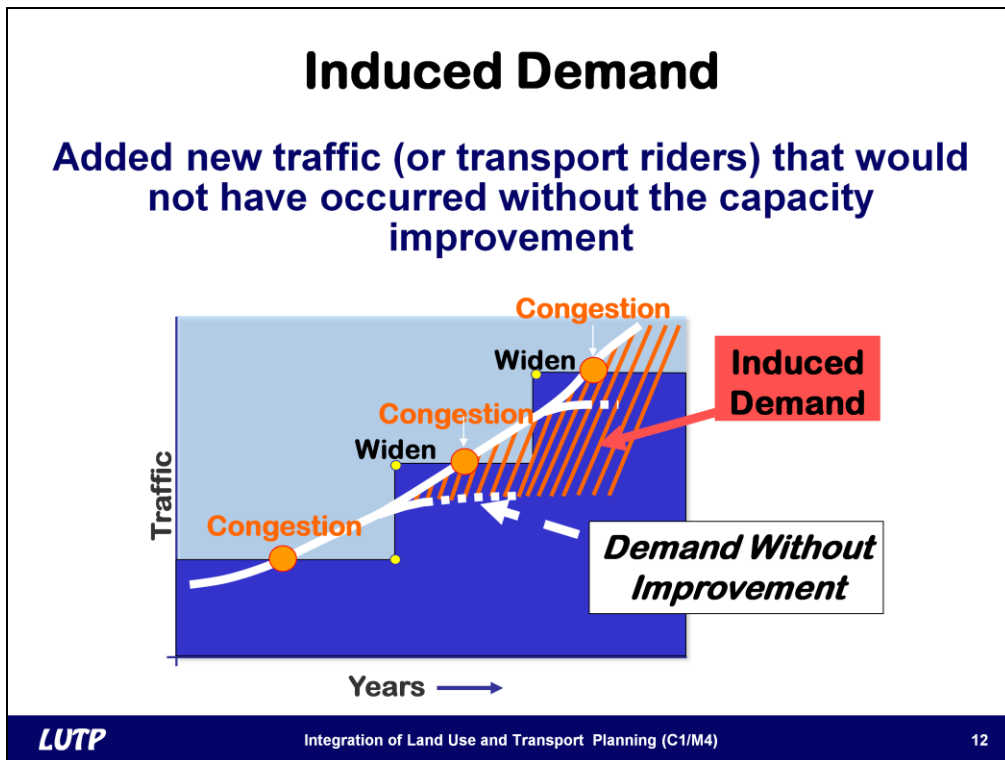
Over time this is not usually true. Instead, it often creates a vicious circle of transportation improvements and new land development. Let us look at this circle.

Transportation and highway facility improvements may initially increase mobility and accessibility. However, this makes existing developed land more expensive. This, in turn, encourages new land development projects, often in suburban areas. Urban sprawl occurs into the undeveloped suburban areas.

The new projects increase travel demand and overcrowd the transportation network. This creates a need for more transportation and highway improvements since the public complains about reduced mobility and accessibility.

What happens next? We are back to where started. We must make more transportation and highway improvements.

These improvements also can have unexpected consequences as we will discuss next.



Transportation investments can have unexpected effects on traffic. When cities first started making transportation capacity improvements, they expected to solve congestion problems. Instead, they often found that traffic levels increased to make use of the increased capacity.

This increase in traffic is known as *induced demand*. Induced demand can be defined as “the increment of new traffic (or transport ridership) that would not have occurred at all without the capacity improvement.”

More traffic (e.g., more vehicle miles traveled (VMT)) is not necessarily a bad thing. Like congestion, it can indicate economic success, and that people are taking advantage of travel opportunities.

However, it does come with negative side effects such as air pollution, energy consumption, and noise. It also may lead to land use *patterns* that are different than what a city wants and identifies in its land use *plans*.

## So What? What Does this Mean?

- **Transportation shapes growth**
  - **BUT... it may not shape growth consistent with our desired land use plans**
- **What can we do?**
  - **Integrate the planning of land use and transport facilities and services**
    - Use transportation investments to shape growth in the way we want it to occur
    - Adopt land use policies that are consistent with transportation investments



The key point in our discussion is that transportation *shapes* growth. However, unless we are conscious of the interaction between transportation and land use, we may not shape growth that is consistent with our desired land use plans.

How do we address this problem?

1. We must integrate land use planning with transport facilities and services.
2. We must make transportation investment decisions regarding modes and locations of facilities that will shape growth in the way we *want* it to occur.
3. At the same time, we must implement land use policies that are consistent with transportation investments. For example, allowing higher densities and mixed uses near transit stations will take maximum advantages of these investments.

## Benefits of Integration

- **Reduced demands on transport system**
  - **Serve same level of activity by making trips shorter, converting some to walking**
- **Lower users costs of travel**
  - **Shorter trips mean time and money savings**
- **Less energy consumed**
- **Improved air quality**
- **Expanded accessibility**
  - **Travelers can get to more sites/activities**

Integration has five benefits.

1. Integration reduces the demand on the transport system. The same level of trip making can be served with a smaller transport network. This occurs because many trips are shorter, while others are converted to walking trips, thereby removing them from the highway and public transport networks.
2. The shift toward shorter trips and more walking trips leads to lower costs — shorter trips equal savings in both time and money.
3. Similarly, the shift leads to lower energy consumption. Shorter trips require less energy. Trips shifted to walking require no energy.
4. Air quality improves. Typically, when less energy is consumed there are less emissions.
5. Accessibility is expanded when people are able to travel to more sites and activities within reasonable travel times.

## Common Barriers to Integration

- **Fragmented institutional set up**
  - Different agencies responsible for land use planning and transport planning
  - Agencies often at different levels of government
- **Coordination mechanisms typically weak**
  - Between different levels of government
  - Within on large government organization

While integrated land use provides these more obvious benefits, integrated land use and transportation planning has been difficult to achieve because of two common barriers. The first barrier is caused by a fragmented institutional structure in many countries. Often different agencies are responsible for land use planning and transport planning. These agencies are often housed in different levels of government (i.e., federal, provincial, and municipal). Coordination is needed to integrate the activities of these agencies.

The second barrier is caused by weak coordination mechanisms. Generally, different levels of government are not legally required to coordinate their planning activities. Even when the planning activities are housed in one level of government, coordination is often lacking among different agencies and departments. Sometimes the individual agencies operate almost like independent authorities and do not coordinate their activities with their “sister” agencies or departments.

## How Can We Move Forward?

- **Create institutions that will take a more comprehensive look**
- **Bring all stake holders to a common platform**
- **Use push factors to encourage integrated planning**
- **Offer incentives for integrated planning**



Although these barriers are significant, it is possible to take action to move towards integrated planning. One potential action is to create institutions at the provincial or local levels that take a more comprehensive look at land use and transport. These institutions may be charged with creating a unified transport and land use plan for metropolitan areas.


The institution can be a common platform for bringing all stakeholders together in this planning effort. The institution need not be a new large agency, but could be a small body that serves as a coordinating committee of relevant agencies.

Fortunately, integrated planning is not a daily activity. It usually occurs periodically as part of strategic planning and master planning activities. Therefore, even temporary agencies, set up for developing master plans, can serve as these integrated planning institutions.


Push factors can be used to encourage the conduct of integrated planning. Local governments have constrained budgets and may have difficulty providing new funding for integrated planning. The central government can offer funding that covers all or most of the costs to “push” local governments to perform integrated planning.

Another way to encourage integrated planning is to offer incentives. The central government can provide special funding for new projects generated from an integrated plan.





## Two Countries Making Progress



- **India**
  - Large, but relatively low income country
  - Federal structure
- **Kuwait**
  - Small, but high income country
  - Virtually a city-state
- **Similarities in integration barriers**
  - Institutional fragmentation exists
  - Both recognize problem and have similar plans to move ahead

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India and Kuwait are countries that have taken some of these actions to encourage integrated land use and transport planning. The purpose of presenting these examples is to show real-world examples of efforts made to move towards integrated planning. The examples do not necessarily show exemplary planning practices, but do show commitment by the two countries.

India is a large, but relatively low-income country. It has a federal government structure in which the central government plays a significant role in many government activities.

On the other hand, Kuwait is a small, but relatively high-income country. It has a city-state government structure.

Although these are two very different countries, they have very similar integration barriers. Both countries recognize this problem and have similar plans to move ahead.

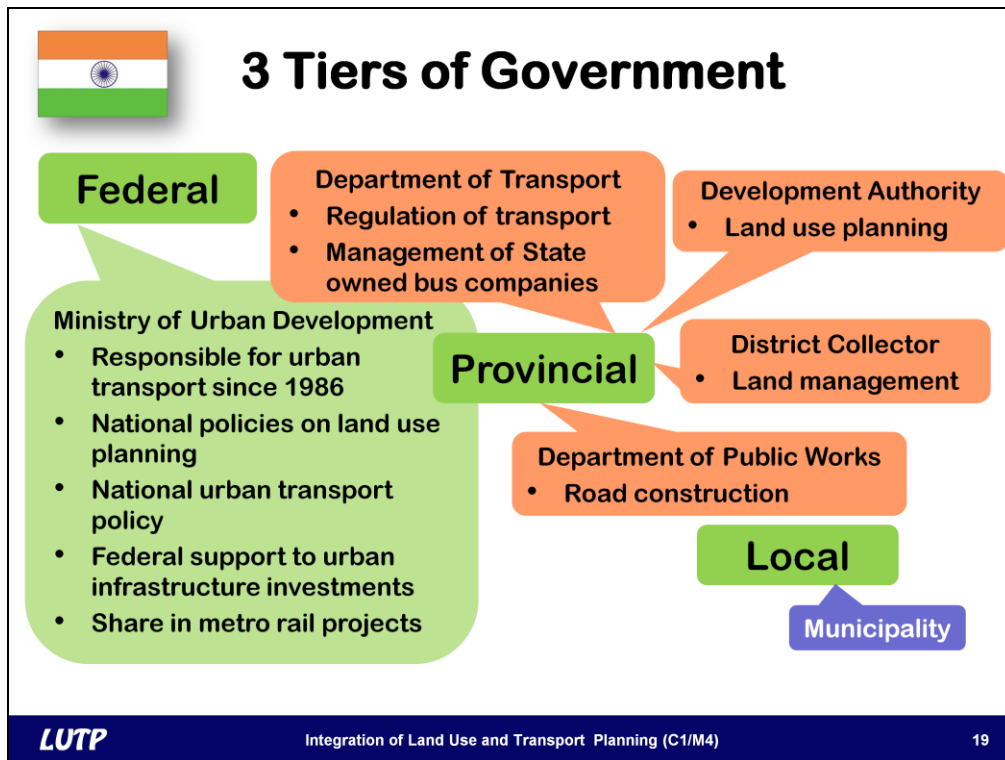
Let us look at these plans.



**India**

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India has a population of more than 1.2 billion people. It is second only to China in terms of population.



India has a federal government structure with three tiers of government — federal (central), provincial, and local.

At the federal level, the Ministry of Urban development is responsible for urban transport. It has set policies on land use and urban transport. It provides financial support for urban infrastructure investments including shares of metro rail projects.

Though prime responsibility rests with the Provincial government, the responsibility is fragmented:

- Land use planning is the responsibility of the Development Authority which is part of the Department of Urban Affairs.
- Land management is overseen by the District Collector, who is under the General Administration Department.
- Regulation and management of the state owned public bus companies is the responsibility of the Department of Transport.
- Road construction is performed by the Department of Public Works.

The quality of the planning is very limited. Land use “master plans” rarely think beyond widening of roads. Coordinated urban transport planning is not required and is seldom conducted.

## Slide 19

Little responsibility resides at the local municipality level besides the maintenance of local roads.



## Ongoing Efforts

- **National Urban Transport Policy in place**
- **Key provisions**
  - **All cities required to set up Unified Metropolitan Transport Authorities (UMTA)**
    - Several studies undertaken on structure and functioning of such Authorities
    - Initial efforts are to set them up as senior level committee of relevant agencies
  - **All cities required to develop integrated land use and transport plans**
  - **Federal government provide incentives**
    - Supports 80% of the cost of developing such plans
    - Provides large pool of funds for city infrastructure projects

India set forth the National Urban Transport Policy to encourage integrated planning. The Policy has several key requirements that are supported by special central government funding.

The policy has two requirements. First, all large cities are required to set up Unified Metropolitan Transport Authorities (UMTA). Second, the cities are required to develop integrated land use and transport plans through the UMTAs.

Since the beginning of the initial effort, progress has been made. Several studies have been undertaken on the structuring and functioning of the UMTAs. The UMTAs were built to be senior committees of relevant agencies. This allows the agencies to retain their responsibilities and authority while coordinating with other agencies in a common setting.

The central government encourages the development of the plans by agreeing to fund 80% of the costs of plan development. The central government provides a large pool of funds to support city infrastructure projects that are recommended in the integrated plans.



## A Start, but a Slow One

- Only 4 cities have set up such UMTAs
- Largely committee of senior officials from concerned departments/agencies
  - No specialized technical agency to support UMTAs (except Bangalore)
- No clear guide on process for and expectation from integrated land use and transport planning
- Tend to take existing land use plans as given and build transport plans around them

Progress has been slow in India in pursuing the goals of the National Policy. Thus far, only four cities have set up UMTAs. These UMTAs are largely committees of senior officials from concerned agencies and departments. Except in Bangalore, technical expertise has not been created in the UMTAs to support the committees.

At the policy level, there is no clear guide on what should be expected from the planning effort. Some people believe that the effort should only be advisory, providing a vision for the city that is based on sound planning and technical analysis. Other people hope that the process will have more control and will outline what projects will be funded and constructed.

At the technical level, initial efforts are very “linear.” A land use plan is accepted as a given and then a transport plan is designed to meet the land use needs. It is not an interactive process in which land use and transport decisions are made jointly in order to pursue the future vision for the city.



## Yet , Progress...

- **Concerned departments now meet regularly**
  - They talk to and understand each other better
  - Forum to discuss and initiate action that no single agency or department could take up
- **Need for integrated plans has been recognized**
- **Governments supportive of new process**
  - **Direction is right – will mature with time**

Although the start has been slow, there have been two significant accomplishments. The concerned departments now meet as a committee around a common table. They are communicating regularly and better understand each department's purpose. They have a forum in which they can discuss and take action on issues that no single agency or department could pursue individually.

Another major accomplishment is that the importance of integrated land use and transportation planning has been recognized. The cities are now aware of the benefits that we have discussed in this presentation.

India's government is very supportive of the new process. The feeling is that the direction is right and that the process will mature over time.

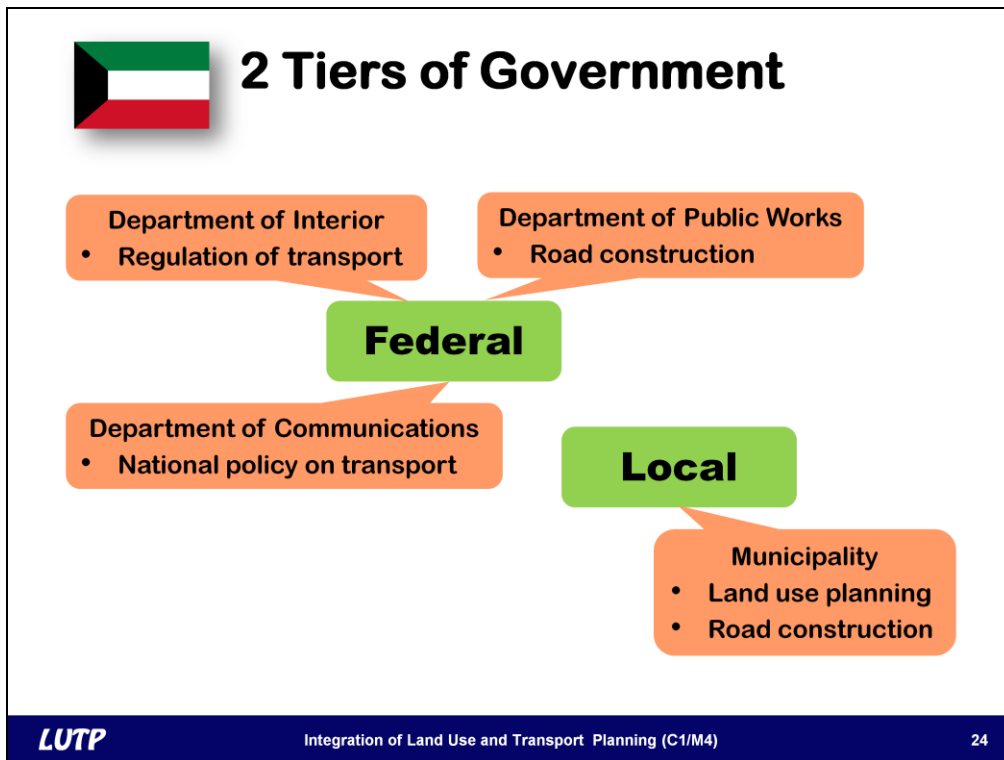


**Kuwait**

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Now let us examine Kuwait, a small country in the Middle East with a population of about 4 million. The country has the world's fifth largest oil reserves and is a high-income country.





Kuwait is virtually a city-state with two tiers of government — federal (central) and local.

Prime responsibility rests with the federal government. However, the responsibilities are fragmented:

- Regulation of transport is the responsibility of the Department of Interior.
- National transport policies are set by the Department of Communications.
- Road construction is performed by the Department of Public Works.

In addition to this fragmentation, the federal departments do not have a formal means to coordinate each other's activities. At this level, the Ministry of Urban Development is responsible for urban transport. It has set policies on land use and urban transport, and also provides financial support for urban infrastructure investments including shares of metro rail projects.

Land use planning and limited road construction reside at the local municipal level. The quality of the land use planning is very limited. Land use “master plans” rarely think beyond the widening of roads. Coordinated urban transport planning is not required and is seldom conducted.



## Metro Has Been Catalyst for Integrated Planning

- Public transport services are limited to traditional public bus services
- Plans now afoot for a metro rail system
- Metro rail planning has spurred interest in better coordination with land use



Kuwait's interest in integrated planning was spurred by its recent efforts to plan a metro rail system. Currently, public transport services consist of traditional bus services operated by the government, with approximately 550 buses in service.

Planning is now being undertaken for a new metro rail system. The large growth of immigrant workers has created severe traffic congestion problems. The initial planning involves the construction of a planned four lines, which total more than 90 km of service. In the future, this service could be expanded to more than 170 km.

This metro planning has spurred interest in coordinated planning with land use. The government is now taking actions to foster this coordination.



## Government Plans ...

- **Created “Public Authority for Land Transport” (PALT)**
  - **Coordinates all aspects of land transport**
- **Start PALT as a committee**
  - **Senior officials with a technical secretariat**
  - **Municipality is a member**
- **Over time PALT expected to develop integrated plans**
  - **Plans will have a common vision for transport and land use**

The Kuwait government has created the Public Authority for Land Transport (PALT). PALT's mission is to coordinate all aspects of land transport.

Initially, PALT will start as a committee. Members will include senior officials with a technical secretariat. The municipality will be included as a member.

Over time it is expected that PALT will evolve into an agency with a technical staff that can develop integrated land use and transport plans that incorporate a common vision.



## Summary of Two Examples



- **Institutional fragmentation is the biggest barrier to integrated planning**
- **The need for integration has been recognized in India and Kuwait**
- **Initial efforts at removing the barriers have started**
  - **Efforts in India are weak, though direction is right**
  - **Metro spurred interest in Kuwait, but results yet to be seen.**

These two country examples have some key similarities. Institutional fragmentation is the biggest barrier to integrated land use and transport planning. Various planning and regulatory functions are housed in various government agencies and departments.

The need for integration has been recognized in both India and Kuwait, and both are now taking action to achieve integration.

Initial efforts at removing the barriers have started. The efforts in India are still weak, though the direction is right. Metro planning spurred interest in Kuwait and a coordinating agency has been created. However, results are yet to be seen.

## Summary



This presentation covered the following:

- How land use and transport decisions affect each other
- How land use considerations can be integrated into transport planning

*Transportation* ↔ *Land Use*



In this presentation, we examined the interaction of land use and transport. In the first half of the presentation, we examined how land use and transport decisions affect each other. We presented an accessibility model to help us think about these decisions. We also examined how coordinating land use with transport can reduce the demands on the transport system and provide additional benefits such as reduced energy consumption and improved air quality.

We then presented examples of how two countries are addressing integrated land use and transport planning. Although India and Kuwait are two very different countries, they have very similar integration barriers. Both countries recognize this problem and have similar plans to move ahead.