

Traffic Engineering
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Lecture 53
Demand Management

(Refer Slide Time: 00:22)

Recap of Lecture G.2

- Access Management
 - ✓ Principles for effective access management
 - Provide a specialized roadway system
 - Limit direct access to major roadways
 - Promote intersection hierarchy
 - Locate traffic control signals to favor through movements
 - Preserve the functional area of intersections and interchanges
 - Limit the number of conflict points
 - Separate conflict areas
 - Remove turning vehicles from through traffic lanes
 - Use non-traversable medians to manage left-turn movements
 - Provide a supporting street and circulation system
 - Complete streets



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Welcome to Module G, lecture 3. In this lecture, we shall discuss about demand management. In the lecture 2, I mentioned to you about access management, why we need access management, why access management is important and pertinent in the context of traffic management. And then, what are the principles for effective access management. So, all these points we discussed and explained to you how they are relevant and how they can be used effectively for access management and therefore, to do better traffic management.

(Refer Slide Time: 01:00)

Demand Management



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Demand Management

- Transportation Demand Management (TDM) consists of strategies that increase overall system efficiency by encouraging a **shift from single-occupant vehicle (SOV) trips to non-SOV modes**, or shifting auto trips out of peak periods



- TDM seeks to reduce auto trips
 - ✓ by increasing **travel options**
 - ✓ by providing **incentives & information** to encourage individuals modify their travel behavior
 - ✓ by **reducing the physical need to travel** through transportation through efficient land uses



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Today, we focus on demand management. Transport demand management consists of strategies that increase the overall efficiency by encouraging a shift from single-occupancy vehicle to non-SOV mode, non-single occupancy vehicles or shifting auto trips out of peak period. That means, as I said, the basic objective is to ensure how with available infrastructure itself and facilities, how we can produce better efficiencies, that is what is the core objective of traffic management, that using the available resource, how best we can perform. So, one way is to reduce the overall traffic volume and thereby increase the overall efficiency.

As you know, if the volume to capacity ratio in general sense, if it is becoming or if we can bring it down, then there will be overall gain in terms of performance. So, what TDM strategies try to achieve, they try to replace car or single-occupancy vehicles, mostly cars during the peak

hour people go to office, individually people will use own vehicle to travel. So, the occupancy is normally 1 or maybe average slightly higher than 1.

So, can we just shift the single-occupant vehicle trips and convert them to non-SOV trips, that is one way. So, three cars, instead of three cars can we just have only one car or instead of 10 cars can we have one car, one bus something like this. So, single-occupant vehicle trips getting converted into non-single occupant vehicle trips or modes.

Second, altogether eliminate auto trips during the peak periods, that will encourage shift from car to non-vehicular modes. For example, bike or even walking or take some of the strategies to bring down the overall transport demand during the peak hour because peak hour is the problematic hour, all problems will be there due to high imbalance between the demand and supply. So, all such strategies come under demand management.

So, you can see here some of the car trips we are trying to replace by non-SOV mode like transit or ride sharing, carpooling, vanpooling. Some were trying to shift to walk or bike, some shifting from peak hour to some other off peak period using flex-time and of course, only a fraction of the car trip will be shifted.

So, the remaining car trips will be as usual, but a little bit shift and intervention in this way to non-SOV modes, non-motorized mode, shifting the peak hour trip to off-peak hours or outside the peak hour, even to some extent can bring a lot of benefit. So, TDM seeks to reduce auto trips by increasing travel options, we are offering range of options so, that people tend to choose something other than the car, by providing incentives and information to encourage individuals, modify their travel behavior, make the offer of carpool or some other public transport so attractive that people feel encouraged to leave their cars and travel by those options.

Third, by reducing the physical need to travel to transportation, through efficient land use, this is also another possibility. It changes the land use, so that the requirement of travel or need for travel that itself is reduced. So, through all this means, we try to reduce number of vehicles in the peak hour. And therefore, with the same capacity, with the same infrastructure, now, the operations are expected to be much better.

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Demand Management

- TDM programs are usually implemented by public agencies, employers, or via public-private partnerships
- The particular set of strategies applied will depend on overall objective and desired result
- Objectives might include
 - ✓ congestion reduction, roadway and parking cost savings, pollution reduction, increased options for non-drivers, energy conservation, increased livability and accessibility of neighborhoods or improved public health



| Mode | Number of vehicles needed to carry 45 people |
|----------------------------|--|
| Bus | 1 |
| Vanpool | 1 |
| 3-Person Carpool | 15 |
| 2-Person Carpool | 22.5 |
| Single Occupant Automobile | 45 |

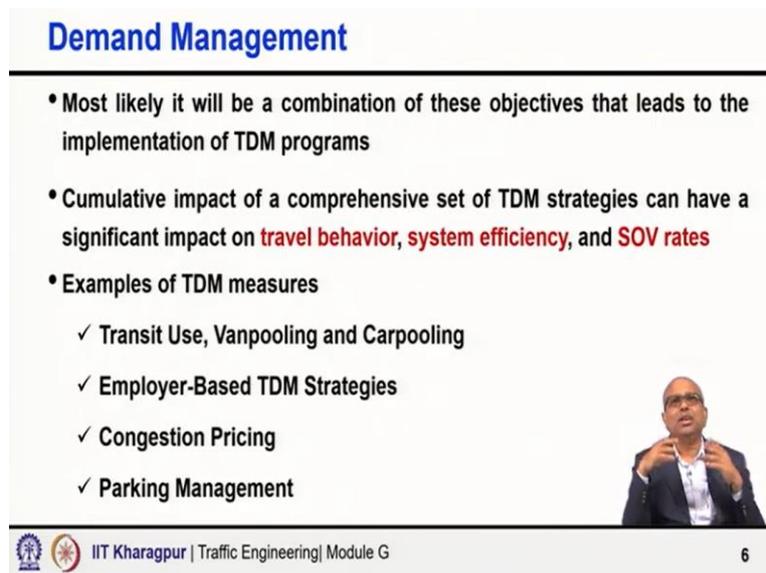


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TDM programs are usually implemented by public agencies or employers or via public-private participation. There are different forms which are available. The particular set of strategies applied will depend on the overall objectives and desired as what why we are applying a TDM strategy in a given context, what I told you is overall what we want to achieve in general.

But in a specific context, the objective may be slightly different or context to context the objectives may be slightly different. And here I have indicated what all objectives one could think say for example, congestion reduction, to pollution reduction, increased option for non-drivers, energy conservation, increase livability and accessibility of neighborhood or improved public health, range of things could be actually our motivation for doing the demand management or reducing the trip, vehicle trips during the peak hour.

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Demand Management

- Most likely it will be a combination of these objectives that leads to the implementation of TDM programs
- Cumulative impact of a comprehensive set of TDM strategies can have a significant impact on **travel behavior, system efficiency, and SOV rates**
- Examples of TDM measures
 - ✓ Transit Use, Vanpooling and Carpooling
 - ✓ Employer-Based TDM Strategies
 - ✓ Congestion Pricing
 - ✓ Parking Management

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Most likely, it will be combination of all these objectives that lead to the implementation of the TDM program and cumulative impact of a comprehensive set of TDM strategies can have a significant impact on travel behavior, system efficiency and SOV rates. Obviously, you influence the behavior of individual, that is why the choice of mode or choice of trip or departure time or location, all this will change.

So, we are influencing the travel behavior and because of that reduced load during the peak hour, particularly the overall system efficiency is increasing and the rate, the way the single-occupant vehicle, single-occupancy vehicles were used, there is going to be change in that. There are several TDM measures or strategies which are possible.

Here I have mentioned four major strategies and I am going to discuss also a little bit more about these strategies namely transit use, vanpooling and carpooling. So, reduce the vehicle volume, overall sense replace single-SOV or single-occupant vehicles and try to attract trips to public transport like transit or in some form like vanpooling or carpooling.

You know the carpooling and vanpooling, carpooling, maybe three of us, we are travelling or four of us we are travelling from the same residential area to the same CBD area every morning because offices are located more or less in the same CBD area. And every time we were travelling using four different vehicles every day, now we decided we will do the carpooling. So, every day one vehicle will go and carry all the 3 or 4 people.

So, if suppose three people are going then we are reducing everybody's individual cost is reduced to one-third as compared to the earlier time, and instead of three vehicles or four

vehicles, you have now only one vehicle. So that way the overall benefit will come. And vanpooling is in a more formal way, carpooling is more of informal. And like the known friends or so.

And the vanpooling is in a larger form of operation, little bit bigger vehicle. Another maybe third party may also operate or may hire a vehicle and then operate it like that with more number of people travelling. So again, basically replacing single-vehicle or SOV single-occupant vehicle and allowing people to, or encouraging people to share either a car or a bigger vehicle in the form of vanpooling. So, either in the form of carpooling or in the form of vanpooling.

The second is employer based TDM strategies, these are primary to encourage again use of shared vehicles like this or change the work hours so, that you go travel other than the peak period adding some flexibility to have benefit to the overall society in terms of reduced congestion, emission etcetera.

Third is the congestion pricing. So, it is the pricing part of it if you need to travel during the congested hour, you have to pay higher simply or travel at other time you can travel cheaper, so, make the travel during the peak hour more attractive, people will get encouraged to travel during the off-peak hour because they can save money.

The last one is the parking management because once you are using your car, you have to finally park at the destination end. So, obviously the parking management also is an important consideration. In fact, we are going to discuss parking management separately, how we may area wide context to the on-site, off-site and all sorts of issues, how the overall parking management can be done.

But parking management is also part of traffic management and can also be linked with the TDM strategies because depending on the how you are doing the parking management, you are actually trying to influence the number of vehicles which are coming to the CBD area. So, that way, you are actually also trying to influence the overall demand and therefore it can be part of demand management.

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Demand Management

Transit Use, Vanpooling and Carpooling

- Proven strategies for increasing the number of people riding buses and carpooling includes
 - ✓ **Put more transit service** in place- buses, trains, vanpooling, etc. - so it is easier for more people to get around without a car
 - ✓ **Build compact communities** with sufficient density to support high frequency transit service
 - ✓ **Encourage employees to carpool** by offering incentives such as dedicated parking spaces for carpoolers and awards for top carpoolers

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First coming to the transit use, van pooling and carpooling, these are the proven strategies for increasing the number of people ride in buses or carpooling or vanpooling and may include or can be implemented in several ways or some of the aspects which are very important may include like things like put more transit service in place, give more supply of buses, trains, LRT more vanpooling options, so, that it is easier for people to get around without a car.

Increase the options, whatever bus services are available, increase the frequency, run more buses, more trains more LRT. Let more vanpooling occurs, services, vanpooling services occur in this area. So, that altogether people have got more options to travel to the CBD area or the city area without a car.

Also, you need to build compact communities with sufficient density to support high frequency transit service. If you want to offer a transit, you will need a certain level of demand. So, if you actually you can operate higher frequency of transit, that is really possible when you build compact communities. So, you have higher concentration of people, higher density of people living in area. So, you run services, there are more tickets for the transit. So, build compact communities with sufficient density to support high frequency transit centers.

Third, encourage employees to carpool by offering incentives such as dedicated parking space for carpoolers or award for top carpoolers or something like that, I mean the companies can also promote. So, they can encourage that okay, if you do carpooling, if then you will be given priority, you will be given a free parking space within the premises or maybe some kind of award or recognition that because ultimately, such individuals are contributing to reduce the

carbon footprint. So, there is a bigger gain, the societal gain is involved. It is not individually saving some money, but they are also contributing in a larger societal context. So, they should be encouraged, they should be, encouraged to do such kind of things more and more.

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Demand Management

- ✓ Get **low cost or free transit passes** into more people's hands. These can be subsidized by employers, developers or public agencies
- ✓ Improve and distribute **transit and vanpool rider information** utilizing the best technologies and promotional tactics
 - Services such as with real time bus and train arrival and departure times, make ridership easier and more customer-friendly

The slide includes three images: a 'TERRACE MUNICIPAL TRANSPORT Employee's Bus Pass' (No. 1208), a blue vanpool with 'VANPOOL' written on the side, and a man in a suit speaking with his hands raised. At the bottom, it says 'IIT Kharagpur | Traffic Engineering | Module G' and the number '8'.

Get low cost or free transit passes into more people's hand, circulate let transit be subsidized, some cases, some countries may not be, may not work in India, may not be possible probably and also may not be possible in many other countries, but there are places where the public transit is made free within the city area, where you do not want people to come by car. So, you make public transport free or highly subsidized.

So, people get attracted, rather than going by car and giving heavy parking fee and so, they prefer okay, let me travel by bus, it is very cheap and highly subsidized, if not free, at least it is highly subsidized. So, this can be subsidized by employer, by developer or even the public agency, anybody can do that.

Improve and distribute transit and vanpool rider information utilizing the best technologies and promotional tactics. So, one very important thing is the information to reach to people, people should know that I mean, they can do carpool, they can carpool of course, in a more closed community that they can join in the vanpool or the transit is also available, you are running point to point, buses maybe to benefit the commuters who are travelling every day from one catchment to the CBD area.

So, such kind of information use available technology maybe in mobile things are available, it will wide publicity you are giving, taking all sorts of promotional tactics to make them such

things popular. Say for example, service such as with real time bus and train arrival and departure time, make ridership easier and most customer friendly. So, they know, you are going by the city now also the bus is also going so, the bus is leaving now.

So, you have a bus and every day that operates and you can get the information. So, you can get the bus very close to your office actually, it is within very reasonable walking distance the bus is available, such kind of give more information, create attraction, or do the promotion of the service. So, all such things can be done.

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Demand Management

- ✓ **Build park-and-rides and HOV lanes** where appropriate
 - They are integral for promoting transit use and ridesharing, alleviating congestion, and reducing overall vehicle miles traveled
- ✓ **Support car-sharing** to help reduce auto ownership and/or usage

The slide includes a 'Park and Ride' sign with a bus icon and an arrow pointing left, and a photograph of a multi-lane highway with HOV lanes. A presenter is visible in the bottom right corner of the slide.

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Then also build park-and-ride and HOV lane where appropriate park-and-ride you know, they can park enough street facility and then use free transit or subsidized transit. So, normally outside the CBD area or outside the city area, particularly not only the CBD, but outside the city area, many times that kind of park-and-ride facilities are developed.

So up to that point because outer part of that, outside of that area, there is not much congestion no issue. So, you do not mind people to travel by car, but then leave the car there park there, that is a parking facility. And then regularly buses are available, either free of cost or at subsidized rate and good quality services are there, attractive enough. So, you encourage people to leave the car there and then travel, are also and or in other context as well.

Try to see if you need some HOV lanes, high occupancy vehicle lanes, you know that certain lanes you can use when you have more than one person, maybe some cases three, some cases even four. So, if more people are using a vehicle, that means you are not using individual vehicles or cars. So, such kind of vehicles can use the shorter route.

So, you encourage people that if you instead of using three cars, if you are doing a carpool and travelling together, then I will allow you to use the shorter route or I will use some specific lane which normally will remain uncongested and you can travel faster. Those lanes are only for this kind of vehicles to give priority. So, this is again encouragement.

So, remember that park-and-ride or HOV lanes, they are integral part of promoting transit use and ride sharing, also for elevating congestion and reducing the overall vehicle miles or vehicle kilometer travel. Then support car sharing to help reduce and auto ownership and or usage, because if you really support car sharing and it becomes popular, then people may not use their own car and they alone with like the single-occupant vehicle.

And overall, the car usage also will come down and ownership also may get affected because some families may not be very appropriate in Indian context, but in some of the developed countries every family member probably everybody has got a car. So, you do not really require that many number of cars if you are doing the car sharing. So, with lesser number of cars you can manage. So, the auto ownership and or usage both may be impacted.

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Demand Management

Employer-Based TDM Strategies

- Reduce vehicle trips by providing employees with **incentives, information,** and additional **transportation options**
 - ✓ to commute via modes other than the single occupant vehicle (SOV)
 - ✓ to commute during off-peak times of day
 - ✓ even to eliminate certain work trips altogether
- Transportation market is largely responsible for peak period congestion conditions twice each weekday

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10

Now, going to the next strategy, all these what we discussed so far, they come under the transit use, van filling and carpooling. So, this is one of the four strategies that we are going to discuss. Next is employer-based TDM strategies. Here, what we are trying to say at employers and what all can be done to do better demand management.

Again, everywhere the key is reducing the number of vehicle or reduce travel or reduce the overall demand for travel during the peak hour and thereby improve it. So, my existing facility

if I can reduce the overall vehicle volume, if I can reduce the overall demand, so, or if I can shift the trip, some of the trips from peak hour to non-peak hour, then my overall system will gain better performance I will get.

So, reduce vehicle trips by providing employees with incentives, information and additional transportation options. For what? To commute via modes other than the single occupant-vehicles, discourage the use of SOV, let them use other vehicles other options. So, for that you provide them incentive, information and additional transportation options, to commute during off-peak times of the day, maybe off-peak, maybe at least non-peak hour travel I would like to say it in that way, even to eliminate certain work trips altogether.

Can you reduce the overall trip itself, one need not travel to office every day, forget about travelling, not travelling in the peak hour and going to non-peak hour, but can we reduce weather all the five days or six days in a week, some cases, whether everyday people need to go to office or can we just reduce the number of days without compromising the overall work hours or can we just allow work from home for 1 day or 2 days in a week.

Transportation market is largely responsible for peak period congestion conditions twice each weekday, you know morning people are going to the office and evening people are returning back and these are the two times when everything is out of control or everything is chaotic.

Because the imbalance will be maximum, demand will be maximum during these two hours or two time maybe more than one hour in the morning, more than one hour in the evening, depending on the context. So, twice each weekday the suffering is primarily due to this work trip. So, if we can do something, particularly employer based TDM strategies that can work like magic, it can help a lot.

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Demand Management

- Modal shifts for these trips can significantly reduce vehicle miles traveled and emissions, alleviate congestion and improve air quality

Financial Incentives

- Either reveal the **true cost of driving** to the workplace, or make **non-SOV** options relatively **cheaper** for the employee to use
- **Overall Incentives to Reduce Parking:** Providing a few free days of parking each month for employees who usually commute using a non-SOV mode; offering lower parking rates to carpools and vanpools, etc.



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Modal shift for these trips can significantly reduce vehicle mile or vehicle kilometer traveled and the emissions, also it can alleviate congestion and therefore, improve the overall air quality because the emission is also reduced, congestion is reduced. So, overall air quality will improve.

Now, what are the different interventions or different ways the such kind of employer-based TDM strategies can work? What are the different ways the employer-based TDM strategies can work? One is obviously the financial incentive, direct financial incentive. So, either reveal the true cost of driving to the workplace or make non-SOV options relatively cheaper for the employee to use.

So, either I make them realize what is the true cost of driving by using single-occupant vehicle during the peak hour, how much they are paying, each employee is paying. And then, show them that if you use actually non-SOV options, then you see how much saving you can do. So, many ways we can do it again, financial incentives also can be given in many ways.

One is overall incentives to reduce parking. That means, providing a few free days of parking each month for employees who usually commute using a non-SOV mode, offering lower parking rates to carpools and vanpools etc., that means, you give incentive in the context of parking, that means, if an employee or employees who are usually commuting use a non-SOV vehicle, in a few days for a few days in a in every month, they will be given free parking.

So, throughout the month, you were using shared modes, non-SOV mode, so, two days or three days in a month, we will give you free parking or if you are doing a carpool or vanpool then

the parking rates will be lower. So, incentive, somewhere other, this is one way of giving financial incentive.

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Demand Management

- **Transit Subsidies:** Provision of free/subsidized transit passes, vanpool vehicles, and/or shuttle services (creating cost-competitive alternatives) such that SOV commutes seem more expensive by comparison

Facilities and Services

- Provide the necessary services or infrastructure to make non-SOV commute options more appealing and viable
- **Bike and Walk Facilities:** Secure workplace parking for bikes, as well as shower and locker facilities that can be made available for those who walk



The slide features a title 'Demand Management' in blue. Below it, there are two main sections. The first is 'Transit Subsidies' with a red bullet point describing free/subsidized transit passes, vanpool vehicles, and shuttle services. The second is 'Facilities and Services' with two red bullet points: one about providing necessary services for non-SOV options, and another about 'Bike and Walk Facilities' including secure parking, showers, and lockers. To the right of the text, there is a photograph of a group of people riding bicycles on a path, and a smaller inset photo of a man in a suit resting his chin on his hand. At the bottom left, there are logos for IIT Kharagpur and the course 'Traffic Engineering | Module G'. At the bottom right, the number '12' is displayed.

Second, transit subsidies, second, transit subsidies maybe provision of free or subsidized transit, buses vanpool vehicles and or shuttle service creating some kind of cost competitive alternatives such that SOV commute seems to be more expensive by comparison. So, give subsidy to non-SOV options to bring down the cost of travel by non-SOV and so, that the SOV commute look even more expensive. So, that is another way.

Then, other than giving financial incentives, there are other ways and means, for example, facilities and services. So, provide the necessary services or infrastructure to make the non-SOV commute options more appealing and viable. There are so many ways we can do it. Say, for example, bike and walk facilities, secure workplace parking for bikes, as well as maybe shower and locker facilities for those who will use walk as a mode, plus mile connectivity for the last mile connectivity.

So, give them such kind of facilities specially in office in some of the countries where such things are possible, this will make the options for using an empty bike or walk more attractive.

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Demand Management

- **Preferred Parking for Carpoolers:** Provision of preferred spaces for carpool and vanpool vehicles
- **Vanpools, Shuttles, and Car-sharing:** Provision of free vanpool vehicles, shuttle services, or car-sharing programs for employees so they do not need to bring a private vehicle to work
- **Guaranteed-Ride-Home:** Allows for a set amount of free taxi rides or use of car-share vehicles for unplanned trips home that cannot be accommodated by the employee's normal commute mode (e.g., working late past last scheduled bus, carpool passenger with sick child at school)



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Preferred parking for carpoolers. So, if you are using carpool or vanpool vehicles then your vehicle will get priority for parking. Vanpool shuttles or car sharing provision of free vanpool vehicles, shuttle service or car sharing program for employees so that they do not need to bring a private vehicle to work.

So, you are offering such kind of free vanpool vehicle, shuttle services or car sharing program for employees. So, they do not need to go and they do not get encouraged to bring their own vehicles. Then guaranteed-ride-home, this is another interesting concept. Allow for a set amount of free taxi rides or use of car share vehicles for unplanned trips home that cannot be accommodated by the employees normal commute mode.

If you are normally commuting using car sharing, carpool, vanpool or using transit, non-SOV vehicles, then certain amount of free taxi rides you will get, you are eligible to get or you can use some car share service for the unplanned trips home or maybe you are working late past the last scheduled bus, you missed the last scheduled bus, but you know that since I use bus, so, even if I am late in the office, I will be provided with transport.

So, either office will arrange for the taxi or arrange for some other carshare to drop us back home. So, carpool passengers with sick child at school, such kind of things. So, you encourage so, they feel yes, I am rewarded, because I am using non-SOV mode.

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Demand Management

Flexible Scheduling

- This strategy allows employees to reduce their number of weekly commute trips and shift work trips to nonpeak hour
- **Telecommuting:** Allowing employees to work from home or a non-office location one or more days a week
- **Compressed Workweek:** Enabling employees to compress regularly scheduled hours into fewer work days per week



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Flexible scheduling, this is another thing which can be done. These strategies allows employees to reduce their number of weekly commute trips, and shift work trips to non-peak hour. There are so many ways you can do it. One, maybe telecommuting, after allowing employees to work from home or a non-office location one or more days a week. They are available, they are available online, they will send you the material what you want, and but they need not be really physically present in the office, they can work from home. So, they are saving the travel cost.

And, as I said every time, do not think that they are only saving, the society is getting benefited that is what is more important. Or maybe compressed workweek, this you allow or enable employers to compress regularly scheduled hours into fewer working days per week. Suppose n number of work hours per week that is fixed. So, instead of doing it in 6 day, you can do it in five day or you can do it in 4 days. So, you are working for the same number of hours, but one more day you are getting as compared to the normal schedule as an off day, that means that day you will not travel.

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Demand Management

- **Flexible Schedule:** Allowing employees to offset work hours from the typical 9-5 standard and shift commute travel to off-peak hours

User Information

- The employer provides information on available alternatives to driving alone, through:
 - ✓ designated employee transportation coordinator;
 - use of print marketing; information kiosks;
 - websites; ride matching services and/or
 - participating in employee oriented informational/educational sessions on available transportation options

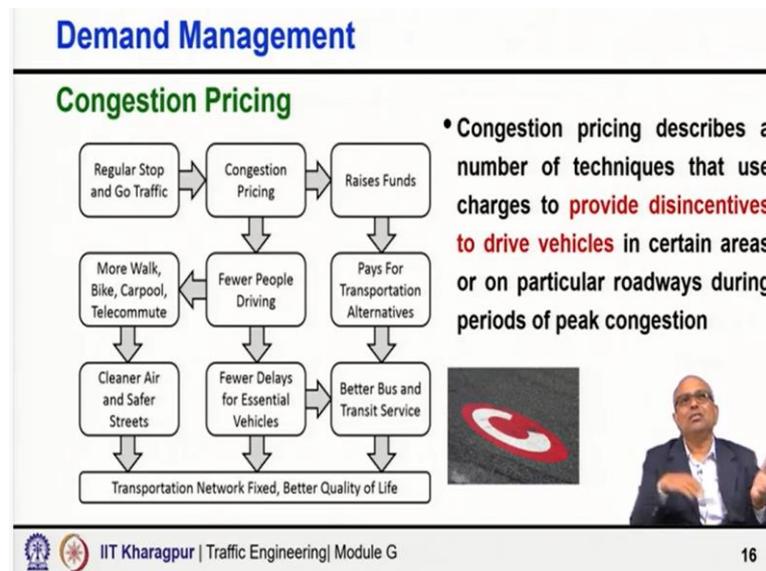


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Flexible schedule, not that everybody has to come following 9 a.m. to 5 p.m. that pattern. So, you allow flexible work hours, flexible schedule. So, they will work in the office with certain restriction, that minimum, everybody there should be four hours in the office where 100% employees are present. So, all meeting, exchange interaction can take place during those four hours, all meetings will be scheduled during those hours.

Other than that, allow such that kind of flexibility. So, people can avoid travel in the peak hour maybe they will travel in the off-peak hour or non-peak hour. Other thing, next maybe user information. Employers provide information on available alternatives to driving alone through designated employee transportation coordinator or use of print marketing, information kiosk, websites, ride matching services and or participating in employee oriented informational or educational sessions on employee-oriented information or educational sessions on available transport options. So that way provide all information which are likely to be attractive, which will encourage them to use non-SOV mode.

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Then, the next third option is congestion pricing. So, what we discussed, we discussed two measure options as I said, one is transit use, van pooling and carpooling, then employer-based TDM strategy. Next is the congestion pricing. So, what we are doing, the congestion pricing actually describes a number of techniques, which use charges to provide disincentives to drive vehicles into certain areas or on particular roadway during periods of peak congestion.

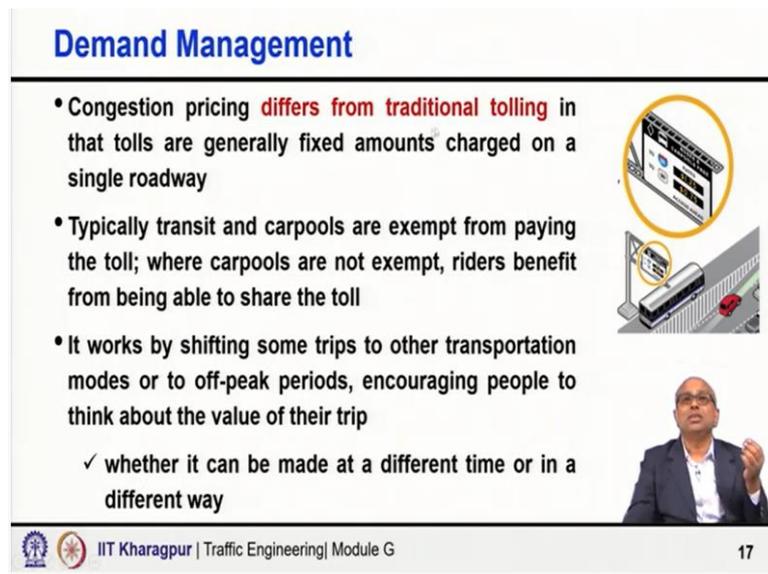
So, basically congestion pricing I want to discourage people to take their vehicle at certain locations or certain geographical area maybe the CBD area or certain particular land use or around that catchment, during a particular time period when actually there is imbalance, high imbalance or high congestion.

So, it is something like this is the regular stop and go traffic. So, if you are doing congestion pricing, then one way you are getting some money which you are raising fund, the other way actually because of that fewer people are travelling. So, once fewer people are travelling more work by carpool, telecommute all these are happening. So, which is actually helping you to get cleaner and safer streets.

And because fewer people are travelling, there will be fewer delay for essential vehicles also, because the road is not so, congested, the incidents are really or the recurring congestion is also not so, not happening the way it used to happen. So, there will be fewer delay for essential services and whatever funds you are getting, you pay that for transportation alternatives, that have made the transportation better.

So better bus and transit services so with fewer delay, and with this your overall transit service may become even better. So altogether, you are helping the transportation network fixed, better quality of life you are able to offer and overall, ambient, in terms of congestion, it is lower, air quality improves and all sorts of benefits. So, different so many techniques are available to do the congestion pricing.

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Demand Management

- Congestion pricing **differs from traditional tolling** in that tolls are generally fixed amounts charged on a single roadway
- Typically transit and carpools are exempt from paying the toll; where carpools are not exempt, riders benefit from being able to share the toll
- It works by shifting some trips to other transportation modes or to off-peak periods, encouraging people to think about the value of their trip
 - ✓ whether it can be made at a different time or in a different way

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17

Congestion pricing differs from traditional tolling because what you do in traditional tolling, you charge a fixed amount on a single roadway, every vehicle, every time going you pay this charge. So, that is typically what you do. So, that is the tolling. But congestion pricing means these will change depending on when you are travelling.

And my objective is basically to reduce the travel during the peak hour, through charging mechanism. So typically transit and car pool are exempted from paying the toll, the additional charge whatever you say congestion charging, because I want people to use those vehicles so I should not charge them.

And wherever carpools are not exempted, even if it is not, exempted, then also the cost is actually getting distributed. So, I was paying every day the toll, now that price is in the whole week, it is shared by three of us or four of us. So actually, I am also saving even if we are paying toll, I am saying.

It works by shifting some trips to other transportation mode because of this pricing or to off-peak period, and therefore encourage people to think about the value of the trip, whether it can be made at a different time or in a different way. So, they may think let me travel in at some

other time, is that possible for me to avoid travel during this hour and go to the next hour, or maybe after some time, when this peak congestion pricing is actually gone, is no more applicable or can I change my travel options where I do not have to pay so much or I do not have to pay, I do not have to pay so much. Both are there, using different options you can exercise those things.

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Demand Management

- Several main types of congestion pricing strategies: variably priced lanes, variable tolls on entire roadways, cordon charges, area-wide charges, variably priced ramps
- Variable tolls on separated lanes within a highway, such as Express Toll Lanes or High-Occupancy Toll lanes (HOV lanes that single-occupant drivers may use if they pay the toll)



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So, several main types of congestion pricing strategies may include variably priced lanes, variable tolls on entire roadway, cordon charges, area wide charges, variably priced ramps, we do the ramp metering there also you do the variable pricing. So variable tolls on separated lanes with the highway such as express toll lanes or high occupancy toll lane that also could be quite useful.

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Demand Management

Variable Tolling

- Variable tolling operates to spread traffic over time in order to **avoid gridlock at times of peak demand** or during heavy seasonal travel
- Alternatively it can be used to generate more traffic by giving a discount on the usual toll when the volume of traffic is low
- Principle of variable tolling is to raise tolls during peak periods (**red periods**) and lower them during periods of lighter traffic (**green periods**)

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So, we are talking about now what are the different ways we can implement this actually congestion pricing, different strategies or different ways. And one very important thing is variable tolling, the whole concept congestion, when congestion is there, you charge, you charge higher, or give some incentives by charging less during the non-peak hour.

So, variable tolling is, variable tolling operates to spread over time in order to avoid gridlock at time of peak demand or during heavy seasonal travel. Alternatively, it can be used to generate more traffic by giving a discount on the usual toll when the volume of traffic is low. So, either you charge extra during the peak hour or whatever you charge normally give some incentive during the off-peak hour. So, both ways you encourage people to go to off peak hour, non-peak hour or off-peak hour.

Principles of variable tolling is to raise tolls during the peak period, you can call it as red period, higher rate we can keep and then get more money. So, get raise the toll during peak period and lower them during periods of lighter traffic, call it green period, charge more during red period, charge less during green period. And thereby try to shift some travel from red period to green period, encourage them through this pricing.

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Demand Management

- Implementation is based on publicity and information dissemination:
 - ✓ **information campaign** prior to launch of operation
 - ✓ **reminders** before each activation
 - ✓ **information signing on the scale of charges and when they apply** along the network
- Some precautions are required to:
 - ✓ **prevent illegal stopping** immediately before the toll booth area by users determined to wait until tolls are lowered (this needs police patrols, and installation of signs)

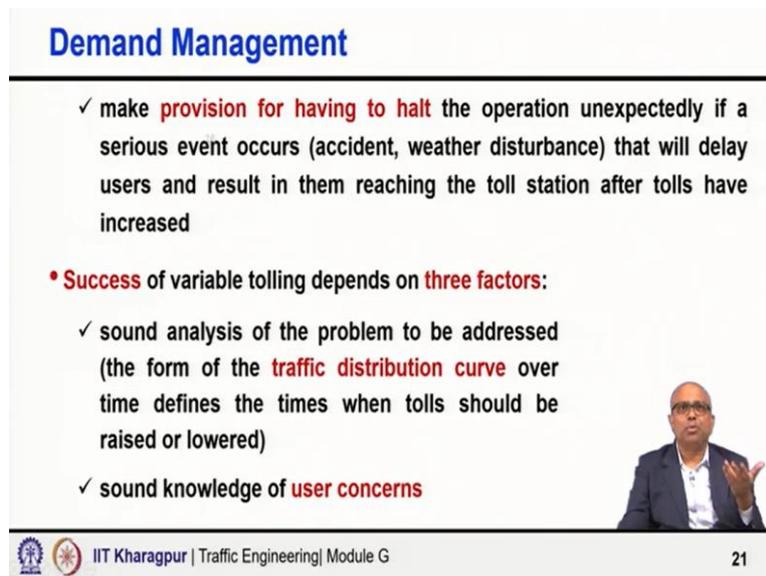


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Implementation is based on publicity and information dissemination. So, information campaign prior to launch of operation is very important, reminders before each activation is actually must, then information signing on the scale of charges and when they apply along the network, people should know that should be publicized, nothing should be a surprise. So, some precautions also may be required.

Say for example, prevent illegal stopping. You are now going to have a lesser rate. So, people may try to stop. Let us wait for 10 minutes and then I will travel. So that gives a different kind of effect. In front of toll booth or all such sensitive places you will find traffic chaos will happen. So, prevent illegal stopping immediately before the toll booth area by users determined to wait until tolls are lowered, so you do not allow that. So, this needs police patrol and installation of sign and proper enforcement.

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Demand Management

- ✓ make **provision for having to halt** the operation unexpectedly if a serious event occurs (accident, weather disturbance) that will delay users and result in them reaching the toll station after tolls have increased
- **Success** of variable tolling depends on **three factors**:
 - ✓ sound analysis of the problem to be addressed (the form of the **traffic distribution curve** over time defines the times when tolls should be raised or lowered)
 - ✓ sound knowledge of **user concerns**

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Similarly, make provisions for having to halt the operation unexpectedly. If you a serious event occur, say for example, an accident has happened or crash has happened or weather disturbances is there and something which will delay users and result them in reaching the toll station after tolls have increased. So, some kind of provisions should be there, that they every day they are doing, they travel actually in the off-peak hour and often the or during the green period.

But due to some incident or other they could not reach on time and therefore they are reaching in the red period, they should not be charged. So, they should still be charged. So that kind of you know that incident has happened, that is why there is a lot of congestion and every vehicle is getting delayed by 20 minutes. So, you extend probably by another 20 minutes, make the green period even longer.

So, they feel and they get encouraged that it is not my fault, something went wrong in the network, and that is why I am delayed so, I am not actually punished. Success of variable tolling depends on three factors very importantly, one is sound analysis of the problems to be addressed in the form of say, traffic distribution curve over time, defines the time when the toll should be raised and when should be lowered.

So, that traffic distribution curve is very important. And a sound analysis should be done. Then sound knowledge of the users concern, because it is to be acceptable by the community. So, what are the user concerns, I must know, I must be aware of those concerns.

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Demand Management

- ✓ solid assessment of the **impact of tolls**
 - Reduction in tolls during the “green” period must be large enough to be attractive
 - Increase during the “red” period must be large enough to dissuade users while remaining acceptable for users unable to return earlier or later, to avoid image problems for the operating company





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And third solid assessment of the impact of tolls, that means reduction in toll during green period must be large enough to be attractive, if you some make some very small difference between red and green, people do not care probably. So, the reduction in toll during the green period must be large enough to be attractive.

On the other hand, increasing toll during red period must also be large enough to dissuade users while remaining acceptable for users unable to return earlier or later, to avoid image problems for the operating company. People should not think that this company is only trying to extract money, that has been the objective, no they should feel that, yes, whatever is done is done logically, understand the objective clearly, that simply the road cannot take more or the congestion cannot be handled.

So, that is the reason with pricing, it is being reduced, but it is sensitive enough, the whole thing is sensitive enough, understand sensitive to the requirement of the user, understands of the uncertain situation and everything and some flexibilities kept to satisfy the requirements or to take care of the unprecedented or unexpected situations.

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Demand Management

Parking Management

- Parking management is a general term for strategies that encourage more efficient use of existing parking facilities, reduce parking demand and shift travel to non-SOV modes
- Managing parking helps to reduce the undesirable impacts of parking demand on local and regional traffic levels and the resulting impacts on community livability and design
- Details will be discussed in module H



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Next strategy, last one is the parking management. The parking management is a general form of strategies that encourage more efficient use of existing parking facilities, reduce parking demand, and therefore shift travel to non-SOV mode. You are taking vehicle but if you cannot park, what you will do? You will feel discouraged to take your vehicle as simple as that.

So, can we just do that, we can use the parking supply or even like congestion pricing, the parking charges could also be made high to create a deterrence, parking management or parking charges in particular, could be very effective demand management instrument. Unfortunately, people do not use it in that manner, especially in emerging or developing countries like India and many other countries.

So, it is just only a matter of, earning getting more money, getting more money, but that is really the objective. Managing parking helps to reduce undesirable impact of parking demand on local and regional traffic level and the resulting impacts on the community livability and design. So, we will discuss more about the parking management in our module H.

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Summary

- Demand management
 - ✓ Transit use, vanpooling and carpooling
 - ✓ Employer-based TDM strategies
 - Financial incentives, facilities & services, flexible scheduling, user information
 - ✓ Congestion pricing
 - Variable tolling
 - ✓ Parking management

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So, what we discussed today about the demand management, four things, transit use vanpooling and carpooling, various strategies employer-based TDM strategies, again various options, congestion pricing, various ways and means of doing it, various considerations that we should understand and an introduction to parking management, because we are going to discuss more about the parking management in another module. So, with this, I close this lecture, thank you so much.