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УПРАВЛЕНИЕ ДИСТАНЦИОННОГО ОБУЧЕНИЯ И ПОВЫШЕНИЯ КВАЛИФИКАЦИИ

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Учебное пособие

УПРАВЛЕНИЕ ДОРОЖНЫМ ДВИЖЕНИЕМ ПРИ ВОЗНИКНОВЕНИИ ЗАТОРОВ: УЧЕБНОЕ ПОСОБИЕ ПО АНГЛИЙСКОМУ ЯЗЫКУ (MANAGING TRAFFIC URBAN CONGESTION)

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Аннотация

В учебном пособии представлены темы и разнообразные типы заданий, направленные на развитие навыков профессионально-ориентированной устной и письменной речи, а также терминологический словарь в направлении совершенствования организации дорожного движения для сокращения продолжительности заторовых ситуаций.

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Оглавление

UNIT 1 DEFINING AND CHARACTERISING CONGESTION

Topic 1.1 What is Congestion?

1. New words and expressions to learn:

congestion – затор
capacity – пропускная способность
to contribute – способствовать, содействовать
treatment – обработка, очистка, переработка, устранение
unpredictable – непредвиденный, непредсказуемый
permutation – перемещение, перестановка

2. Read and translate the text:

Most people know what congestion is and likely have their own definition of the phenomenon. However, when pressed, precise definitions of congestion rapidly give way to descriptive terms (e.g. "stopped traffic") and causal explanations (e.g. "too much traffic"). These have resonance with those experiencing congestion but only contribute marginally to understanding the phenomenon. There is still no universally accepted definition of what exactly "congestion" is. This situation is further complicated by the fact that congestion is as much a physical phenomenon that can be quantitatively described as a subjectively experienced situation that varies from person to person and from place to place. While many people instinctively "know" what congestion is, few are able to say with any precision when a road starts to be "congested" and where it stops being so. This lack of precision complicates matters for transport policy since any effort to manage congestion should ideally be based on a shared understanding as to what it is that is being managed.

Congestion is both a *physical* phenomenon relating to the manner in which vehicles impede each others' progression as demand for limited road space approaches full capacity … as well as a *relative* phenomenon relating to user expectations *vis-a-vis* road system performance. Congestion in a vernacular sense is the inability to reach a destination in, or at, a satisfactory time due to slow or unpredictable travel speeds. But what then can be said about the *precise* meaning of the term "congestion"? As noted, a quick review of most popular and/or research-oriented treatments of roadway congestion will reveal some permutation of the following phrase in the opening themes: *Congestion is a situation in which demand for road space exceeds supply.*

This is a correct definition as it identifies the central characteristic of congestion: e.g. the inadequacy of supply of road space vs. demand. However, it leaves much to be desired as an operational definition as it provides little insight into the multiple, complex and interconnected factors that lead to this mismatch of supply vs. demand. This definition has underpinned many efforts by transportation engineers to "solve" the problem of congestion by increasing supply – that is, by doing away with bottlenecks or expanding the capacity of the roadway network. In some circumstances, this has proven to be an effective response. Yet can it be said that roadway expansion – as a stand-alone policy – has "solved" much of anything vis-a-vis overall levels of congestion? Indeed there is solid evidence now that increases in roadway capacity may in many (but not all) circumstances lead to more roadway usage without alleviating overall congestion and/or impacting general accessibility. Furthermore neither demand nor capacity – nor even the definition of congestion itself – are "fixed" variables. Traffic demand varies significantly by time of day, day of the week, and season of the year, and is also subject to significant fluctuations due to recreational travel, special events, and emergencies. Available capacity, which is often viewed as being fixed, also varies constantly; being frequently reduced by lane-changing behaviour, speed differentials between vehicles, incidents (e.g. crashes and disabled vehicles), work zones, adverse weather, and other causes. Another approach to characterising congestion reduced the phenomenon to simple problem of hydraulic engineering. In this analogy, larger pipes allow for greater flows – e.g. by increasing the capacity of the roadway, more vehicles are able to pass and queues are eliminated. However, this approach ignores the essential nature of the system at hand; people – unlike water – adaptively choose where to go. Moreover, roads, unlike pipes, serve several functions in urban areas – many of which are not necessarily linked to transport activity.

A more sophisticated definition was formulated in a 1999 by J.M. Dargay and P.B. Goodwin and state that: *Congestion is the impedance vehicles impose on each other, due to the speed-flow relationship, in conditions where the use of a transport system approaches its capacity.*

This definition highlights two defining attributes of congested roads. The first is that vehicles, and in particular, each *new* vehicle on the roadway, impose constraints on those *already circulating*. Congestion is both *caused* by vehicular traffic (for a given segment of road) and *impacts* that same traffic. The second attribute is encapsulated in the concept of the "speed-flow relationship". This concept has served as the basis for understanding the mechanics of congestion and queue formation and has underpinned most operational responses to the problem. The definition above also highlights the fact that, because of inherent instability in the speed-flow relationship as demand nears roadway capacity, congestion can be said to exist *before* the physical capacity of the network is attained. However, as discussed later in this report, the speed-flow relationship referenced in this definition primarily describes traffic behaviour on links in *uninterrupted flow facilities* such as urban motorways – its relevance to understanding congestion on dense urban networks where flow is interrupted by signalised intersections and frequent access/egress points is somewhat limited. Furthermore, the above definition still focuses on the proximate causes of congestion, i.e. too much demand for a particular segment and/or segments of the road network. This explanation begs a greater question: *Why is the volume of traffic swamping the road infrastructure at that/those particular time(s) and place(s)?* This is a question to which there are no easy and/or obvious answers. This report examines many of the contributing factors but, in some ways, the answer may be more important from a strategic and longer term perspective rather than be of relevance for the day-to-day management of roadway networks. This is not to say that the answer isn't important – *it is* – but rather that developing a congestion management policy based on one specific answer to the question posed above may not be as helpful as developing a congestion management policy that can effectively and flexibly address a rapidly changing environment where today's answer to the above question is quickly supplanted by tomorrow's reality – a reality which includes the changing expectations of roadway users. User expectations are not static and these heterogeneous and changing expectations can influence how congestion is perceived and experienced. What passes for intolerable congestion in rural communities (where expectations of free-flow travel conditions are high) may not even register as an annoyance in a large metropolitan area. Likewise, while roadway users may tolerate relatively high levels of congestion during the weekday commute, they may find the same level – or any level – of congestion completely intolerable on a Sunday morning. The inherent difficulty in capturing user expectations renders the precise quantitative definition of congestion a difficult, if not impossible, task. In this respect, as the U.S. Federal Highway Administration notes: *Congestion is essentially a relative phenomenon* *that is linked to the difference between the roadway system performance that users expect and how the system actually performs.*

3. Answer the questions.

1. What is the physical phenomenon of congestion?
2. What are the central characteristics of congestion?
3. Who is the road-user?
4. What determines the traffic demand?
5. When was the sophisticated definition of congestion formulated?
6. How can engineers solve the problem of congestion?
7. What is the central and main question of this text?
8. How can we characterize the speed-relationship?
9. What does the hydraulic engineering include?
10. How can we solve the problem of traffic congestion?

Topic 1.2 Characterizing Congestion: Key Factor to Consider – Roadway Users and Congestion

1. New words and expressions to learn:

solely – исключительно
amount – объем
routinely – регулярно
repercussion – последствия, результаты
willingness – готовность
conveyance – перевозка
perceptible – заметное, ощутимое

2. Read and translate the text:

Traffic congestion is a factor of the *level of traffic*, itself a function of how routes are selected by specific roadway *users* on a *road network* at a particular *time*.

It is important to bear in mind that congestion is not solely a physical phenomenon. At a micro level, billions of decisions are made by millions of individuals and/or firms resulting in hundreds of thousands of trips every day in urban areas.

Congestion management policy should not lose focus on these users – not only because they are at the heart of the trips that flood the road network at certain times, but also because any successful policy must deliver benefits that are perceivable to these users. Congestion management policy has often reflected the point of view of the network manager with the assumption that the latter's performance criteria centred on speeds and link-based travel times closely mirrored those of roadway users. This assumption has led to policies that have sought to increase speeds and reduce delays. However, it is not at all clear that users are exclusively focused on travel speeds and delay – or that when they are, they share the same reference points as network managers. Furthermore, not all users are alike; they value time savings, schedule delay, travel speed improvements each in various degrees.

The perceived impact of congestion experienced by users may be different from its "objective" impact as physically measured by network managers. This is especially so when considering the perception of time. Travel time, even when spent in congestion, is not necessarily viewed as a "burden" by many users. Users form expectations based on first-hand experience regarding the amount of time it takes for "normal" trips. When this experience routinely includes travel within congested conditions, expected travel times include congested travel. While *expecting* and *accepting* are two different things, many researches have pointed out that many travellers do accept routine levels of congestion. Many transport economists have also pointed out that "optimal" congestion charges – that is those charges that users are willing to pay in order to maximise the utility they derive from using the roadways accounting for the full range of costs their travel imposes – lead not to the disappearance of congestion, but rather to its reduction to "tolerable" levels.

Increasing the *predictability* of travel times is important when seeking to prioritise congestion policies – unexpected congestion is often perceived much more negatively and experienced much more strongly by users than "normal" background levels of congestion. Figure 1.1 provides a conceptual illustration of this point. Here, two reference cases are considered. The first on the left has more evenly distributed travel speeds but the average speed is lower than in the second case to the right where travel speeds are more variable but average speed (for the week) is higher. In the first case, users are likely to view travel conditions as predictable and therefore tolerable since they can plan around consistent trip times. In the second case, the disutility of being unexpectedly caught in traffic and the repercussions unpredictable travel times may have on individuals engenders stress and imposes a burden on roadway users. However, if only weekly average travel speeds were used as a system performance yardstick, the first case may be seen as "worse" off than the second.

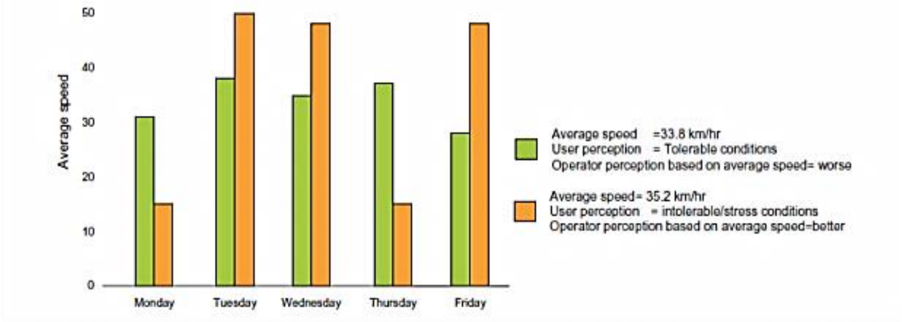

Figure 1.1 – Average speed, specific speeds and the perception of the congestion burden

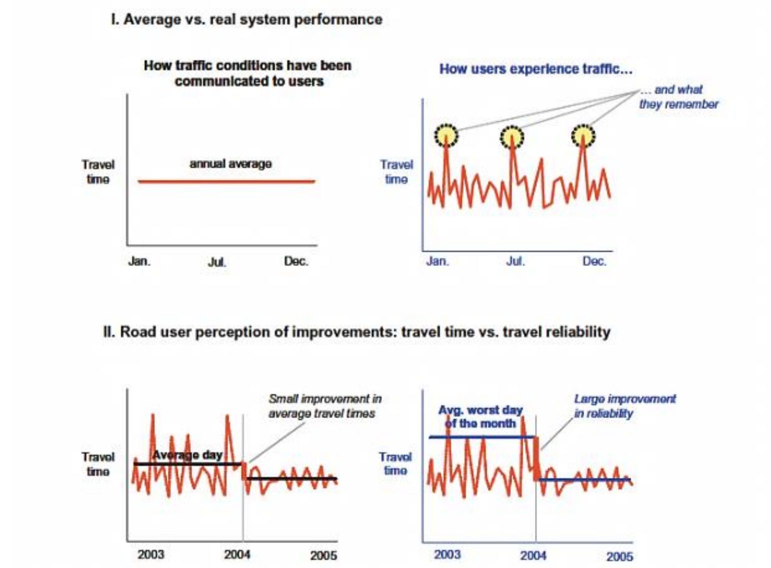

Figure 1.2 – Road user perception of system performance

Another way to understand the road user perspective in relation to travel time variability is to understand that most road users do not retain average travel times when considering their travel experiences but, rather, remember principally the worst days where their travel was unexpectedly delayed. Figure 1.2 illustrates this point and shows how a small improvement in average travel times may indeed be much less important than the large improvement in reliability (and related large improvement in travel conditions experienced by users) that may have resulted.

While *unpredictable* travel is almost always perceived negatively, overall travel time – even in routinely congested conditions is not always regarded in the same manner. In fact, time spent in traffic is even seen as a positive experience by some roadway users. University of California Davis researcher P. Mohktarian has pointed out that the only two places where adults are fully in control of their immediate environment is while in their car alone or in the bathroom. On-board entertainment systems, advances in vehicular comfort, mobile communications and computing have all contributed top making the drive-alone experience something that many look forward to, rather than dread. If transport authorities ignore this factor, they may find themselves puzzled at the remarkable resilience of demand for car-travel even in consistently congested conditions.

Another point to bear in mind is that time is not *perceived* uniformly by all roadway users in all instances. There is evidence of a disparity between objective "clock" time and the passage of time as perceived by roadway users. Time spent waiting or spent while in a state of frustration (as when expectations of travel times are not met) is often perceived by individuals as lasting longer than real "clock" time. Five minutes spent in unexpected congestion may be perceived by those caught in it as having lasted ten minutes – which may also lead these users to inflate their stated willingness to pay to reduce congestion.

Even if all travellers were to perceive time spent in congestion objectively, it is not at all clear that their concerns can, or should, be reduced to only travel time and speed – indeed there is considerable evidence that travel time *reliability* is an even more important factor in the user experience. Individuals undertake most travel in order to arrive at one or several destinations. When the activities at these destinations follow fixed schedules, individuals seek to ensure that they arrive *on time* – and not necessarily *quickly*. Likewise, the focus on "just-in-time" production systems in industry have led planners to seek to maximise freight travel *speeds* when freight users are often more interested in the *reliability* (e.g. arrival at the planned time) of their conveyances. This has important implications for congestion policy since transport authorities must also be able to demonstrate that the reliability of the roadway network is being addressed through their actions.

Furthermore, it should be pointed out that the degree to which users are constrained – at least in the short run – by rigid schedules has an impact on how they perceive time savings delivered through successful congestion policies. While network managers often aggregate all travel time savings or time "losses" to help guide their policies, it is not clear that all these time savings/losses – especially small ones – are perceptible to users.

3. Answer the questions.

1. What is the "traffic congestions"?
2. What do the users prefer and value?
3. Why do the users pay in the road?
4. What is so important when scientists are seeking the reasons of congestions?
5. Small improvement in average travel times may indeed be much less important than the large improvement in reliability, mayn't it?
6. How is the unpredictable travel perceived?
7. What kind of modern technology helps us to reduce the stress in congestions?
8. What is the purpose of congestion policy?
9. How congestions can affect on industry?
10. Why we should solve the problem of congestion?

4. Translate into English.

1. Объем перевозок с каждым годом увеличивается.
2. Политика устранения заторов имеет положительные последствия.
3. Также весьма ощутимый вклад в решение проблемы заторов вносят интеллектуальные транспортные системы.
4. Исключительно готовность к серьезным действиям может обеспечить решение проблемы.
5. Регулярно работающие терминалы – залог нормального функционирования транспортной системы.

Topic 1.3 Characterizing Congestion: Key Factor to Consider – Networks and Flows and Time

1. New words and expressions to learn:

homogeneity – гомогенность, однородность
antithetical- антитетический, несовместимый
tenet – принцип, постулат
road space – дорожное пространство
timing – сроки
carriageway – проезжая часть

2. Read and translate the text:

Most people intuitively understand some basic form of road hierarchy. Some streets are calmer and carry essentially local traffic, whereas others are busier and carry more through traffic. Many countries have adopted some form of functional classification of their roadway network more or less in line with that illustrated by Figure 1.4.

Figure 1.4 – Typical road network hierarchy

This functional classification often comes into play in congestion management policies when some classes of road receive a high level of scrutiny (essentially those that carry the highest volumes of traffic – such as urban motorways), while others receive relatively less attention even though they may carry as much, if not more, traffic in congested conditions. In those areas where urban roads carry a substantial share of rush hour traffic, it is important to account not only for the different ways in which congestion is triggered on each type of roadway, but also for the impacts policies seeking to alleviate congestion on one type of roadway may have on other parts of the network. This is especially important in the context of "link-spreading" where traffic spills over from a congested primary roadway onto lesscrutinised collectors and local networks (see Figure 1.6).

A second issue regarding the non-homogeneity of the road network is that congestion "triggers" can vary according to the geometric design and resulting functional classification of the road. As discussed in later in this report, urban motorway congestion is an immediate function of lane flow to capacity and on/off-ramp flow to capacity, whereas congestion on arterial/collector networks is often a function of intersection clearing times and congestion on the local network is often linked to directional imbalances.

Finally, it should be stressed that road systems are not managed with uniform performance objectives in mind. What may seem to be a desirable goal for traffic speeds and flow on motorways and arterials would certainly be antithetical to the management objectives for collectors and local roadway networks. Accordingly, congestion management responses should be aligned to the type of roadway network in question.

The non-homogeneity of the road network also comes into play when congestion policies succeed in improving vehicle travel speeds on the urban roads. A fundamental tenet of urban planning is that roads in cities are not only "links" between places but also "spaces" in their own right extending from frontage buildings, across the sidewalk and onto the carriageway proper. In dense urban settings, the non-carriageway component of road space can be quite important (e.g. in the city of Paris, the carriageway accounts for 13.5 million m^2 and sidewalks 10 million m^2). Non-traffic use of road space includes parking, pedestrian travel, urban green space (when sidewalks are planted with trees or other vegetation), social space for residents, an extension of school facilities, commercial space for businesses (e.g. sidewalk cafes or cinema waiting lines) and an extension of roadside homes/apartments. The management of the roadway network to optimise the transport function of these spaces often ignores significant non-transport uses and users of roads.

Congestion policies that fail to recognize the non-transport functions of roads, can result in fluid traffic but poorly liveable urban neighbourhoods. Some countries have sought to refine their roadway classification scheme in order to capture some of the diversity of roadway uses and integrate these into the transport planning process.

Figure 1.6 – Spatial spread of rush-hour traffic

Finally, time is an important factor to consider when acting on congestion since road networks do not operate at capacity all of the time. It follows that congestion is a temporal phenomenon, affecting some periods more than others and some not at all. *Which* periods are affected is linked to the temporal scale (daily, weekly, monthly and/or yearly) and the timing of urban activities which is linked to decisions made by individuals and firms relating to the purpose of their trips.

Most people are acutely aware that space is "timed". Shops operate on fixed schedules, children's activities commence and end at fixed intervals and most work activity, despite all the discourse surrounding the long-awaited emancipation from the industrial age timekeeper, still takes place following a remarkably regimented schedule. Production systems depend also on fixed and reliable schedules in order to minimize "down" time and maximize productivity. Observed congestion follows a daily cyclical pattern that reflects activities that are constrained in time. For individuals, these timing decisions are taken in the context of household time budgets whereas logistical systems dictate the timing of production activities– including freight delivery – for firms. Typically, these cycles of traffic peaks and troughs have been principally influenced by the rigid and recurrent timing of the work day. Traffic has flowed to areas where jobs are concentrated in the morning and flowed back after the work day is completed in the early evening.

However, the "timing" of urban areas is not what it used to be. For one, congestion has had an impact on temporal travel patterns.

Most large urban areas experience some form of "peak" spreading of the rush hour. Indeed, the "rush hour" has now become "rush hours" as congestion delays and trip departure re-scheduling have lead to a prolongation of congested road conditions. Congestion – or more precisely, congestion avoidance – is not the only factor in the observed peak hour spreading.

The timing of urban space has become more complex and while the rigid timing described above still is a major factor, its influence has somewhat become eroded. Shops are open longer, public services operate more flexibly and some work patterns have shifted away from the conventional "9- to5" schedule. There are a number of reasons for this including the shift from production activities to service-oriented urban economies, the massive influx of women in the workforce and the move towards globalized "24-hour" cities.

Congestion policies must account for these new and emerging temporal demands placed on the road network if they are to be effective. Equally important is the observation that to some degree, *congestion mitigation policies can themselves influence the "timing" of urban space*. This is especially true for wider urban and sometimes national policies that have an impact on scheduled activities and services such as working hours, shop-opening hours and rules concerning the scheduling of freight delivery, removals, etc.

3. Answer the questions.

1. What do you know about road hierarchy?
2. What factors should be taken into account when considering the intensity of the road in rush hour?
3. What is the one of the fundamental principles of urban planning?
4. What does the road space include?
5. Why had some countries sought to refine their roadway classification scheme?
6. Why time is an important factor to consider when acting on congestion since road networks do not operate at capacity all of the time?
7. What are the implications of globalization of the city?
8. What should a policy of eliminating congestion consider?
9. What might the congestion cause?
10. What congestion's characteristics do you know?

4. Translate into English.

1. Большую роль в устранении заторов играет создание однородного транспортного потока.

2. Основным принципом транспортной логистики служит оптимальное перемещение груза в назначенное место.

3. Дорожное пространство должно использоваться по максимуму для профилактики заторов.

4. Проезжая часть предназначена для движения транспортных средств.

5. В короткие сроки нужно выполнить два несовместимых дела.

UNIT Summary

- Traffic congestion takes place on the roads, but it is not only, nor necessarily primarily, a traffic engineering problem.
- Congestion prevents us from moving freely yet unfettered movement is not the primary benefit we expect to derive from living in urban areas. Congestion management policies should account not only for the manner in which congestion impacts mobility but, equally, the manner in which it impacts accessibility.
- Congestion, while often regarded as a sign of poor policy or even transport policy failure, is oftentimes the outcome of successful economic development, employment, housing, cultural, etc. policies that make people want to live and work relatively close to each other and attract firms to benefit from the gains in productivity thus derived.
- ▪Nonetheless, some forms of congestion are the direct outcome of poor policy choices, inadequate transport planning and/or a lack of system management. In these cases, much can be done to better balance the specific disadvantages accruing from system bottlenecks and overall traffic volumes with the benefits of dynamic, growing and prosperous urban areas.
- There is no useful single definition of urban traffic congestion. Operational definitions of the phenomenon should reference the nature of supply and demand for roads and their imbalance as well as incorporate some understanding of user perception of the problem. The latter can help to understand congestion as the difference between the roadway system performance that users expect and how the system actually performs.

UNIT 2 MEASURING CONGESTION: METHODS AND INDICATORS

Topic 2.1 Performance Measurement

1. New words and expressions to learn:

measure – степень, мера
access – доступность
intervention – вмешательство
ill – adapted- плохо приспособленный
target – цель
density – плотность
recurrent – периодический
elected officials- выборные должностные лица
comprehensible – приемлемые
counts – счётчики
suburb – пригород
corollary – следствие
sppended – добавляемый, прилагаемый

2. Read and translate the text:

The manner in which *congestion is measured* has a fundamental impact on the manner in which *congestion is defined and managed*. Measures of congestion based alternately on speed, access, user costs, delay, reliability, etc. will give rise to different problem statements regarding congestion and will motivate sometimes radically different policy interventions. When incomplete or ill-adapted metrics are used to address congestion, policy-makers may find themselves wondering why it is that that the results fall well below their expectations.

Congestion impacts how the transport system facilitates high quality access. It does so by reducing mobility and thus, it is understandable that most congestion indicators relate to the manner in which either speeds are affected and/or delay is imposed by congestion. However, the measurement of congestion can take place at several levels, is carried out for different purposes and may be requested by, or target, different audiences. Table 2.1 illustrates those categories of people most typically interested by congestion and the specific concerns they may have regarding performance measurement.

Table 2.1 – Congestion Indicators: Typical Audiences and their Concerns

	Speed	Flow/Density	Delay	Reliability/Variability
Roadway manager	◦◦◦	◦◦◦	◦	
Transport system manager	◦	◦◦	◦◦◦	◦◦
Roadway user	◦◦		◦◦◦	◦◦◦
Elected Official	◦◦		◦◦◦	◦◦

At a micro level, roadway managers need congestion metrics that allow them to address operational concerns on specific roadway links. These may relate to road traffic density vs. capacity, to average speeds vs. rated and/or posted speeds and/or to speed/flow relationships on network links. This information is necessary in order to diagnose specific bottlenecks and compare link performance to overall performance.

However, these metrics are relatively difficult to aggregate and do not directly address the concerns of roadway system managers and/or roadway users. Furthermore, it is not at all certain that measuring traffic speeds on discrete network links provides a good basis for understanding overall traffic conditions in dense urban networks where most congestion and the "delay" it causes are generated at and by roadway access points and intersections.

System managers need to understand how well the entire network – as opposed to individual links – is operating. System managers are typically concerned with how large volumes of vehicles on the network impact travel time – thus the importance of the measurement of delay.

Roadway users are most often concerned with trip-based metrics. "How much time should I plan for to have a reasonable chance of arriving at my destination *on time?*" is a recurrent and central question for trip decision-making for both individuals and firms and highlights the need for information regarding travel time reliability and variability of travel conditions.

Elected officials, while primarily concerned with the issues that are of concern to their electorate (e.g. travel time reliability and variability) also must be able to demonstrate in an easily comprehensible manner how they have (hopefully) had a positive impact on congestion.

Elected officials must also have access to indicators that allow them to gauge the cost-effectiveness of their interventions.

There is no "simple" measure of congestion that is good for all purposes and all situations. The rating of a specific roadway segment's performance as translated by hourly vehicle counts against rated capacity will mean little to a user even if they travel over that link every day. Conversely, knowing the amount of time one must plan for to get from one suburb to another at peak hours in order to arrive before 09:30 will not necessarily help an engineer better time traffic signals in the central business district. There are not necessarily "better" indicators of congestion than others, but there may exist a *better fit* between those indicators selected and specific outcomes desired. In this respect, it is important not to simply use a specific congestion indicator because it is available (others might be as well), but because it allows one to measure progress towards a specific goal (e.g. link performance, system operation, user experience, etc…) Finally, when measuring congestion – with any indicator – one must keep in mind another form of observational bias. It is a truism in the literature regarding transport system performance measurement that "what gets measured, gets done". However, the following corollary could easily be appended to that useful maxim: "what is *seen*, gets measured". *How* congestion is observed – and especially *where* one looks for congestion – are fundamentally important issues.

There are several techniques for gathering the raw data necessary for measuring congestion (see box). These can be characterized as being based either on human observation (traffic management centers, police, news/private sector observers, etc) or some form of remote sensing (embedded magnetic loop detectors, automatic video feed-based counts, etc). While it may be conceptually possible to do so, none of these observation systems has yet been extended to the entire transport network of an urban region. What traffic managers *see* – and what indicators are communicated to different audiences – is only *one part of the picture*. The risk of bias lies in the temptation to interpret what one can see and measure as an easy, but not necessarily accurate, representation of the entire system. This is especially true for automatic remote sensing-based systems – e.g. just because performance on a "wired" motorway network shows improvement, it doesn't necessarily follow that congestion is diminishing. It may have simply moved "out of sight" onto unmonitored local networks.

Even on fully instrumented roads – e.g. those that are fully covered by a network of embedded loop detectors or other such point measurement devices (such as video monitors), the "reality" of congestion conveyed to managers and decision-makers may be biased by such things as sensor spacing sensor location and/or sensor quality. Some preliminary research indicates that changes in the latter three variables can lead to consistent over- or under-estimating of congestion severity relative to a baseline measure of congestion.

Another matter to consider is that deploying comprehensive sensor arrays entails both costs and time. Typically, the expansion of a sensor-instrumented road network takes place slowly and incrementally with the most problematic portions of the network getting sensors first. In order to complete the picture of "reality" on the urban road network, increasingly sophisticated models have been combined with inputs from partially instrumented roads to create a satisfactory portrayal of traffic conditions and behavior. Of course, the very deployment and maintenance of sensors responsible for monitoring road system performance can give rise to congestion. The roadwork associated with installing and repairing embedded loops entails the partial closure of the roadway which can trigger congestion if the work takes place during heavily travelled periods. In this respect, gantry-based systems can reduce these work-related costs and impacts.

3. Answer the questions.

1. On what factors are the measures of congestion based?
2. How does the congestion impact on the transport system?
3. Why does the roadway manager need to measure of congestion?
4. What information is necessary to diagnose bottlenecks and compare link performance to overall performance?
5. What is the good basis for understanding overall traffic conditions in dense urban networks?
6. What terms are used in the text?
7. What kind of techniques for gathering the raw data are necessary for measuring congestion?
8. Who are the "elected officials"?
9. What is necessary to complete picture of "reality" on the urban road network?
10. What impacts has the roadwork associated with installing and repairing embedded loops?

4. Translate into Russian.

1. Roads affect on the degree of access in the city.
2. This situation requires the police intervention.
3. This road is ill-adapted for the suburbs.
4. They decided to achieve the target.
5. This area of the city has the high density of the road network.
6. This factor has a recurrent character.
7. At this place there are comprehensible conditions of work.
8. The corollary of these appended efforts is the great result.
9. Elected officials took an important decision for road safety.
10. Counters of traffic violations are used throughout the city.

Topic 2.2 Congestion Indicators

1. New words and expressions to learn:

inventory – запасы
density – плотность
free flow – свободный поток
congestion – затор
vehicle – транспортное средство
extrapolating – экстраполяция
duration – продолжительность
queue length – длина очереди

2. Read and translate the text:

Table 2.2 inventories a broad set of indicators used across OECD/ECMT regions to track congestion. There are two general approaches for measuring congestion: an operational approach that has had the favour of those responsible for constructing and managing road networks and an economic-based approach that has generally been used to prioritise public expenditures for transport. The former is typically concerned with observable features of roadway performance (speed, flow, density, queue length and duration), whereas the latter has typically focused on extrapolating physical measures into monetary values that can then serve to guide policy through cost-benefit analysis. In the former context, engineers have sought to deliver *technically "optimal" roadway performance* whereas economists have attempted to determine *economically "optimal" levels of congestion*. A review of national and regional practice among Working Group countries highlighted that the former approach – measuring physical and technical system performance – seems to be the overwhelmingly dominant approach. Indicators that refer to time, service level or delay typically incorporate some arbitrary definition of the reference travel speed (e.g. free-flow as determined by design, legal operating speeds, or an arbitrary percentage of the free flow travel speed) that make no reference to what *users* may consider an economically optimal speed. Of course these indicators can be used as inputs to generalised cost calculations to derive economically optimal traffic levels. The use of such economically optimal traffic levels was surveyed as part of this study but most respondents confirmed that physical indicators and link flow maximisation were the main features of congestion measurement used in their experience. Furthermore, it seems that relatively few jurisdictions seem to track or otherwise monitor the *variability* of traffic performance via reliability indicators. The manner in which these indicators are actually derived can be broken down into three broad approaches; those derived from point-related measurements (vehicle count, flow), temporal/speed indicators extrapolated or derived from the former (link travel time and delay) or spatial indicators (density, queue length, congested lane kilometres, etc). There is some evidence (see box), supported by the Working Group's informal survey, that point-related measurements of travel time (delay, speed, travel time and Level of Service) dominate the measurement of congestion. There also seems to be mixed views on the accuracy of these indicators, alone, to deliver an accurate understanding of congestion on the roadway network.

Table 2.2 – Congestion Indicators

Indicator	**Description**	**Notes**
1. Speed-based indicators		
Average Traffic Speed Peak Hour traffic speed	Average speed of vehicle trips for network	Does not adequately capture congestion effects
Average Traffic Speed Peak Hour traffic speed	Average speeds of vehicle trips during peak hours.	Can serve as a benchmark for reliability measures based on actual average or median speeds
2. Temporal/Delay-based indicators		
Annual Hours Of Delay	Hours of extra travel time due to congestion.	All delay-based indicators depend on a baseline value for calculating the start of "delayed" travel when this baseline is free-tlow speed, the term "delay" becomes misleading since it is not at
Annual Delay Per Capita	Hours of extra travel time divided by area population.	
Annual Delay Per Road User	Hours of extra travel time divided by the number of peak period road users.	

		all clear that travellers on the network would ever be able to achieve delay-free speeds at peak hours.
Average Commute Travel Time	Average commute trip time.	
Estimated Travel Time	Estimated travel time on a roadway link (used in conjunction with variable message signs). Estimate of how long congested "rush hour" conditions exist	
Congested Time		
Delay per road kilometre	Difference between reference travel time and congested travel time per network kilometre	
Travel Time In Congestion Index	Percentage of peak-period vehicle or person travel that occurs under congested conditions.	The use of the travel time index and the travel time rate also depend on the identification of a baseline value for signalling the start of congested conditions – when this value is based on free flow speeds, the same reservation as noted for other "delay"-type indicators holds
Travel Time Index	The ratio of peak period to free-flow travel times, considering both reoccurring and incident delays (e.g., traffic crashes).	
Travel Time Rate	The ratio of peak period to free-flow travel times, considering only reoccurring delays (normal congestion delays).	
3. Spatial indicators		
Congested Lane Miles/kms	The number of peak-period lane miles/kms that have congested travel	Spatial indicators also depend on threshold values. These may be based on the median/average speeds typically achieved or on free-flow speeds (see note above).
Congested Road Miles/kms	Portion of roadway miles/kms that are congested during peak periods.	
Network Connectivity Index	An index that accounts for the number of nodes	This is an indicator of the potential for congestion to arise, whether or not this

	and interchanges within a roadway network	potential is realised depends on a number of other factors
4. Service level/capacity indicator		
Roadway Level Of Service (LOS)	Intensity of congestion delays on a particular roadway or at an intersection, rated from A (uncongested) to F (extremely congested).	These indicators have had the favour of roadway managers. They typically reference the design capacity of a roadway and are typically implicitly used to maximise throughput up to the design capacity of the roadway link in question.
Roadway Saturation Index	Ration of observed flow to design capacity of roadway	
5. Reliability Indicators		
Buffer index	See planning time index below	These indicators try to capture how road users typically make trip decisions on congested networks – they explicitly take into account the importance to many users of making trips "on time" rather than simply making trips at a high rate of speed.
Congestion Variability Index	An index relating the variability of travel speeds on the network.	
Planning time index	An index that accounts for a time buffer that allows an on-time arrival for 95% of trips on a network	
Mean vs. variance travel times	Measure of the standard deviation of travel times on a link or on the network for a given period	
Distribution of travel times: Percentile – mean	Measure of the difference between the 80th or 90th percentile of the travel time distribution and the median or 50th percentile	

6. Economic cost/efficiency indicators		
Annual Congestion Costs	Hours of extra travel time (generated by travel below reference speed) multiplied by a travel time value, plus the value of additional fuel consumption. This is a monetised congestion cost.	As noted above, the selection of free-flow speeds when trying to account for "congestion costs" is highly problematic.
Current marginal external congestion costs	The additional external costs (not borne by users) of every additional vehicle/use entering the network.	
Total dead weight loss	The sum total of the overall losses (costs-benefits) incurred for a given level of use/traffic	
Average dead weight loss per vehicle/km	The dead weight loss divided by the number of vehicles/km giving rise to that loss.	
7. Other indicators		
Congestion Burden	The exposure of a population to congested road conditions (accounts for availability and use of alternatives)	
Excess Fuel Consumption	Total additional fuel consumption due to congestion.	Again, determining the point of reference for "additional" fuel consumption can be problematic if based on free-flow speeds.
Excess Fuel Consumption Per Capita	Additional fuel consumption divided by area population	

Among the multitude of available indicators, one can discern *three broad families of primary indicators and performance measurements* that could usefully transmit a more accurate picture of congestion and its burden. These primary indicators of congestion could be used to track both system performance as well as to derive the economic impacts of congestion.

These indicators relate to system performance in relation to: 1. *Travel time* (and thus the average speeds experienced on the roadway at peak hours). 2. Travel quality (and primarily to trip reliability and predictability). 3. The exposure of urban peak-hour travellers to roadway congestion (e.g. roadway users travelling on congested roads vs. all urban travellers in peak hours*)*.

3. Answer the questions.

1. What kind of the approaches are used to measure congestion?
2. What is the operational approach?
3. What kind of the characteristics of the roadway are used in the economic-based approach?
4. What are the observable features of roadway performance?
5. What are the general indicators to measure the congestion?
6. What is the extrapolation?
7. What are the three broad families of primary indicators and performance measurements?
8. Why do we use primary indicators of congestion?
9. What are the travel-time indicators?
10. What are the travel-quality indicators?

4. Translate into Russian.

1. We can use inventories of transport.
2. There is high density of the Moscow's road.
3. We can watch free flow on the federal road on our country.
4. Congestion is one of the multitude roads problems.
5. Quality of the vehicle is important indicator.

5. Translate into English.

1. Для изучения заторов используются различные подходы.
2. Наблюдение – самый эффективный способ изучения дорожной ситуации.
3. Существует множество подтверждённых данных о том, что в крупных городах высокая плотность транспортного потока.
4. Экстраполяция – это метод научного исследования, заключающийся в распространении выводов, полученных из наблюдения.
5. Процент транспортных средств на планете с каждым годом растёт.

Topic 2.3 Traffic Surveillance Techniques

1. New words and expressions to learn:

deploy – применять
to stem – происходить
consecutive – последовательный
performance – производительность
point detection – точечное исследование
inductance loop – индукционная петля
video image detection – видеонаблюдение
microwave radar technology – сверхвысокочастотный радар
cell phone tracking – отслеживание по мобильному телефону
satellite-tracking – спутниковое отслеживание

2. Read and translate the text:

Point detection involves placing surveillance equipment at a specific location and using the measures of traffic performance at that location to estimate traffic performance over a segment of roadway. Point detectors generally report data on vehicle volume and lane occupancy (which when combined can be used to estimate vehicle speed), and when deployed in a "dual loop" configuration can also directly measure and report vehicle speed and vehicle classification (by length.) The primary limitation of point detectors is that they provide information about the performance about a single location, and that location may not be an accurate representation of the performance of the rest of the roadway segment to which those data are associated. This problem becomes less of a concern, the more closely spaced the point detectors. The main point detection methodologies are:

- **Inductance loops** are inexpensive to purchase, and are generally considered a robust, well known, reliable technology. However, inductance loops require lane closures for installation and for maintenance of the wire loop itself. In freeze/thaw climates, in pavements in poor condition, and if installation is poorly done, the wire can break, meaning that additional lane closures are required to replace the failed loop. In addition, because loops are physically "cut" into the pavement, they are not moveable, and thus must be replaced if lane lines are moved as a result of new construction activities or other geometric and operational changes.
- **Video image detection** technology was designed in part to deal directly with the limitations in loop technology. Because cameras are above ground, in many (but not all) instances, traffic lanes need

not be closed to place, repair, maintain, or adjust the data collection devices. If lane lines are changed, detection zones in the camera image can often be "redrawn" without physically moving the camera system, thus allowing continued data collection without roadway closures or other significant disruptions to the facility or data collection system. However, video image detection techniques also have limitations. Most of these problems stem from the fact that video systems can only measure "what they see." Thus video systems tend to work poorly in low-visibility weather conditions (e.g., heavy snow and thick fog.) and at night. Thus, they are often not recommended for implementation in climates where these conditions occur frequently. Finally, cameras frequently require more routine maintenance than loop detectors, as dirt and water can reduce image clarity, thus degrading system performance.

- **Microwave radar technology** was developed, in part, in response to the limitations in loop and video technology. In particular, Microwave radar detection is not impacted by weather or low light conditions. Microwave radar does, however, have other minor limitations that generally result in slightly less accurate volume count information than obtained with loops and/or video detection. Like video detection, microwave radar can work from sensor positions either above the traffic lanes, or from beside the roadway. And also like video, the "above" locations provide more accurate data (less chance of occlusion) than the "side-fired" positions. Unfortunately, the "side fired" positions are usually less expensive to install, maintain, and repair because they do not require working within the constraints of moving traffic.

Vehicle-based detection provides a good source of information on travel times and speeds. However, one significant drawback to probe vehicle-based performance monitoring it does not provide information about the level of roadway use (vehicle volume.) It only provides information about the speeds and travel times being experienced. Thus, if probe vehicles are the primary source of performance information used, some supplemental data collection will be needed to supply the performance measures related to the level of use freeways are experiencing.

- **Probe Vehicles** are typically instrumented vehicles that are driven at regular intervals down specific roadway segments. Data regarding travel speed is either automatically or manually recorded and is linked to location data at set mileposts. Several vehicle runs on different days are necessary to build a representative view of travel speeds.

- **·Beacon-based probe vehicle** data collection is most commonly associated with electronic toll data collection systems. In these systems, a device (beacon) interrogates electronic vehicle tags as vehicles pass that reader location. The result is a data record that indicates when individual tag-equipped vehicles pass particular points on the roadway. By matching the time and location data associated with each vehicle as it passes from one beacon location to the next, it is possible to determine the travel time for that vehicle between two consecutive beacon locations. Travel times collected in this manner are more accurate than those estimated from point detectors, but they do not provide information about the geographic distribution of delays within the road segment being monitored.
- **Cell phone tracking** techniques take advantage of the fact that it is possible to determine the approximate location of all cellular phones. By tracking the movement of cell phones it is possible to determine the speed of the cell phone. By restricting the analysis to those phones located on roadways, cell phone tracking provides a means to measure vehicle speeds on those roads. The advantage of this technique is that the number of cell phone equipped vehicles is quite high, and increasing. This means that (potentially) entire roadway systems can be monitored without the need to install costly "roadway monitoring infrastructure. Research is currently underway in order to examine how cell phones can be used for roadway performance monitoring without compromising privacy concerns.
- **Satellite-tracking** technology (GPS/ Galileo) devices report current location, heading, and speed information with a high degree of accuracy. When placed in vehicles and combined with electronic map information, satellite-tracking devices are the primary component of excellent vehicle location systems. Storage and analysis of the satellite-tracking location data allow for very accurate roadway performance measurement. The difficulty with satellite-tracking data is that the latter is stored on-board the vehicle itself. It is therefore necessary to provide some communication mechanism to/from satellite-tracking-equipped vehicles in order to obtain the relevant data.

3. Answer the questions.

1. What does point detection involve?
2. What does point detection generally do?
3. What are the main point detection methodologies?
4. What disadvantages does inductance loop have?
5. What was video image detection technology created for?

6. What was made in response to the limitations in loop and video technologies?
7. What kind of information does vehicle based detection provide?
8. Where can we put microwave radar technology?
9. What kind of technologies does vehicle-based detection include?
10. What advantages do the cell phone tracking have?

4. Translate into Russian.

1. John deployed his architecture skills to create a fabulous house for his family.
2. The performance of electric cars has improved.
3. The aerial system of an induction loop installation can consist of one or more loops of a conductive element.
4. Microwave radar technology can be introduced as a remote sensor or remote object detection system.
5. Cell phone tracking system detects even the smallest cell phones.

UNIT Summary

- Measuring congestion is a necessary step in order to deliver better congestion outcomes. Good indicators can be based on a wide network of roadway sensors yet simple indicators based on less elaborate monitoring can adequately guide policy.
- Free-flow speeds should not be used as a direct benchmark for system performance.
- It is important to track indicators that are of relevance to road users (predictability of travel times and system reliability) as well as those that are of relevance to road systems operators (e.g. speed and flow).
- Sets of indicators should be used to communicate both the extent and relative scale and evolution of congestion
- A basic set of congestion indicators should communicate for the entire network or for specific network links: a measure of travel time, a measure of reliability/travel time predictability and, if possible, some measure of traveler exposure to congestion.

1. Translate into Russian.

1. They are not always able to deploy this skill.
2. They were able to deploy facts and figures to sharpen the journalism, challenging those politicians who spoke in pre-fabricated slabs of argument.
3. You can deploy power in a wide range of ways.
4. The aim is to deploy control mechanisms and procedures, which meet international standards.
5. Many of the universities' problems stem from rapid expansion.
6. Many of the difficulties stem from continually falling prices.
7. Her success stems from hard work.
8. He is a wise and kind man, and comes of a good stem.
9. These sessions will continue for four consecutive Thursday evenings.
10. "Straight" is a combination of cards in consecutive order, regardless of suit.
11. Their performance was first rate, and they did the job completely.
12. Webmaster Tools: Improve your site's performance in Google's organic search results.
13. You can use this information to fine-tune your campaigns and settings for better performance.
14. Now we can compare this to cutting-edge human performance.
15. Several methods of point detection require laborious installation.
16. Point detection can be realized by using devices like video image detection, inductance loop, microwave radar technology etc.
17. We can get information about vehicle volume, lane occupancy, vehicle speed and even vehicle classification by using point detection.
18. Inductance loop requires laborious maintenance.
19. For installation of the inductance loop workers need to remove pavement.
20. An inductance loop is an electromagnetic communication or detection system which uses a moving magnet to induce an electric current in a nearby wire.
21. An inductance loop creates inductance – the ability to store energy in a magnetic field.
22. Performance of video image detection depends on weather conditions.

23. Video image detection doesn't require laborious installation.

24. Video image detection has the ability to provide data on type of vehicle, its registration number, speed ect.

25. Video image detection has been installed on almost every road in our city.

26. I got a fine, because video image detection caught my car's registration number.

27. Microwave radar technology is extensively used to image the terrain, ocean and space.

28. Microwave radar system has risen to the top of the process level instrumentation chain for level measurement needs.

29. Microwave radar technology can be a non-contact or a contacting method of level measurement.

30. When you have a difficult level measurement requirement in a challenging environment microwave radar technology is often the best solution.

31. Cell phone tracking is the ascertaining of the position or location of a mobile phone, whether stationary or moving.

32. There are special phone apps for tracking someone's cell phone.

33. With the satellite tracking app, you can determine when the space station or other satellites are visible from Earth.

34. Cellsence Plus is the most effective cell phone tracking system.

35. Tom Doyle has released a free satellite tracking app.

36. A satellite vehicle tracking software system is the ultimate solution for managing your company vehicles or assets wherever they go.

2. Translate into English.

1. Для решения этой задачи необходимо применить новейшие технологии.
2. Джеймс применил свои навыки выживания в дикой природе, для того чтобы вывести свою группу из леса.
3. Применение нового навигационного оборудования позволяет получать более точные данные о загруженности дороги.
4. Что вы применяете в подобных случаях?
5. Какое латинское слово происходит от греческого слова, означающего круг?
6. Обычная проверка возобновляется, если принимается пять последовательных партий.

7. Укажите максимальное число последующих абзацев для включения в документ автореферата после каждого заголовка.
8. Чем выше производительность труда, тем выше спрос на него.
9. Производительность индукционной петли зависит от качества материала из которого она сделана.
10. Спустя несколько проведенных опытов, удалось выяснить, как повысить производительность данного механизма.
11. Если это программное обеспечение не улучшит производительность вашей системы, значит, это невозможно.
12. Точечное исследование позволяет получать информацию об определенном участке территории.
13. Чаще всего приборы точечного исследования располагаются сбоку от или над дорогой.
14. Некоторые приборы точечного исследования могут располагаться прямо под асфальтом.
15. Благодаря точечному исследованию в некоторых случаях возможно даже определить классификацию ТС.
16. Точечное исследование позволяет анализировать загруженность участков трассы.
17. Производительность индукционной петли зависит от качества материала из которого она сделана.
18. Принцип действия индукционной петли — изменение индуктивности кольцевой петли.
19. Индукционная петля — это простой приёмопередатчик с антенной из провода в виде кольца.
20. Одно из применений индукционной петли — обнаружение металлических объектов.
21. Индукционную петлю используют для обнаружения автомобилей на дорогах.
22. Видеонаблюдение позволяет получить картину происходящего на определенном участке дороги.
23. Видеонаблюдение требует дорогой установки.
24. На дороге было установлено круглосуточное видеонаблюдение.
25. С помощью видеонаблюдения был обнаружен нарушитель скоростного режима.
26. Видеонаблюдение может использоваться не только на дорогах, но и на различных предприятиях.
27. Пользователи отдают предпочтение сверхвысокочастотному радару потому что его можно применять в разных целях.

28. С помощью сверхвысокочастотного радара можно получить данные практически в любых условиях.
29. Рабочая частота различных высокочастотных радаров колеблется от 1 до3,5 Ггц и от 6 до 26 Ггц.
30. Вы можете узнать больше об сверхвысокочастотном радаре в новой книге Лорен Эндрюс.
31. Отслеживание по мобильному телефону достаточно популярная технология.
32. С помощью отслеживания по мобильному телефону можно получить информацию практически о любой машине.
33. Программы для отслеживания мобильных телефонов находятся в свободном доступе.
34. С помощью отслеживания по мобильному телефону можно определить местонахождение ТС и его скорость.
35. С помощью спутникового отслеживания можно найти автомобиль практически в любой точке планеты.
36. Спутниковое отслеживание – это дорогостоящая технология.
37. С помощью спутникового отслеживания автотранспортные предприятия узнают о местонахождении их ТС и грузов.
38. Применяя системы спутникового отслеживания можно контролировать перевозки как внутри города и региона, так и внутри страны и за ее пределами.
39. Погодные условия не влияют на производительность системы спутникового отслеживания.
40. Последовательно пронумеруйте страницы.

UNIT 3. CONGESTION MANAGEMENT STRATEGIC PRINCIPLES

Topic 3.1 Strategic Planning, Strategies and Congestion Management Policy

1. New words and expressions to learn:

to sought – стремиться
inhabitants – жители
to eradicate – искоренять, ликвидировать
well-meaning – благонамеренный
intractable – неразрешимая
vibrant city – динамичный город
authorities – власти
determination – решимость
holistic – комлексный, целостный
struggle – борьба
mitigation actions – действия по снижению
to deploy – развертывать, применять
to implementate – реализовывать
policymakers – директивные органы

2. Read and translate the text:

If society is at all interested in better managing congestion –and any reader of the daily news in most of the world's cities would confirm that it is – it is because many urban inhabitants are affected in some manner or the other by what seems like an intractable problem. And while congestion has historically gone hand-in-hand with the growth and maturity of otherwise dynamic urban areas, citizens certainly feel that much more can and should be done to reduce these impacts. Indeed, much *has* to be done and transport authorities from around the world have shown great creativity and displayed determination and energy in seeking to minimise the adverse impacts of congestion … unfortunately with few durable successes.

The limited successes and past failures in the struggle to contain congestion have been in part due to the framework in which congestion management policies have been deployed.

Many have sought to eradicate congestion, a well-meaning but nearly unrealisable goal, at least in growing and economically vibrant cities. Others have sought to treat congestion "on the roadway" and have been frustrated when changes in travel patterns and demand –

including those brought about by new infrastructure itself –have thwarted their plans. And in many cases, congestion management policies have been deployed in a relatively limited framework that has sought to treat the most immediate aspects rather than adopting a more holistic and strategic vision of the congestion management process.

While there are many possible measures that can be deployed to "treat" congestion, there is no single *perfect* solution. Congestion mitigation actions are part of the broad and complex land use and urban planning and general transport master planning process unique to each urban region. Furthermore, roadway congestion impacts not only road users but all urban inhabitants. The success of the implementation of actions targeting congestion depends on many factors such as place, date, the economic and demographic situation and of course on the type of congestion.

The challenge, therefore for policymakers is developing the appropriate strategic vision of the congestion management process in order to guide the selection of specific and necessarily varied congestion management measures for their city..

3. Answer the questions.

1. Why is the society interested in improving congestion management?
2. What were the authorities trying to do in order to reduce congestions?
3. What were target frameworks to which congestion management policy has been concluded in?
4. What were these frameworks to be targeted on?
5. Do congestion impact on someone else other than the drivers? On who else they are affect?
6. What factors determine the success in the implementation of measures aimed at congestion?
7. What is being developed for policymakers?

4. Translate into Russian.

1. The inhabitants are very unhappy with effects of congestions.
2. Holistic measures have been taken.
3. Transportation authorities are trying to get rid of congestions.
4. This problem is intractable.
5. This struggle has been going on for many years.

Topic 3.2 Strategic Framework for Congestion Management

1. New words and expressions to learn:

congestion – затор
cordon pricing – ценовая политика
to underpinning – поддерживать, подкреплять
assumption – допущение
approach – подход
in its turn – в свою очередь
impact – влияние, воздействие
environment – среда
decision – решение
heterogeneity – неоднородность
purpose – цель
freight transport – грузовой транспорт
framework – рамки, структура, каркас, архитектура
condition – условие, обстоятельство
disbursement – выплаты
appropriate – присваивать (глаг.), соответствующий(прил.)
activity patterns – шаблоны действий
to encompass – охватывать, заключать в себе
equation – уравнение
complication -усложнение

2. Read and translate the text:

Looking across a many of countries and/or regions there is a wide range of conceptual frameworks and operational underpinnings for congestion management policies.

For instance:

- The United States Federal Highway Administration conditions the disbursement of federal funds for congestion-relief infrastructure projects on the premises that all other options have been addressed (traffic management, demand management, etc).
- Japan has a strong belief that in the context of the greater Tokyo region, infrastructure expansion (or more precisely, the completion of road networks) is the first option for managing congestion (followed and/or accompanied by demand management).
- London (U.K.) believes that cordon pricing has delivered a market-based approach, in which roadway users can rationally act on

their travel decisions in response to a price that reflects an approximation of the congestion burden they might impose.

Each of these approaches is based on a national framework, the local and regional context and a set of assumptions. All of these factors, in turn, have an impact on the mix and staging of appropriate congestion management measures.

Addressing the "micro" level drivers of congestion generally entails more traditional transport and roadway operational responses whereas addressing the "macro" drivers of congestion involves much broader instruments since the latter encompass a broad range of factors such as:

- Land use
- Activity patterns
- Time patterns
- Culture of mobility behaviour
- Economic development
- Motorisation
- Fuel price

The individual traveller with his/her experience, habits and behaviour is the centre of the congestion equation. Mitigating congestion means not only bringing about changes in transport and its environment, but also influencing the potential traveller/driver and his/her decision if, how and when to travel. Further complicating the equation is the fact that there exists a great heterogeneity of travellers and travel purposes, including freight transport, which may not be equally responsive to specific congestion management policies.

3. Answer the questions.

1) What kind of strategic framework for congestion management is used in the USA?
2) What kind of strategic framework for congestion management is used in Japan?
3) What kind of strategic framework for congestion management is used in London?
4) What is the basis of the approaches?
5) What kind of factors does "macro" level encompass?
6) What is the centre of the congestion equation?
7) What does mitigating congestion mean?
8) What is the reason of further complicating the equation?
9) What leads to the elimination addressing the "micro" level drivers?

10) What operational underpinnings did you like?

4. Translate into Russian.

1. Subject of congestion is one of the most important in transport area.
2. Harmful emissions have destructive impact on atmosphere.
3. Fright transport provides economical union of country.
4. Cordon pricing has impact on customers.
5. They established a committee to supervise the disbursement of aid.

5. Translate into English.

1. Неоднородность действий водителей усложняет процесс анализа транспортной ситуации
2. Цель транспортной отрасли – доставка груза от производителя к потребителю
3. Для успешного устранения проблемы нужно рассматривать разные подходы
4. При оптимизации перевозки необходимо учитывать различные обстоятельства
5. Трудно переоценить воздействие научного технического прогресса на транспортную инфраструктуру

Topic 3.3 Strategic Planning and Congestion Management

1. New words and expressions to learn:

coherent – последовательный, связный
disbursement – выплаты, расходы
congestion management – управление заторами
to obviate – устранять, избегать
to align – выравнивать, равняться

2. Read and translate the text:

Developing and implementing congestion management approaches that address both the "micro" and "macro" drivers of congestion requires a broad and holistic approach. Measures that only limit themselves to what is taking place on the road (e.g. by focusing on project-by-project piecemeal decision-making) will likely not deliver durable relief from congestion – if they provide any relief at all.

Some public authorities have recognised this need for such an approach and have focused on developing a strategic planning framework for congestion management that seeks to address the problem at its multiple sources.

This approach is one that is often found within national and regional land-use planning applications (such as that of France). Figure 3.1 illustrates the hierarchy of transport policy objectives as defined in the Australian approach. The strength of this approach is that policies applying this concept can deliver traceable and coherent strategies at the local, regional and national levels. Furthermore, when this type of strategic framework is linked to conditional funding of specific projects, this approach can ensure the delivery of specific desired outcomes. Such is the case with the United State's conditional disbursement of gas tax revenue for strategic plan-compliant projects under the Intermodal Surface Transportation Efficiency Act of 1991 and its subsequent iterations.

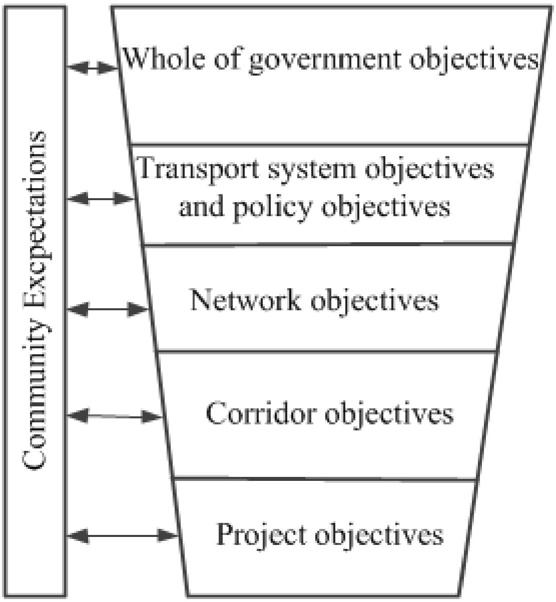

Figure 3.1 – Hierarchy of transport policy objectives as defined in the Australian approach

Under this or other similar frameworks of strategic transport policy setting, policy linkages between different levels of transport planning can be made explicit. For instance, Germany uses a framework for planning its congestion management responses that enables policy-makers to link on road projects to broader areas of policy intervention such as mobility management and land-use planning as illustrated in figure 3.2

This framework allows policy-makers and roadway operators to understand the linkages between the broadest level of measures (Urban development and Land Use Planning) and the most specific (on road Congestion Management). A greater application of the linkages between Urban development and Land Use Planning, because they address many of the underlying drivers of congestion, may obviate to some extent the need for the widespread application of road Congestion Management. This approach also allows transport policy-makers to see where specific congestion management strategies align themselves with longer-term infrastructure development policies falling equally across all axes and with the short-term traffic management policies falling under the rubric of demand oriented "soft" (e.g. non-infrastructure) policies.

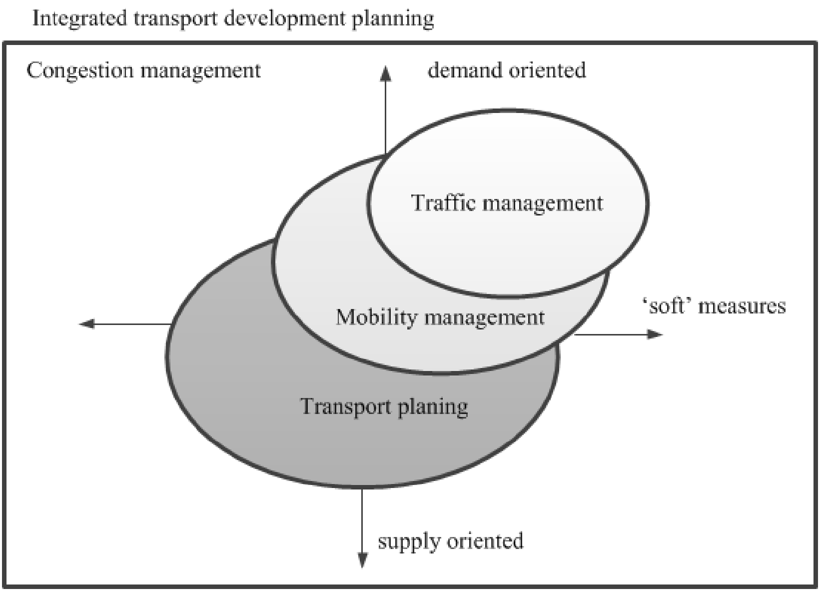

Figure 3.2 – German Classification Framework for Congestion Mitigation Measures

These and other such holistic approaches to defining the framework for congestion management policies are useful because they allow policymakers to ensure that they cover the full spectrum of congestion causes and address specific congestion contributing factors in their responses.

Developing a strategic framework for *assessing* congestion management policies and developing a strategy of *action*, however, are two different activities. In the latter case, policymakers are seeking guidance on *how*, and not necessarily *at what level* to act. What then, can be said about the *strategic principles* that can guide policy-makers in *how* to best manage congestion?

3. Answer the questions.

1) What does developing and implementing congestion management require?
2) What is the advantage of Australian approach?
3) What kind of framework does Germany use?
4) What does this framework allow?
5) Why are these holistic approaches useful?
6) What have public authorities done?
7) What can policies applying Australian approach deliver?
8) What is the broadest level of measures?
9) What is the most specific level of measures?

4. Translate into Russian.

1. Congestion management is a broad, regional level planning tool designed to help manage congestion by identifying congested corridors and recommending multimodal strategies for congestion mitigation.
2. The goal of the congestion management is to provide information that helps transportation planners, professionals and others to understand the overall congestion climate in individual corridors and the region
3. With help of congestion management we can predict where congestion may occur over a lengthy period of time.
4. Congestion management provides a structured framework for evaluating travel demand reduction and operational management strategies
5. Data and information from the congestion management system benefits the transportation planning process by helping the region

focus limited federal transportation dollars where they can have the greatest impact.

5. Translate into English.

1. Управление заторами помогает спрогнозировать возможные заторы на различных участках дороги.

2. Управлением заторами занимается отдельный департамент.

3. Каждый год разрабатываются новые методы, помогающие совершенствовать методы управление заторами.

4. Управление заторами – инновационная методика, помогающая организовать движение на дорогах.

5. Интеллектуальные транспортные системы – комплексная специальность, включающая в себя изучение управления заторами.

Topic 3.4 Strategic Principles for Congestion Management Policy

1. New words and expressions to learn:

interlinkage – взаимоствязь
traffic signals – указатели дорожного движения
urban road – городская дорога
scarcity – ограниченность, недостаточность
saturation level – уровень насыщения

2. Read and translate the text:

Early we detailed the interplay between the availability of new or newly freed-up road capacity and traffic levels. This positive feedback loop, strongest in congested urban areas, is essential in framing the strategic approach for congestion management. The relationship is complex but one should retain that, rather than the impact that policies might have on *existing* levels of demand, what matters most for congestion management efforts is the impact that policies will have on *future* levels of demand – especially those that evolve after the implementation of congestion management measures. If the latter – e.g. the demand for transport capacity after intervention – represents no real improvement over the existing situation from an operational and/or user perspective (the roads are as congested as before but with more vehicles travelling potentially longer distances), what can be said about the purported benefits of the congestion management policies?

Three types of strategies appear to be useful to address the overall demand for road space and have been embodied in the following congestion management principles:

- *Coordinate land use and transport planning*. This principle relates to the speed with which new capacity is utilised – and the impact that policies might have on the nature and scope of future demand for road travel.
- *Deliver reliable transport system performance*. This principle addresses how transport authorities can deliver improvements in road travel performance even when it may be difficult to put in place measures that deliver large travel time savings.
- *Pro-actively manage demand for road capacity*. This principle relates to the necessity to manage capacity such that transport system performance is not negatively impacted.

Principle 1: Ensure that Land Use Planning, and the Community Objectives it Embodies, is Coordinated with Congestion Management Policies. It has been said that the most certain way to cut congestion is through economic depression. This is because one way to avoid crowding on the roads is to avoid crowding in cities – areas that are losing their population due to unfavourable economic conditions are sure to have less crowded roads. Yet this is anathema to urban regions whose very success is linked to their economic, cultural and human dynamism – and rightly so. Are there not tools and strategies at the disposal of governments to more proactively and beneficially manage the scope and nature of urban travel demand?

Many governments believe so and at the heart of these examples is a strong interlinkage between spatial policies and transport policies. These two fields are intimately linked in reality – land uses give rise to trip generation and the interplay between spatially distant origins and destinations gives rise to regional trip patterns. However, in practice, many regions (with many important exemptions) fail to co-ordinate long term land-use and transport planning.

In this context, it is essential that policies seeking to provide long-term congestion relief in urban areas be approached as a coordinated and multi-level, multi-actor process.

Experience from a number of countries and regions, however, has shown that well-thought out land-use policies that explicitly make a link between community expectations relating to the long-term development of the city and transport outcomes, can have a positive impact on a number of outcomes – including traffic and congestion management. And on the other hand: policies that do not confront such community expectations with the impacts on congestion will not lead to durable results (though they will sometimes yield short term successes). As noted elsewhere, while congestion arises on the roads, its solution will necessarily involve actors who have responsibilities in other domains.

The first strategic principle for effective congestion management policies is that urban regions must explicitly link land use policies, and the community expectations that these embody, to congestion management policies.

Principle 2: Deliver Predictable Travel Times. Earlier portions of this report have highlighted the importance of reliability in road transport performance. Congestion impacts both average travel speeds and travel reliability – and there is some evidence that the latter may be more important than the former in that people plan for congested travel but are frustrated by unreliable travel.

This suggests a third general strategic principle subordinate to the ones outlined above: *The second strategic principle for effective congestion management policies is to target travel time variability and the most extreme congestion incidents first when prioritizing congestion management measures since unreliable and extremely variable travel times impose the greatest "misery" on roadway users.*

An increase in the reliability and predictability of travel times can rapidly relieve this "misery". Typical measures include planning and coordination of road works, speedy response to defective traffic signals and to blockages caused by accidents.

Principle 3: Highly trafficked Urban Roadways must be managed to Preserve Adequate System Performance. At present access to urban roads is generally unconstrained by everything but congestion itself. Indeed, congestion by queuing is a powerful rationing mechanism but one that few would agree is efficient.

How might signals of relative road space scarcity in high traffic urban environments, other than low travel speeds and unreliable traffic conditions, be incorporated into the travel-making calculus? The first step would be to recognize that only a very few types of policies can explicitly provide such a signal.

The universe of potential congestion management strategies is vast but most strategies fall into one of two categories – those that either provide new capacity or directly/indirectly free up existing capacity and those that signal scarcity by capping, limiting or otherwise managing traffic levels on the new or recently freed-up capacity.

However one cannot expect that newly added or freed up capacity will not eventually fill up to saturation levels in dynamic urban areas unless the usage of the added capacity is managed in some manner: *The third strategic principle for effective congestion management policies is that, in light of induced and/or suppressed demand, capacity-producing measures should always be accompanied by measures that manage traffic levels on highly trafficked urban roads in order to lock in the benefits derived from new capacity.*

Generally speaking, there are only three broad sets of such "signal-setting" policies that have the immediate potential to temper the phenomenon of induced traffic. All three work by controlling the amount of travel that can take place on the newly available capacity. These are:

- Managing the physical access to the roadway through *access policies*.
- Affecting the ability of potential road users to travel by car to their final destination through comprehensive and consistent *parking policies applied to high trip density locations*.
- Managing the level of traffic seeking to use the available road capacity at different times of the day (e.g. through *pricing policies* that moderate the use of, or access to, road networks or parts of the city).

3. Answer the questions.

1) What congestion management principles do you know?
2) What does the principle of coordinating land use and transport planning mean?
3) Why is the most certain way to cut congestion through economic depression?
4) How can spatial policies and transport policies interlink?
5) What has experience from a number of countries and regions shown?

4. Translate into Russian.

1) Traffic signals, also known as traffic lights, traffic lamps, signal lights and stop lights are signalling devices positioned at road intersections, pedestrian crossings and other locations to control competing flows of traffic.
2) This is where we see a strong interlinkage between unsustainable patterns of production and consumption and economic interests.

3) Urban road tunnels may be used to divert traffic from center cities or to ease this traffic in the center.

4) Scarcity of food forced the herds to move.

5) It is generally accepted that, in most locations, road capacity will not be increased sufficiently to provide for unrestrained growth in car use.

Topic 3.5 No Managing Congestion without Managing Demand

1. New words and expressions to learn:

entity – организация
eloquent – красноречивый, выразительный
witness – свидетель, свидетельство
flow – поток
to devote – уделять, посвящать
constraint – скованность, ограничение, принуждение
to impede – препятствовать, затруднять, мешать
to flatten – выравнивать, сглаживать
to exceed – превышать
to occur – происходить, иметь место
unrestrained – безудержный, несдержанный
mitigation – смягчение, уменьшение (последствий)
to implement – осуществлять
overwhelmed – переполненный

2. Read and translate the text:

A fundamental issue related to the principles enumerated above relates to the *management of what has previously been an unmanaged entity – demand for roads.*

It is not quite fair to say that demand for roads has not been managed in the past – it has – but most often by the queuing triggered by congestion itself. The cumulative energy deployed to address congestion is an eloquent witness to the general dissatisfaction with that type of demand "management". Also, saying that *demand* for roads has often not been managed is not the same as saying that *roads* have not been managed – they have – but the management of roads in many urban areas has not led satisfactory performance at peak hours.

Road infrastructure has traditionally been developed, operated and maintained by government transport or roads administrations. Despite a number of important roads projects undertaken with private sector involvement in some countries, the traditional government roads administration role has generally been maintained. Once road infrastructure has been built, road administrations generally have limited involvement in road network management and in most instances focus on improving flows on the network. For example, administrations typically devote considerable resources to:

- Monitoring roadway and intersection performance, where necessary improving local infrastructure and increasing intersection capacity (through measures such as traffic signal coordination, turning lanes etc.
- Removing constraints that are impeding traffic flows in congested periods (e.g. restricting on-street parking) etc.
- Attempting to maximize the capacity of the infrastructure to meet traffic demand.

By comparison with managers of infrastructure other than roads, road administrations generally have much less of a role – if they are assigned any role at all – in relation to managing overall demand for use of their infrastructure systems. In fact, there may be little consideration given to whether overall demand for use of the road system should be managed at all. In other infrastructure sectors (e.g. water, telecommunications, electricity), infrastructure managers are assigned a key role in managing their infrastructure. Fixed and mobile phone operators and electricity distributors place great importance on managing demand for their infrastructure in ways which flatten use of the infrastructure in peak periods and increase usage in off-peak periods. The same is often true for transport sectors other than roads, although both airlines and rail also limit access so that demand does not exceed the capacity of their services. Airline companies often also spread demand across their networks by charging less for indirect services than direct services.

Such management of network infrastructure demand and usage in these other sectors helps maintain the levels of service provided to users at acceptable levels. Although there are generally occasional delays in telecommunications services or occasional electricity blackouts caused by excess demand, an important distinction from road systems is that such delays tend to be relatively rare. A second important distinction from road infrastructure is that when such delays do occur, the infrastructure managers take action to try to ensure they do not occur again.

In most cases involving other infrastructure, the improved outcomes are achieved by using policies and measures that increase resistance to excess demand appearing on their networks by moderating unrestrained levels of demand.

Unless governments give road infrastructure managers the ability to employ similar policies and measures in road system management, many of the congestion mitigation and management measures that can be implemented will be wasted. This is true not only for improvements to existing infrastructure but also new infrastructure built to reduce congestion. Without proper management, all infrastructure is susceptible to eventually being overwhelmed by demand.

The first principle underlines that demand for roads should be managed in reference to how roadway users and urban dwellers wish to see their community develop and to the types of mobility options they wish to have over the long run. Managing demand for roads should not simply be a technocratic top-down process but should be related to how citizens wish their communities to evolve and function.

3. Answer the questions.

1. Who has developed the road infrastructure?
2. What do administrations usually allocate significant resources for?
3. What role is assigned to heads of infrastructures other than roads?
4. What do airlines and railways do to ensure that in peak periods the demand does not exceed their capabilities?
5. What do people who manage other than road infrastructures do when delays in providing their services occur?
6. What will happen if governments do not provide the road infrastructure managers with the opportunity to use similar policies and measures in managing the road system?
7. What will happen if the infrastructure is not managed properly?
8. How must demand for the road be regulated?
9. What should be demand management for roads related to?
10. What is the main idea of the text?

4. Translate into English.

1. Дорожные власти должны уделять больше внимания проблеме заторов.

2. Нам необходимо сгладить последствия допущенных ошибок.
3. В данном случае это отличие существенно.
4. В итоге мы все равно добьемся чего хотели.
5. Парковка в данном месте препятствует нормальному движению потока.

UNIT Summary and Policy Conclusions

- Measures that only limit themselves to what is taking place on the road (e.g. by focusing on project-by-project piecemeal decision-making) will likely not deliver durable relief from congestion – if they provide any relief at all. An integrated and strategic approach to congestion management is a pre-requisite for success.
- Demand for roads should be managed in reference to how roadway users and urban dwellers wish to see their community develop and to the types of mobility options they wish to have over the long run.
- By comparison with managers of infrastructure other than roads, road administrations generally have much less of a role – if they are assigned any role at all – in relation to managing overall demand for use of their infrastructure systems. In fact, there may be little consideration given to the question of whether overall demand for use of the road system should be managed at all.
- In this context, three important strategic principles emerge which should guide congestion management efforts:

1. Urban regions should explicitly link land use policies, and the community expectations that these embody, to congestion management policies.
2. Target travel time variability and the most extreme congestion incidents first when prioritizing congestion management measures – unreliable and extremely variable travel times impose the greatest "misery" on roadway users.
3. The age of un-managed access to urban roads is coming to an end. In light of induced and/or suppressed demand, capacity-producing measures should always be accompanied by measures that manage traffic levels in order to "lock in" the benefits derived from new capacity.

UNIT 4. IMPROVING THE RELIABILITY OF URBAN ROAD SYSTEM PERFORMANCE

Topic 4.1 Incident Management

1. New words and expressions to learn:

emergency services – аварийные службы;
land line – разметка;
capacity – пропускная способность;
roadway – проезжая часть;
congestion – затор, пробка;
traffic flow – транспортный поток;

2. Read and translate the text:

Incident management is a process of planning and coordinating that detects, responds to and removes the impediments caused by traffic incidents and re-establishes road capacity as quickly as safe and feasible. The impacts of incidents such as crashes, vehicle breakdowns or debris on the roadway typically extend beyond the immediate area surrounding the debris or vehicles involved since responders and emergency vehicles will also be present and enough space must be made available for rescue services to work in safe conditions. The amount of roadspace needed (and thus the amount of roadspace not made available to traffic) will also change over the duration of the incident as emergency vehicles arrive, set up a perimeter, move vehicles/debris off the road and eventually restore capacity. Table 4.1 shows values used to evaluate incident-triggered capacity reductions in the United States on motorways.

Table 4.1 – Temporary Capacity Reduction due to Motorway Incidents

Incident	Motorway with			
	2 lanes	3 lanes	4 lanes	5 lanes
Vehicle moved to shoulder	25%	16%	11%	-
1 lane blocked	68%	47%	44%	25%
2 lane blocked	100%	78%	66%	50%

It is also important to note that incidents will also trigger slowdowns and potentially cause congestion on the lanes in the opposite direction of travel as drivers slow down to see what has or is happening (known as the "rubber-necking" effect). Incident management strategies are composed of 7 broad activities that must be coordinated throughout the duration of the incident and beyond (in the case of traffic management and information communicated to motorists). Figure 4.1 shows Incident Management Activities/

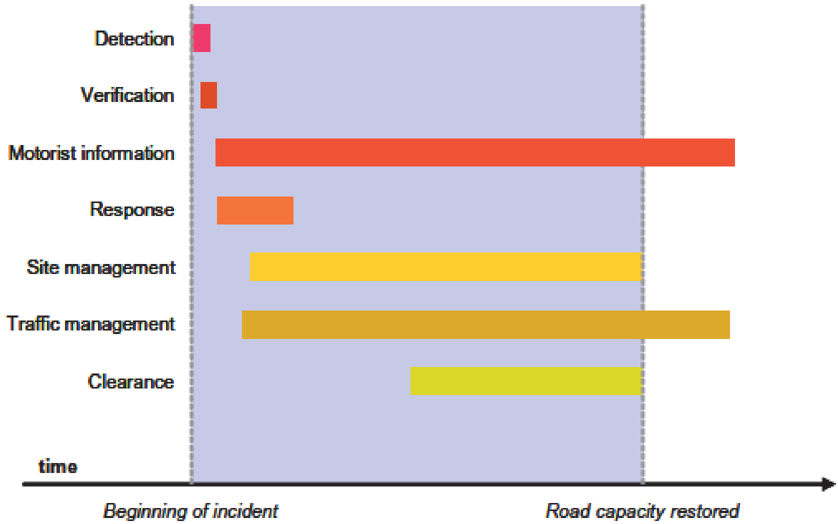

Figure 4.1 – Incident Management Activities

Automatic incident detection can help to speed up incident response. Emergency services have traditionally been alerted to traffic incidents via traditional land-line phone calls and, increasingly, via mobile phone calls. One advantage of the former over the latter is that fixed roadside phones automatically allow emergency services to locate incidents (or at least the origin of the calls) whereas, the automatic location of mobile phones, while technically feasible, requires advanced coordination with telephone service providers. Incident detection systems based on ITS area surveillance and traffic surveillance by cameras, especially on motorways, can accelerate the detection and verification process, which in turn can lead to improved safety outcomes (fewer fatalities) and less congestion (shorter incident duration). One government review of the cost-effectiveness of these systems found that the benefits of automatic incident detection systems outweighed the costs by a factor of approximately 2 to 1 (and up to 2.6 to 1) depending on the local circumstances.

Local police and emergency services play a primary role in addressing road crashes. They are typically responsible for securing the area around the incident and oftentimes have primary responsibility in restoring the roadway back to its normal level of service. Regional traffic management centres (discussed in the next chapter) are an ideal centre where traffic and road management authorities can coordinate with police and other emergency services to ensure the rapid restoration of traffic flows. These centres can also serve as the principal loci for the dissemination of information regarding the incident, travel times and possible detours to motorists who would otherwise be caught unawares. Inter-agency cooperation at the level of traffic control centres is not only effective in clearing crash sites but also in re-establishing traffic flows thus minimising delays, induced congestion and possible further accidents.

This system requires a high level of coordination amongst all agents implicated in clearing crashes, vehicles or other temporary blockages – including both specialist and generalist media (especially radios and, increasingly, web portals. Furthermore, for this coordination to be most effective, it should span the entire urban region and cover motorways and major urban arterials.

The coordination among incident management actors should extend to the coordination amongst, or at least an accounting for, these actors' different ways of treating crash-sites. Emergency service personnel are principally concerned with securing any victims present and ensuring the safety of their personnel. Road authorities are typically concerned with restoring traffic flows as quickly as possible.

Law enforcement agencies also have an interest in keeping crash sites "closed" for investigative purposes. However, in many instances, these objectives need not be divergent and can be met without conflict. Doing so requires established and negotiated protocols to be put into place by both emergency service providers and roads authorities regarding the management of crash scenes – addressing such things as the rapid removal of vehicles, documenting the crash, the number of lanes that must be closed to ensure the safety of emergency responders, upstream signage warning of the crash scene, etc.

3. Answer the questions.

1. What is the incident management?
2. What kind of incidents are used in the text?

3. What can incidents trigger?
4. Automatic incident detection can help to speed up incident response, can't it?
5. How can the emergency services alert?
6. What role do the local police and emergency service play?
7. What tasks are implemented by the regional traffic management centre?
8. What helps to quickly respond to incidents?
9. What are law enforcement agencies interested in?
10. What is the task of incident management?

4. Translate into English.

1.После зимы разметку плохо видно.
2.Из-за аварии на дороге образовался затор.
3.Транспортный поток имеет высокую интенсивность.
4.Старый автомобиль остановился посреди проезжей части.
5.У этой машины высокая производительность.

5. Translate into Russian.

1. Traffic flow is very dense today.
2. Sidewalks are not roadways.
3. Emergency services quickly arrived on the area of incident.
4. The land-line helps the driver to navigate on the road.
5. The drivers of the motor transportation enterprise are of high capacity.

Topic 4.2 Roadwork Management

1. New words and expressions to learn:

to maintain – обслуживать
infrastructure – инфраструктура
surface – покрытие
carriageway – проезжая часть
alert – предупреждение, оповещение
delivery – снабжение, поставка
congestion- затор

2. Read and translate the text:

Roadworks are often necessary to maintain or improve infrastructure in order to deliver ultimately smoother traffic flows but they can be trigger important surges in congestion if not managed properly. The scheduling of such interruptions are oftentimes known in advance to road authorities, but not necessarily to road users who oftentimes experience the onset of these as "unexpected" periods of congestion. It is therefore critically important then that road managers both include congestion management actions when developing and carrying out road maintenance/expansion activities as well as inform road users well in advance of such work, if possible. Traditional communication vectors such as print and radio can alert travellers to forthcoming roadworks prior to their departure while radio, variable message signs and, ultimately, interfaces with in-vehicle navigation systems can inform travellers already underway of potential roadwork-related blockages. Other strategies8 that reduce the impact of roadworks on traffic flows include working during off-peak hours, especially at night, and diverting traffic flows on other alternative roads. Work zone safety rules and protocols are also important from the perspective of work zone related congestion reduction since they can help avoid induced accidents and the congestion that these entail.

Roadwork management is concerned with optimising the trade-off between delays to road users and the cost of different options for carrying out the works. For busy roads, there is a good case for carrying out most of the works at night, when the costs to the highway authority are higher, but the costs of delay are lower. And the decision of whether to close a complete carriageway or a single lane is based on similar analysis.

Roadwork management is usually granted by local administrators, transport operators and public work companies. Information has to be provided before the beginning of the roadwork and managed till the end. Finally, it should be noted that some road administrations are fundamentally re-thinking the relationship between maintenance activities on the road network and the congestion these give rise to. Indeed, rather than asking how the impact of scheduled maintenance activities on traffic flows can be minimized, they have asked how to do away with, or at least greatly reduce the frequency of, necessary maintenance activities. One example is the use of long-life pavement materials requiring resurfacing up to every 30 years rather than typical pavement surfaces which, on average, must be resurfaced every 10 years. In many highly trafficked areas, the added costs of long-life pavements are more than covered by the added benefits of these pavements including the avoided work zone related congestion.

3. Answer the questions.

1. What is the roadwork management?

2. What include the road managers?
3. What is the traditional communication vectors?
4. What is important for related congestion?
5. What concerned the roadway management?
6. Why road work a being at the night time?
7. What information provided by local administrations?
8. Why we use the long-life pavement?
9. What can help avoided the work in zone related congestion?
10. Typical pavement serfaces must be resurfaced every 10 years, isn't it?

4. Translate into English.

1) Наша станция производит обслуживание автомобилей.
2) Это покрытие очень стойкое.
3) Мы снабжаем заказчика всем необходимым.
4) На экране появилось предупреждение о поломке.
5) Инфраструктура – важная часть развития любой отрасли.

5. Translate into Russian.

1) We supply products for many shops.
2) This vehicle needs maintenance.
3) The system can alert about the amount of fuel.
4) The surface needs to be replaced.
5) There is congestion on the carriageway.

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