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UNIT 1 THE FREEWAY CONCEPT

1.1 The Functions of the Traffic Engineer

PRE-TEXT EXERCISES

I. Mind the pronunciation of the following words:

traverse	перетинати
propound	пропонувати
variable	змінна величина
frequency	частота
duration	тривалість
fluctuation	коливання
desirable	бажаний
scheme	схема, проект

II. Learn the following word-combinations:

to traverse urban streets and highways – перетинати міські вулиці та шосе;

to face a motorized society – стояти перед моторизованим суспільством;

to carry plans into practice – приводити плани у дію;

to demand a detailed knowledge – вимагати повних знань;

to refer to the quantity of movement per unit of time – стосуватися кількості руху на одиницю часу;

to depend on the purpose of the study – залежати від мети дослідження;

to establish the relative importance of any route – установлювати відносне значення будь-якого маршруту;

fluctuation in flows – коливання потоку;

distribution of traffic – розподіл руху;

to be desirable / undesirable – бути бажаним / небажаним;

to spoil the specific character of the environment – псувати особливий характер середовища;

to relieve congestion – послаблювати затори;

operating characteristics of the traffic – робочі властивості руху;

to determine the frequency, duration of the flow – встановлювати частоту, тривалість потоку;

to lessen the toll of road accidents – зменшувати втрати у дорожньо-транспортних пригодах.

FUNCTIONS OF THE TRAFFIC ENGINEER

To cater for the enormous flow of motor cars that now traverse urban streets and highways is the function primarily of the traffic engineer. The traffic engineer has a substantial contribution to make to task the complex problem facing a motorized society. Whatever plans are propounded and carried into practice, they

must be as a result of intensity study and co-operation between the planner, sociologist, architect and engineer. So, the traffic engineer should be a member of the town planning team.

Traffic studies form a major part of the traffic engineer's work, as most control and design problems demand a detailed knowledge of the operating characteristics of the traffic concerned.

The results of data collection are used in traffic planning, traffic management, economic studies, traffic and environmental control, and monitoring trends, both for the establishment and updating of design standards. Volume is a variable of the greatest importance to the traffic engineer and is essentially a counting process referring to the quantity of movement per unit of time at a specified location. The quantity of movement may refer specifically to single types of traffic unit – pedestrians, cars, buses, or goods vehicles or to composite groups. Selected time periods will depend on the purpose of the study and, in turn, the required level of accuracy will determine the frequency, duration and subdivision of the particular flow. Volume studies basically establish the relative importance of any route, the fluctuation in flows, the distribution of traffic on a road system, and the trends in road use, but are also used for many other purposes.

The work of the traffic engineer comprises three principal categories.

The first, of course, is the planning and design of effective highways.

It is not always possible; however, nor indeed even desirable to begin with new schemes. In many instances, particularly in some areas of old and developed cities new schemes might be uneconomic or be undesirable because they would spoil the specific character of the environment.

The second task is to make the best of what are available, using such techniques as traffic signals, roadway markings, and one-way traffic routing.

The work is important not only in relieving congestion but in lessening the toll of road accidents.

The traffic engineer’s third field lies in the general sphere of town planning.

TEXT-BASED ASSIGNMENTS

I. Translate into English: величезний потік машин, міські вулиці, суттєвий внесок, складна проблема, дослідження руху, проблеми контролю, робочі властивості, норми проектування, необхідний рівень, ефективні дороги, дорожня пригода.

II. Match words from columns A and B to make word-combinations:

A	B
1) motorized	a) trends
2) operating	b) highways
3) planning	c) society
4) effective	d) congestion
5) roadway	e) team

6) environmental	f) accident
7) monitoring	g) characteristics
8) to relieve	h) unit
9) road	i) control
10) traffic	j) marking

III. Find synonyms of the given words among those in brackets:

1) flow; 2) substantial; 3) to cater for; 4) enormous; 5) to traverse; 6) complex; 7) to propound; 8) to demand; 9) purpose; 10. to comprise; 11) principal; 12) characteristic; 13) volume; 14) instance; 15) goods.

(1) cargo; 2) essential; 3) complicated; 4) case; 5) flood; 6) to satisfy; 7) tremendous; 8) to cross; 9) traffic intensity; 10) feature; 11) aim; 12) to require; 13) to suggest; 14) to include; 15) basic.)

IV. Complete the following sentences:

1. To cater for the enormous flow of motor cars that now traverse urban streets and highways is …. 2. The traffic engineer should operate in cooperation with …. 3. The quantity of movement may refer specifically to …. 4. The required level of accuracy will determine …. 5. The primary functions of the traffic engineer are ….

V. Form sentences using the following words:

1. The, engineer, should, traffic, team, be, town, the, member, of, planning, a.
2. Studies, work, the, traffic, part, a, of, major, form.
3. The, data, are, results, in, used, collection, of, management, traffic.
4. Variable, importance, is, the, a, greatest, of, volume.
5. Time, on, study, selected, the, of, periods, the, depend, purpose, will.

VI. Answer the following questions:

1. What does the traffic engineer have to make a substantial contribution to?
2. Who must take part in the town planning?
3. What forms a major part of the traffic engineer's work?
4. What are the results of data collection used in?
5. What is the volume?
6. What do volume studies establish?
7. How many categories does the wok of the traffic engineer comprise? What are these categories?

VII. Put questions to the following sentences:

1. Most control and design problems demand a detailed knowledge of the operating characteristics of the traffic concerned.
2. Selected time periods will depend on the purpose of the study.

VIII. Write down the main idea of the text and key words.

IX. Make up a summary of the text.

1.2 The Freeway Concept

PRE-TEXT EXERCISES

I. Mind the pronunciation of the following words:

mileage	відстань у милях
annoyance	прикрість
curve	кривизна
distraction	відволікання уваги
alignment	вирівнювання
imply	мати на увазі
prohibit	забороняти
accommodate	пристосовувати
shoulder	узбіччя
median	розділювальна смуга

II. Word-combinations to remember:

toll road – платна дорога;

an arterial highway for through traffic – магістральна дорога для транзитного руху;

grade separation – перетинання у різних рівнях;

right-of-way – смуга відведення дороги;

through lane – проїзна частина;

through roadway– магістральна дорога;

turning movement – потік автомобілів, що повертає;

cross-traffic – рух у пересічному напрямку;

with acceleration and deceleration lane – зі смугою розгону та гальмування;

the level of service – рівень обслуговування;

to eliminate annoyances – усувати неприємності;

blind intersection – тупиковий перетин;

control of access – контроль доступу;

a purchase of rights – купівля прав.

THE FREEWAY CONCEPT

The network of freeways to be built will serve one-fifth of all motor vehicle travel in the United States. About 9,600 miles of the National System of Interstate and Defense Highways are already in use, including some 2,300 miles of toll roads. An increasing mileage of these modern high-type facilities, which will eventually comprise the 41,000-mile system, is being completed every year. Facilities with freeway design are known by various names in different parts of the country – parkways, throughways, turnpikes, expressways, etc.

The freeway concept began to emerge in the parkways designed and built in the late 1920's. The term «freeway» is not the opposite of «toll road». A freeway

(and many toll roads are freeways) is a divided arterial highway for through-traffic, with full control of access and grade separations at all crossings. It is a unpurpose road, a motorist's road. It is defined, in the motorist's mind, not by its physical characteristics but by the level of service it provides. It is the superhighway, eliminating annoyances, hazards of left turns, blind intersections, dangerous curves and distractions close to the roadway.

Control of access – one of the most vital features of freeway design – implies that rights to light, air, view and access are controlled by the public authority. As a rule, this is accomplished through purchase of these rights from abutting property owners at the time right-of-way is acquired. Control of access to the through – lanes also may be insured by the provision of parallel service (frontage) roads separated from the main roadways or by placing the through-roadways on structures above a city street. Other features which make the freeway unique are high-type alignment and substantial dimensions of rights-of-way, lanes, shoulders and median areas.

The bulk of the Interstate (88 % of rural mileage and of the urban) will have the 4-lane design. Six percent of the rural mileage will be 2-lane and the remaining 6 % will be 6 lanes or more. Urban sections will all offer 4 or more lanes, with 37 % having 6 lanes and 20 % – 8 or more lanes.

To quality as a freeway, no crossing movements at grade are permitted. Pedestrians, turning movements, rail crossings and cross-traffic are prohibited or are accommodated on grade separation structures. On the rural sections of the Interstate System, some 48,000 structures will be required. Interchanges, with full acceleration and deceleration lanes, will be provided at average spacing of 3,7 miles.

TEXT-BASED ASSIGNMENTS

I. Give verbs of the same root and translate them into Russian: including, increasing, eliminating, placing, remaining, crossing, turning, spacing, designed, divided, prohibited, separated, permitted, separation, construction, occupation, invention, realization.

II. Give English equivalents: паркова дорога, небезпека лівого повороту, небезпечне закруглення, контроль в'їзду, державна влада, фронтальна дорога, перетин, залізниця, заміський, відрізок, середній інтервал.

III. Find synonyms of the given words among those in brackets:

1) toll road; 2) to complete; 3) various; 4) express-way; 5) to begin; 6) to emerge; 7) to build; 8) grade separation; 9) hazard; 10) roadway; 11) to accomplish; 12) to provide; 13) to acquire; 14) to insure; 15) main; 16) movement; 17) to permit; 18) average spacing; 19) concept.

(1) average headway; 2) traffic; 3) to start; 4) to construct; 5) danger; 6) through lane; 7) turnpike; 8) to finish; 9) superhighway;10) interchange; 11) to obtain; 12) different; 13) to supply; 14) to appear; 15) to fulfill; 16) to secure; 17) to allow; 18) idea; 19) chief.)

IV. Match words from columns A and B to make word-combinations:

A	B
1) toll	a) intersection
2) arterial	b) feature
3) through	c) lane
4) grade	d) road
5) turning	e) annoyances
6) acceleration	f) road
7) to eliminate	g) traffic
8) blind	h) movement
9) unipurpose	i) highway
10) vital	j) separation

V. Put questions to the following sentences:

1. The freeway concept began to emerge in the parkways designed and built in the late 1920's.

2. On the rural sections of the Interstate System, some 48,000 structures will be required.

VI. Complete the following sentences:

1. The network of freeways will serve …. 2. The freeway concept emerged in …. 3. The term «freeway» is not …. 4. A freeway is …. 5. Control of access is one …. 6. Rights to light, air, view and access are controlled by …. 7. Other features which make the freeway unique are …. 8. Crossing movements are not permitted on …. 9. The bulk of the Interstate will have …. 10. Interchanges with full acceleration and deceleration lanes will be provided at ….

VII. Answer the following questions:

1. What network of freeways will be built in the United States? 2. What are the names of the facilities with freeway design in different parts of the country? 3. What does control of access imply? 4. What is a freeway? 5. What does the superhighway eliminate? 6. What may control of access to the through-lanes be insured by? 7. What design will the bulk of the Interstate have?

VIII. Translate into English:

1. Концепція автомагістралі почала з'являтися в паркових магістралях, що спроектовані та побудовані у кінці 20-х років. 2. Автомагістраль – це розділена магістральна дорога для транзитного руху з повним контролем доступу й розв'язками ліній на всіх перетинах. 3. Контроль доступу – це одна з найбільш важливих рис автомагістралі. 4. Автомагістраль є багато-функціональною дорогою, дорогою для автомобіліста.

IX. Write down the main idea of the text and key words.

X. Prepare a short report on the text.

1.3 Patrol and Emergency Services on a Freeway

PRE-TEXT EXERCISES

I. Mind the pronunciation of the following words:

emergency	аварія
authority	влада
disable	виводити з ладу
guidance	керівництво
convoy	супроводити
surveillance	спостереження
customary	звичайний
militate	свідчити проти
prohibition	заборона
tow	буксирування

II. Word-combinations to remember:

to clear accident rate – проясняти аварійність;

to remove disabled vehicles – переміщати пошкоджені транспортні засоби;

to provide assistance – забезпечувати допомогу;

emergency aid – аварійна допомога;

to convoy special vehicles – супроводжувати особливі транспортні засоби;

to anticipate impending trouble – передбачати загрозливі ускладнення;

freeway surveillance – спостереження за автомагістраллю;

to give better access – надавати кращий підхід;

a minor slow-down – незначне сповільнення;

toll roads – платні автошляхи;

to supply aid to stranded motorists – надавати допомогу автомобілістам, які знаходяться у скрутному становищі;

tow trucks – тягач;

to stop on the shoulder – зупинятися на узбіччі;

to remove abandoned vehicles – переміщати покинуті транспортні засоби.

PATROL AND EMERGENCY SERVICES ON A FREEWAY

Duties of the patrol service fall into four categories listed below in the approximate order of priority:

1. Keep traffic moving. This involves detecting and correcting conditions which cause congestion and resultant accidents, also clearing accident sites and removing disabled vehicles.

2. Provide assistance to motorists. This includes emergency aid in case of accident, fire, sickness, service to drivers of disabled vehicles: information and guidance.

3. Enforce traffic and vehicle regulations.

4. Accident prevention and general protection. Included are such duties as convoying special vehicles, alerting drivers to unsafe vehicle conditions, patrolling rest areas.

Conditions that slow or stop freeway traffic are responsible for a high proportion of freeway accidents. If not defected and corrected promptly a minor slow-down develop into a blockade of serious proportions.

The first duty of the freeway patrol unit is therefore one of surveillance to anticipate impending trouble. This is usually carried out by moving patrol, although on high-density urban freeways a system of fixed posts is occasionally used.

Helicopters have been used to a limited extent for freeway surveillance. For this purpose, radio communication with patrol units is essential. Helicopter observation is effective under good conditions, but is restricted during bad weather or hours of darkness. This necessitates a stand-by surveillance procedure for these critical periods.

The surface patrol vehicle has been most commonly used in surveillance. In urban areas the two-wheel motorcycle is widely used for freeway patrol, as it gives better access when a blockade occurs. Cars are employed mainly during off-peak evening hours and in cold weather. On rural sections cars are widely used at all periods, because they can carry supplies and equipment for immediate use in emergency.

The moving patrol results in an intermittent surveillance. A major unresolved question is the proper frequency. During peak-traffic periods on high-density routes, a patrol frequency of 3 to 5 minutes appears to be desirable. In off-peak periods and on less heavily travelled rural sections the frequency is often 20 to 45 minutes. Under whatever conditions, the frequency of patrol on the freeway is substantially higher than that customary on conventional highways.

One condition which militates against minimum patrol frequency is the necessity of supplying aid to stranded motorists. The control of access, plus the prohibition of pedestrians on most freeways, forces the driver to rely almost completely on official agencies to bring needed roadside assistance.

Toll road authorities as a rule arrange operating service areas on the right-of-way to provide for roadside services. During heavy traffic hours, service trucks carrying fuel and other frequently needed supplies patrol major toll roads. During light traffic hours, the trucks, stationed at service areas are dispatched by radio.

In line with the parking prohibition and the probable need in assistance, it is customary to investigate all vehicles stopped on the shoulder. The higher traffic density of urban freeways makes provision of roadside service more difficult and time-consuming, particularly where towing is required.

Unattended, temporarily abandoned vehicles constitute a considerable problem on urban freeways since they tend to distract drivers and disrupt freeway movement. Tow- trucks patrol the freeways each morning and remove abandoned vehicles before the rush period starts.

TEXT-BASED ASSIGNMENTS

I. Choose English equivalents:

1) аварія	a) accident	b) incident	c) addition
2) підхід	a) entry	b) access	c) decline
3) допомога	a) aim	b) add	c) aid
4) сповільнення	a) slowdown	b) shoulder	c) service
5) патруль	a) piston	b) patrol	c) party
6) свідчити	a) militate	b) rotate	c) consider
7) потреба	a) need	b) demand	c) wish
8) спостереження	a) security	b) supply	c) surveillance
9) платний	a) tall	b) toll	c) take
10) здатність	a) capacity	b) volume	c) ability

II. Translate into Ukrainian: peak, density, emergency, authority, prohibition, heavy traffic, disabled vehicle, light traffic, tow truck, militate, slowdown, freeway, extent, aid.

III. Match words from columns A and B to make word-combinations:

A	B
1) private	a) rates
2) abundant	b) opinion
3) heavy	c) capacity
4) poor	d) conditions
5) developing	e) trips
6) daily	f) cars
7) economic	g) competition
8) accident	h) infrastructure
9) maximum	i) countries
10) public	j) resources

IV. Find out synonyms:

A	B
1) condition	a) carrier
2) patrol	b) fittings
3) surveillance	c) examine
4) aid	d) obstruct
5) vehicle	e) obligation
6) blockade	f) guard
7) equipment	g) usual
8) customary	h) assist
9) investigate	i) supervision
10) duty	j) convention

V. Decide whether the statements are true or not. Correct the wrong ones:

1. Conditions that slow or stop freeway traffic are responsible for a high proportion of freeway accidents.
2. Helicopters have been used widely for freeway surveillance.
3. Duties of the patrol service fall into five categories.
4. During peak-traffic periods on high-density routes, a patrol frequency of 3 to 5 minutes appears to be desirable.
5. During heavy traffic hours, service trucks carrying fuel and other frequently needed supplies patrol major toll roads.

VI. Put questions to the second part of the text and ask them to your fellow-students.

VII. Answer the following questions:

1. What is the reason that militates against minimum patrol frequency on freeway?
2. What are the factors that force the driver to rely completely on official agencies in order to get roadside assistance?
3. Where is operating service areas arranged?
4. When do service trucks patrol major toll roads?
5. What is used to a limited extent for freeway surveillance?
6. What does the moving patrol result in?
7. What trucks remove abandoned vehicles before the rush period starts?

VIII. Translate into English:

1. Обов’язки дорожнього патруля поділяються на чотири категорії. 2. Умови, що сповільнюють або зупиняють магістральний рух, є причиною більшої частини дорожньо-транспортних пригод. 3. Дуже важливим є радіо зв'язок з дорожнім патрулем. 4. Нові економічні умови змінили спосіб життя людей. 5. Суспільна думка почала зосереджуватися на якості життя й проблемах захисту навколишнього середовища.

IX. Speak about:

- the towing of disabled vehicles;
- the problem of abandoned vehicles.

X. Make up a plan of the text; prepare a short report on the text.

UNIT 2 SAFETY PROVISION

2.1 Accidents and Safety Provision

PRE-TEXT EXERCISES

I. Mind the pronunciation of the following words:

Experience	досвід
collision	зіткнення
predominate	переважати
fatigue	втома
excessive	надмірний
doze	дрімати
occurrence	випадок
tangent	дотична
substantiate	підтверджувати
proper	відповідний

II. Word-combinations to remember:

angle collision – зіткнення під кутом;
head-on collision – лобове зіткнення;
road surface conditions – умови поверхні дороги;
rear-end collision – наїзд ззаду;
fatality rate – смертність від нещасних випадків;
to hive the lowest accident record – збирати інформацію про найнижчий рівень аварійності;
to occur at an overpass structure – відбуватися на естакаді;
an installation of guard rails – установка огороджень;
tangent section – пряма ділянка шляху;
to substantiate the conclusion – підтверджувати висновок;
to reduce speed under unnecessary conditions – знижувати швидкість за непотрібних умов.

ACCIDENTS AND SAFETY PROVISION

Experience has shown that accident and fatality rates on freeways with full control of access are lower than on highways with either no or partial control.

Types of accidents include angle collision, head-on collision and pedestrian accidents. These are the most fatal. Then there are skidding and car failure accidents. Skidding is mostly caused by weather and road surface conditions.

Rear-end collision predominates on high-volume urban sections, while the single car accident and the rear-end collision are the most common on rural highspeed sections of the road.

Just another type of accident is caused by animals. Over 650 deer were struck on the New York Throughway in 1958, and on the New Jersey Turnpike, more than 400 dogs a year are killed by traffic.

The other major rural freeway accident type is the one – car accident, often involving a fixed object.

High accident record happens to be in early morning hours. The worst fatality rate is found between 2 a.m. and 3 a.m. A large number of drivers involved in these collisions had been drinking or were fatigued or dozing.

Commercial (passenger) buses hive the lowest accident record. The worst record belongs to trailers drawn by passenger cars.

Accidents involving trucks are 1,7 times as frequent as those involving passenger cars, and account for 39 % of all fatal accidents. The truck rate of accidents could be materially reduced by improving rear lighting and truck design and by better control of excessively long periods at the wheel by commercial drivers.

Half of the fatal accidents involving trucks occur when a truck is struck from the rear by another vehicle. This is interpreted as a strong argument against a speed limit differential between trucks and passenger cars.

A number of factors appear to contribute to the pattern of freeway accidents by location. It has been found that the probability of an accident occurring at an overpass structure is little different from the probability of an accident on another section of the freeway. But the odds that an accident will result in a fatality are nine times as great at a structure.

Fatalities may be substantially reduced:

a) by improved road surface;

b) by the installation of guard rails;

c) by up-grades, which even as low as 2 %, have a direct effect on accidence occurrence on rural sections;

d) by proper and respective lighting;

e) by proper use of regulatory signs, especially on tangent sections.

In general findings appear to substantiate the conclusion that factors which force traffic to reduce speed under unnecessary conditions will contribute to accidents.

TEXT-BASED ASSIGNMENTS

I. Choose English equivalents:

1) зіткнення	a) collision	b) collapse	c) condition
2) поверхня	a) surpass	b) surface	c) service
3) аварійність	a) attack	b) incident	c) accident
4) втома	a) fault	b) fatigue	c) depress
5) необхідність	a) nobility	b) mobility	c) necessity
6) доступ	a) ability	b) access	c) attain

7) занос	a) skidding	b) kidding	c) destruction
8) пішохід	a) vehicle	b) pedestrian	c) passenger
9) швидкість	a) source	b) right	c) speed
10) знижувати	a) reduce	b) redact	c) increase

II. Translate into Ukrainian: improve, collision, substantiate, result, pedestrian, failure, common, rural, car access, fixed object, fatigue, doze, commercial, record, truck, account, guard rail, tangent section.

III. Give:

a) synonyms of the following words: to lower, clash, to make better, misfortune.

b) antonyms of the following words: low, rare, best, safe, to increase.

IV. Match words from columns A and B to make word-combinations:

A	B
1) angle	a) effect
2) fatality	b) limits
3) tangent	c) conditions
4) guard	d) conclusion
5) car	e) signs
6) speed	f) collision
7) to substantiate	g) rate
8) unnecessary	h) rail
9) regulatory	i) accident
10) direct	j) section

V. Complete the following sentences:

1. Experience has shown that accident and fatality rates on freeways with full control of access are lower …. 2. Types of accident include …. 3. Skidding is mostly caused by …. 4. Just another type of accident is caused by …. 5. The worst fatality rate is found between …. 6. The worst record belongs to …. 7. The truck rate of accidents could be materially reduced by …. 8. It has been found that …. 9. In general findings appear to substantiate the conclusion that

VI. Decide whether the statements are true or not. Correct the wrong ones:

1. Types of accident include angle collision, head-on collision and pedestrian accidents.

2. Rear-end collision predominates on rural sections.

3. Skidding is mostly caused by weather and road surface conditions.

4. High accident record happens to be in evening hours.

5. The other major rural freeway accident type is the one – car accident, often involving a fixed object.

6. Commercial (passenger) buses hive the highest accident record.

7. The worst record belongs to trailers drawn by passenger cars.

8. Accidents involving trucks are 1,7 times as frequent as those involving passenger cars, and account for 45 % of all fatal accidents.

9. Half of the fatal accidents involving trucks occur when a truck is struck from the rear by another vehicle.

10. It has been found that the probability of an accident occurring at an overpass structure is little different from the probability of an accident on another section of the freeway.

VII. Answer the following question:

1. When are accident and fatality rates lower?
2. What do types of accidents include?
3. When does high accident record happen to be?
4. What has the lowest accident record?
5. How could the truck rate of accidents be materially reduced?
6. How may fatalities be reduced?

VIII. Translate into English:

1. Види автопригод включають зіткнення під кутом, лобове зіткнення та нещасні випадки з пішоходами. 2. Наїзд ззаду переважає на міських дорогах. 3. Високий рівень нещасних випадків відбувається в ранкові години. 4. Вірогідність аварії на естакаді трохи відрізняється від вірогідності аварії на інших ділянках дороги.

IX. Speak about:

– problems of accident and fatality rates;
– fatality reduction.

X. Make up a plan of the text; prepare a short report on the text.

2.2 Road Signs

PRE-TEXT EXERCISES

I. Mind the pronunciation of the following words:

coherent	зрозумілий
comply	підкорятися
confirmatory	підтверджувальний
caution	застереження
perceive	усвідомлювати
longitudinal	подовжній
hazard	небезпека
bear	носити, нести

dazzle	засліплення
dimension	розмір

II. Word-combinations to remember:

to form a coherent system – складати зрозумілу систему;
to comply with instructions – підкорятися вказівкам;
to contradict traffic regulations – суперечити дорожнім нормам;
danger warning sign – попереджувальний знак;
regulatory sign – регулювальний знак;
mandatory sign– обов'язковий дорожній знак;
advanced sign – висунутий вперед знак;
confirmatory sign – підтверджувальний знак;
longitudinal markings – подовжня розмітка дороги;
to give warning of possible road hazards – попереджувати об імовірних дорожніх небезпеках.

ROAD SIGNS

All road signs, traffic light signals and road markings installed in their territory must form a coherent system. The number of types of signs must be limited and signs be placed only at points where they are deemed useful.

Road users are to comply with the instructions conveyed by road signs, light signals and road markings even if the instructions appear to contradict other traffic regulations.

Road signs are of the following types:

a) danger warning signs: these signs are intended to warn road-users of a danger on the road and so inform them of its nature;

b) regulatory signs: these signs are to inform road-users of special obligations, restrictions or prohibitions with which they must comply, they are subdivided into: 1) priority signs, 2) prohibitory or instructive signs, and 3) mandatory signs;

c) informative signs: these signs are intended to guide road-users while they are travelling or to provide them with other information which may be useful. They are subdivided into: 1) advanced signs; 2) direction signs; 3) road identification signs; 4) place identification signs; 5) confirmatory signs; 6) other signs providing useful information or indicating facilities to road-users.

Signs are so placed that the drivers can recognize them easily and in time. They are normally placed on the side of the road appropriate to the direction of traffic or above the carriageway. Signs may be made to apply to only one or to several lanes when the latter are defined by the longitudinal markings.

The dimensions of sign panels must be large enough to be easily visible for a distance and understood by a person approaching it. Road signs, in particular danger warning and regulatory ones are usually lighted or equipped with reflecting material provided that this does not result in road-users being dazzled.

Danger warning signs have to be sited to give warning of possible road hazards with due caution for a driver to perceive in time. The signs must be the most effective both by day and night, having regard to road and traffic conditions, including the normal speed of vehicles and the distance at which the sign is visible.

Advance direction signs are placed at a distance approximately about 50 meters from the intersection in built-up areas, but must be not less than 500 meters on motorways and other roads carrying fast traffic.

One direction signs may bear the names of several places; the names appear one below the other on the sign. The letters used for one place name may be larger than those used for the others only if the place in question is the largest of them.

Place identification signs are used to show the frontier between two geographical or state places or the boundary between two administrative divisions of the same country or the name of a built-up area, river, mountain pass, beauty spot etc.

TEXT-BASED ASSIGNMENTS

I. Choose English equivalents:

1) розмітка	a) marking	b) making	c) putting
2) вважати	a) doom	b) deem	c) done
3) зрозумілий	a) capable	b) cognitive	c) coherent
4) суперечити	a) contradict	b) consult	c) construct
5) обов'язки	a) duty	b) obligation	c) population
6) підкорятися	a) comply	b) convince	c) consider
7) розмір	a) deduction	b) sight	c) dimension
8) зменшувати	a) recycle	b) restart	c) reduce
9) усвідомлювати	a) perceive	b) purpose	c) predict
10) небезпека	a) warning	b) hazard	c) harm

II. Translate into Ukrainian: traffic light, deem, road sign, prohibition, comply, mandatory sign, advanced, identification sign, confirmatory, carriageway, longitudinal, built-up area, frontier, division, facilities, beauty spot.

III. Give

a) synonyms of the following words: section, limitation, helpful, danger, understandable;

b) antonyms of the following words: low, urban, bad, many, modern.

IV. Match words from columns A and B to make word-combinations:

A	B
1) road	a) signal
2) regulatory	b) useful
3) to provide	c) area

4) longitudinal	d) spot
5) reflecting	e) warning
6) to give	f) user
7) built-up	g) material
8) beauty	h) marking
9) to deem	i) information
10) light	j) sign

V. Complete the following sentences:

1. Road users are to comply with …. 2. Signs are so placed that the drivers can …. 3. Signs may be made to …. 4. The dimensions of sign panels must be …. 5. Road signs, in particular danger warning and regulatory ones are …. 6. Danger warning signs have to be …. 7. The signs must be …. 8. Advance direction signs are placed at …. 9. One direction signs may bear …. 10. Place identification signs used to ….

VI. Decide whether the statements are true or not. Correct the wrong ones:

1. All road signs, traffic light signals and road markings installed in their territory must form a coherent system.
2. Road users are to comply with the instructions conveyed by road signs, light signals and road markings even if the instructions appear to contradict other traffic regulations.
3. Signs are so placed that the drivers cannot recognize them easily and in time.
4. They are normally placed on the side of the road appropriate to the direction of traffic or above the carriageway.
5. Road signs, in particular danger warning and regulatory ones are not usually lighted or equipped with reflecting material.
6. Danger warning signs have to be sited to give warning of possible road hazards with due caution for a driver to perceive in time.
7. The signs must be the most effective only by day.
8. Advance direction signs are placed at a distance approximately about 20 meters from the intersection in built-up areas.
9. One direction signs may bear the names of several places; the names appear one below the other on the sign.
10. Place identification signs used to show the frontier between two geographical or state places or the boundary between two administrative divisions of the same country or the name of a built-up area, river, mountain pass, and beauty spot.

VII. Answer the following questions:

1. What must a coherent system form?

2. What are road users to comply with?
3. What are the types of road signs?
4. How are the signs placed?
5. What must the dimensions of sign panels be?
6. Where are advance direction signs placed?
7. How are place identification signs used?

VIII. Translate into English:

1. Кількість знаків повинна бути обмежена. 2. Регулювальні знаки інформують водіїв про особливі обов'язки, обмеження та заборони, котрих треба дотримуватися. 3. Знаки повинні розміщатися так, щоб водії могли впізнавати їх легко та вчасно. 4. Щоб добре бачити панелі знаків на узбіччі, треба, щоб їх розміри були достатньо великі.

IX. Speak about:

– the types of road signs;
– peculiarities of road signs placement.

X. Make up a plan of the text; prepare a short report on the text.

UNIT 3 VISUAL ATTENTION

3.1 Visual Attention

PRE-TEXT EXERCISES

I. Mind the pronunciation of the following words:

halt	зупинка
hindrance	перешкода
range	межа, діапазон
impede	перешкоджати
abutment	торець
furniture	улаштування
background	задній план
amber	жовтий
patchiness	ямний ремонт
onlooker	спостерігач

II. Word-combinations to remember:

to ensure visibility – забезпечувати видимість;
opposite direction traffic – зустрічний рух;
the curve of the road – вигин дороги;
sharp turn – крутий поворот;
dark background– темний фон;
to use the road at night– використовувати дорогу вночі;
degree of brightness – ступінь яскравості;
specular reflection – віддзеркалення;
without glare discomfort – без блискучого дискомфорту;
to provide a suitably illuminated field of view – забезпечувати відповідно освітлювальне поле зору;
well-lit streets – добре освітлені вулиці;
external lighting sources – зовнішнє джерело освітлення;
to define the width and length – визначати ширину та довжину;
poorly-lit streets – погано освітлені вулиці;
pedestrian convenience – зручність пішоходів;
a sufficient light background – достатній фон освітлення;
high-power beam – потужний промінь.

VISUAL ATTENTION

Ensuring visibility of road surface and opposite direction traffic is a necessary condition of road safety. Visibility is considered secured when the driver sees the surface and an opposite moving vehicle on the eyes level (1, 2 m high) at the

distance which provides the half of his own moving device before the hindrance. The angle of the driver's sight must be four times the distance of the possible braking. In reality road visibility is usually lower than calculated due to side green plantations and different road structures.

Visibility is improved by taking away all obstacles on the curve of the road. If visibility on sharp turns is insufficiently deep, mirrors are installed on the sides.

On curvature ranges of the road markings and warning signs are necessary.

Visibility is often impeded by curvature, hedges and trees, bridge abutments and street furniture, masking by other vehicles and mud splash. These are some of the factors to be taken into account of in both sign's design and location. It will be apparent from these considerations that different road conditions will affect the size, colour and location of road signs.

As viewing takes place by night as well as by day, the effect of illumination of the sign must be considered together with the types of reflectorisation. The colours preferred for use against the darker backgrounds of vegetation and housing are amber, white and then red, in that order.

The road may be intensively used at night. A standard degree of brightness over the areas of signs and the road is essential for clarity, and all lighting must avoid the production of specular reflections and patchiness.

Vehicle lighting has two main requirements:

a) to vehicle, and the parking and rear lights help to define the width and length of the vehicle.

b) to provide the driver with a suitably illuminated field of view consistent with operating speeds and road conditions at all times.

There are three conditions under which vehicles must be seen.

1. Well-lit streets. These are usually traffic routes, where external lighting sources provide enough illumination to show, a clear outline of the clearly define the vehicle to an external viewer from all approach angles and without glare discomfort to the onlooker.

2. Poorly lit streets. These should only occur in residential areas, which are mainly lit for pedestrian convenience and as such do not provide a sufficient light background to make oncoming vehicles visible or for drivers to detect other objects without the use of headlights. Speeds on this type of road should be low.

3. Streets without lighting. Some urban and most rural roads have no street lighting and the approach of a vehicle is determined by its own lighting. At high speeds on such roads a long, high-power beam is required.

TEXT-BASED ASSIGNMENTS

I. Translate into Ukrainian: surface, moving vehicle, eye level, possible braking, green plantation, obstacle, mirror, bridge abutment, street furniture, glare, safety, rear lights, oncoming vehicle, rural road, approach, sufficient.

II. Give English equivalents: умова, видимість, зворотний, відстань, перешкода, кут, гальмування, поле зору, рух, насадження, розміщення, безпека, кривизна, колір, розвиток, наближення, задній план.

III. Match Ukrainian and English equivalents:

A	B
1) direction	a) перепона
2) secure	b) обрис
3) obstacle	c) зовнішній
4) to impede	d) придатний
5) mirror	e) забезпечувати
6) vegetation	f) дзеркало
7) requirement	g) затримувати
8) suitable	h) рослинність
9) external	i) напрям
10) outline	j) вимога

IV. Find out synonyms of the given words among those in brackets:

1) traffic; 2) to secure; 3) obstacle; 4) requirement; 5) to define; 6) route; 7) vehicle.

(a) carrier; b) determine; c) way; d) transport; e) hindrance; f) protect; g) need.)

V. Make the word-combinations using the words in both columns:

A	B
1) moving	a) illumination
2) road	b) beam
3) green	c) route
4) sharp	d) objects
5) to provide	e) discomfort
6) vehicle	f) plantation
7) glare	g) visibility
8) to detect	h) lighting
9) traffic	i) turn
10) high-power	j) device

VI. Complete the following sentences:

1. Visibility is considered secured when …. 2. The angle of the driver's sight must be …. 3. Visibility is improved by …. 4. Visibility is often impeded by …. 5. It will be apparent from these considerations that …. 6. The colours preferred for use against the darker backgrounds of vegetation and housing are …. 7. A standard degree of brightness over the areas of signs and the road is …. 8. These are usually traffic routes, where …. 9. These should only occur in…. 10. Some urban and most rural roads have no ….

VII. Answer the following questions:

1. What is a necessity condition of road safety? 2. What must the angle of the driver's sight be? 3. How is visibility improved? 4. What is visibility impeded by? 5. When must the effect of illumination on the sign be considered? 6. What are the two main requirements for vehicle lighting? 7. What are three conditions under which vehicles must be seen?

VIII. Find an appropriate word for each blank space using the following words:

at night	all obstacles	the possible braking	road surface
	high-power beam	warning signs	street lighting

1. Ensuring visibility of … and opposite direction traffic is a necessary condition of road safety.
2. Visibility is improved by taking away … on the curve of the road.
3. The angle of the driver's sight must be four times the distance of ….
4. On curvature ranges of the road markings and … are necessary.
5. The road may be intensively used ….
6. Some urban and most rural roads have no … and the approach of a vehicle is determined by its own lighting.
7. At high speeds on such roads a long, … is required.

IX. Speak about:

– requirements of the vehicle lighting;
– conditions under which vehicles must be seen.

X. Make up a plan of the text; prepare a short report on the text.

3.2 Sight Distance

PRE-TEXT EXERCISES

I. Mind the pronunciation of the following words:

circumstance	обставина
appropriate	відповідний
assessment	оцінка
intersection	перетин
perception	сприйняття
brake	гальмувати
assumption	припущення
maneuver	маневр
opportunity	можливість
alignment	вирівнювання

II. Word-combinations to remember:

to assess situation – оцінювати обстановку;
to take appropriate action – ужити відповідних заходів;
to vary according to circumstances – змінюватися згідно обставинам;
frequent occasions – часті випадки;
stopping sight distance – шлях гальмування;
passing sight distance – відстань видимості під час обгону;
intersection sight distance – відстань видимості на перетині;
perception time – час сприйняття;
break reaction time – час між гальмуванням та реакцією водія;
an overtaking driver – водій, що обганяє;
to complete passing maneuver – завершати маневр обгону;
to be dependent on many variables – залежати від багатьох змінних;
an overtaken vehicle – автомобіль, який обганяє;
topographical conditions – топографічні умови.

SIGHT DISTANCE

The necessity for a driver to see sufficiently far ahead to enable him to assess developing situations and to take appropriate action is obvious. The most frequent occasions that arise are those: a) calling upon him to stop when approaching an obstacle, b) requiring a decision regarding overtaking, and c) requiring an assessment of the course of action to be taken at an intersection. The sight distances needed in the circumstances are discussed below under the headings of stopping sight distance, passing sight distance and intersection sight distance.

Stopping sight distance. The distance is made up of three components: (a) the distance travelled during the perception time, (b) the distance travelled during the brake reaction time and (c) the distance travelled during braking. Values of 15 and 10s are normally accepted for the perception, and break reaction time respectively in most road conditions encountered.

Passing sight distance. An overtaking driver on a two-way road requires sufficient visibility ahead to ensure that there is a large enough gap in the opposing traffic stream to safety complete the passing maneuver. This safe passing sight distance is dependent on many variables, but by making a number of simplifying assumptions a model can be developed. The assumptions are that the overtaken vehicle travels at constant speed and that the overtaking vehicle travels at the same speed whilst awaiting a suitable opportunity to overtake. An overtaking driver also requires a perception time before commencing a manoeuvre and during the maneuvre accelerates to a speed which is, on average, 16 km/h faster than the overtaken vehicle. The overtaking vehicle returns to its own lane with a safe clearance distance between it and the oncoming vehicle is assumed to be travelling at the same average speed as that of the overtaking vehicle.

Minimum overtaking sight distances are required in the operation of two-way flow roads and are based on the time an overtaking vehicle occupies a counter-flow lane. Practical safe distances will vary according to circumstances, e. g. the speeds

of overtaking and overtaken vehicle, approach vehicle speeds in the counter-flow lane, the number and size of overtaken vehicles and also alignment characteristics.

Safe passing distances are considerably greater than safe stopping sight distances and situations will arise where topographical conditions make it reduced.

TEXT-BASED ASSIGNMENTS

I. Translate into Ukrainian: assess, appropriate, obvious, occasion, intersection, circumstances, two-way road, sufficient visibility, gap, traffic stream, variable, assumption, constant speed, suitable opportunity, overtake, on average, counter-flow lane, alignment characteristics, topographical conditions.

II. Choose English equivalents:

1) відносний	a) relative	b) reluctant	c) reliable
2) розмір	a) side	b) size	c) strike
3) знаходити	a) to found	b) to find	c) to fulfill
4) підхід	a) abroad	b) approach	c) appointer
5) змінювати	a) change	b) challenge	c) exchange
6) попит	a) demand	b) need	c) supply
7) перетин	a) extension	b) intersection	c) exercise
8) обмежувати	a) line	b) lay	c) limit
9) міра	a) measure	b) pleasure	c) amount
10) сприяти	a) ensure	b) favour	c) increase

III. Match words from columns A and B to make word-combinations:

A	B
1) to assess	a) opportunity
2) to take	b) vehicle
3) to approach	c) stream
4) perception	d) a model
5) road	e) time
6) traffic	f) action
7) sufficient	g) an obstacle
8) to develop	h) conditions
9) suitable	i) situation
10) overtaken	j) visibility

IV. Decide whether the statements are true or not. Correct the wrong ones:

1. The necessity for a driver to see sufficiently far ahead to enable him to assess developing situations and to take appropriate action is obvious.
2. The distance is made up of four components.
3. Values of 15 and 9 s are normally accepted for the perception, and break reaction time respectively in most road conditions encountered.
4. This safe passing sight distance is dependent on many variables.

5. The assumptions are that the overtaken vehicle travels at constant speed and that the overtaking vehicle travels at the same speed whilst awaiting a suitable opportunity to overtake.

6. The overtaking vehicle returns to its own lane with a safe clearance distance between it and the oncoming vehicle is assumed to be travelling at the same average speed as that of the overtaken vehicle.

7. Maximum overtaking sight distances are required in the operation of two-way flow roads and are based on the time an overtaking vehicle occupies a counter-flow lane.

8. Safe passing distances are considerably greater than safe stopping sight distances.

V. Choose the most appropriate answer to complete the sentence:

1. The necessity for a driver to see sufficiently far ahead to enable him to assess developing:
   a) demands;
   b) circumstances;
   c) situations.
2. The distance is made up of three:
   a) components;
   b) keys;
   c) answers.
3. Values of 15 and 10 s are normally accepted for the perception, and break reaction time respectively in most road:
   a) situations;
   b) conditions;
   c) components.
4. An overtaking driver on a two-way road requires sufficient visibility ahead to ensure that there is a large enough gap in the opposing traffic:
   a) stream;
   b) route;
   c) part.

VI. Answer the following questions:

1. What is it necessary for a driver?
2. What are the most frequent occasions?
3. What headings are the sight distances discussed under?
4. What is the safe passing sight distance dependent on?
5. How can a model of the safe passing sight distance be developed?
6. What time are minimum overtaking sight distance based on?
7. What are considerably greater than the safe stopping sight distances?

VII. Translate into English:

1. Дуже важливо для водія бачити досить далеко уперед, щоб оцінювати ситуації, що розвиваються. 2. Безпечна відстань, що дозволяє зробити обгін,

залежить від багатьох змінних. 3. Якщо зробити деякі припущення, то можна опрацювати певну модель. 4. Практична безпечна відстань змінюється згідно обставинам.

VIII. Speak about:

– stopping sight distance;
– passing sight distance;
– safe passing distance.

IX. Write out the key facts from each part of the text.

X. Make up a plan of the text; prepare a short report on the text.

3.3 Eye and Object Heights

PRE-TEXT EXERCISES

I. Mind the pronunciation of the following words:

height	висота
acuity	гострість
discernible	помітний
summit	на найвищому рівні
anthropometry	антропометрія
earthwork	земляні роботи
centripetal	доцентровий
junction	перехрестя
minor	незначний
mandatory	обов'язковий

II. Word-combinations to remember:

to be dependent on the eye height – залежити від рівня розміщення ока;
eye height of the observer – рівень розміщення очей спостерігача;
anthropometric measurements – антропометричні вимірювання;
summit curve – вигнута крива;
sag curve – угнута крива;
earthwork cuttings – викоп ґрунту;
average visual acuity – середня гострість зору;
to be adopted for economic reasons – прийматися через економічні причини;
centripetal acceleration – доцентрове прискорення;
mandatory control – обов'язковий контроль;
side road – бічна дорога;
minor road – другорядна дорога;
priority junction – перетин, де здійснюється регулювання руху з пріоритетом для однієї з доріг, що перетинаються.

EYE AND OBJECT HEIGHTS

The sight distance available is dependent on the eye height of the observer which in United Kingdom practice is taken as 1:05 m. This inevitably represents a compromise as anthropometric measurements and vehicle dimensions will vary considerably. The minimum height selected for the object is also important and ideally should be the minimum detail discernible by, at least, the average visual acuity, for the given speed and viewing conditions.

The principal control in the design of summit curves is the sight distance requirement. Two conditions arise which depend on whether the vertical curve is longer or shorter than the specified sight distance. Because large earthwork cuttings may be needed for the establishment of safe passing sight distances it is frequently the case that the shorter safe stopping sight distances are adopted for economic reasons.

Riding comfort. The effect of travelling over a summit curve is to give an apparent loss of weight and, on a sag curve, an apparent increase due to the centripetal acceleration.

Sight distances at junctions. The operation of junctions is affected by the sight distances allowed for approaching drivers and the relative and absolute speeds of the vehicle manoeuvres. Priority junctions are the simplest form of mandatory control and are either of the Give Way (or yield) type and those requiring the side-road vehicle to stop at the major road.

In the case of Give Way junctions it is necessary for a driver approaching on the minor road to have a sufficiently long length of the intersecting road in view to enable him to assess the major road traffic situation, and to make a decision whether to cross or not. A view far enough back along the approach is needed to enable a stop to be made at the junction, if required.

Where there is a STOP control on the side road of the junction a halted driver must have time to perceive the traffic situation, decide to cross (perception-reaction time) and accelerate from the stopped position to clear the junction (acceleration time).

TEXT-BASED ASSIGNMENTS

I. Translate into Ukrainian: eye height, compromise, anthropometric measurements, vehicle dimensions, acuity, summit curves, sag curve, centripetal acceleration, junction, mandatory, major road, minor road, accelerate, clear the junction, traffic situation.

II. Choose English equivalents:

1) спостерігач	a) observer	b) arrangement	c) organization
2) розміри	a) detail	b) dimensions	c) consume
3) гострість	a) acuity	b) search	c) examine
4) крива	a) crane	b) curve	c) cater

5) причина	a) reason	b) respect	c) attitude
6) перехрестя	a) jump	b) junction	c) point
7) обов'язковий	a) regular	b) main	c) mandatory
8) усвідомлювати	a) perceive	b) enable	c) achieve
9) прискорення	a) acquire	b) acceleration	c) accident
10) оцінювати	a) evident	b) apparent	c) assess

III. Match words from columns A and B to make word-combinations:

A	B
1) eye	a) junction
2) summit	b) control
3) anthropometric	c) road
4) earthwork	d) reasons
5) visual	e) acceleration
6) economic	f) acuity
7) centripetal	g) curve
8) mandatory	h) cuttings
9) side	i) height
10) priority	j) measurements

IV. Decide whether the statements are true or not. Correct the wrong ones:

1. The sight distance available is not dependent on the eye height of the observer.

2. The minimum height selected for the object is also important.

3. Three conditions arise which depend on whether the vertical curve is longer or shorter than the specified sight distance.

4. The effect of travelling over a summit curve is to give an apparent loss of weight.

5. The operation of junctions is not affected by the sight distances allowed for approaching drivers and the relative and absolute speeds of the vehicle manoeuvres.

6. Priority junctions are the simplest form of mandatory control.

7. In the case of Give Way junctions it is necessary for a driver approaching on the major road to have a sufficiently long length of the intersecting road in view to enable him to assess the major road traffic situation, and to make a decision whether to cross or not.

8. Where there is a STOP control on the side road of the junction a halted driver must have time to perceive the traffic situation.

V. Choose the most appropriate answer to complete the sentence:

1. The sight distance available is dependent on the eye height of the:
   a) observer;
   b) viewer;
   c) worker.

2. The principal control in the design of summit curves is the sight distance:
   a) condition;
   b) requirement;
   c) consequence.
3. Priority junctions are the simplest form of mandatory:
   a) car;
   b) bus;
   c) control.
4. Where there is a STOP control on the side road of the junction a halted driver must have time to perceive the traffic:
   a) condition;
   b) situation;
   c) water.

VI. Answer the following questions:

1. What is the sight distance dependent on?
2. What does the sight distance represent?
3. What should the minimum height selected for the object be?
4. What conditions arise?
5. Why are the shorter safe stopping sight distances adopted?
6. What is the effect of travelling over a summit curve to give?
7. What is the operation of junctions affected by?

VII. Translate into English:

1. Відстань видимості залежить від рівня розміщення очей спостерігача. 2. Мінімальна висота, яка була обрана для об'єкта також важлива. 3. Робота перехресть залежить від відстані видимості. 4. Перехрестя – це найпростіша форма обов'язкового контролю.

VIII. Divide the text into some logical parts.

IX. Write out all the key words from the text.

X. Make up a plan of the text; prepare a short report on the text.

3.4 Circular Curves

PRE-TEXT EXERCISES

I. Mind the pronunciation of the following words:

tire	шина
alternative	вибір
counteract	протидіяти
balance	рівновага
judgment	думка

design	план
irrational	ірраціональний
accommodate	пристосовувати
shallow	мілкий
parabolic	параболічний

II. Word-combinations to remember:

coefficient of friction – коефіцієнт тертя;
treaded tire – шина з протектором, що відновлюється;
icy surface – льодова поверхня;
to set an upper limit – встановлювати верхню межу;
a factor of safety – чинник безпеки;
frictional force – сила тертя;
road heating – підігрівання дороги;
to maintain the vehicle in the curve – утримувати засіб пересування на кривій;
drivers' feelings of comfort – відчуття комфорту водіїв;
design speed – проектна швидкість;
friction requirements for curvature – вимоги тертя для кривизни;
to experience negative friction – зазнавати негативне тертя;
to accommodate the average speed – пристосовувати середню швидкість;
sides of triangle – боки трикутника.

CIRCULAR CURVES

The value of the coefficient of friction for a treaded tire on an icy surface, is about 0,1 and this sets an upper limit to super elevation for such conditions (i.e. 1 in 10), but allowing a factor of safety, a value of 0,07 is generally recommended for roads liable to freezing and built without road heating.

The speed at which no frictional force is required to maintain the vehicle in the curve is called the «hands off» speed. Maximum side friction factors are based on drivers' feelings of comfort with the higher values causing discomfort.

There are the alternatives for superelevating curves of less than the maximum curvature. The method of sufficient superelevation is applied to counteract all out-of-balance forces for a vehicle travelling at the design speed without using friction. Friction requirements for curvature increase rapidly and drivers are, in effect, presented with two different types of curves, and hence a more complicated judgment in negotiating a curve is necessary. Further, the majority of cars will be travelling at less than the design speed and these will experience negative friction on the flatter curves, i.e. they will be travelling at less than the «hands off» speed and will tend to slip in towards the centre. This tendency will have to be counteracted by the irrational manoeuvre of steering out of the curve.

Method 2 overcomes this latter difficulty by applying superelevation to accommodate the average speed. This still suffers from the defect of giving two

types of curves for the driver to judge – those flatter and those sharper. Method 3 is theoretically logical but does not allow for the common tendency to drive faster on shallow curves. Accordingly method 4 has been suggested in which the superelevation curvature relationship is parabolic and tangential to the sides of triangle.

TEXT-BASED ASSIGNMENTS

I. Choose English equivalents:

1. тертя	a) friction	b) revolution	c) development
2. підігрівання	a) negotiating	b) heating	c) expanding
3. чинник	a) corrector	b) director	c) factor
4. проектна	a) design	b) intent	c) trend
5. зазнавати	a) exercise	b) experience	c) clear
6. трикутник	a) triangle	b) scarcity	c) science
7. рівновага	a) compare	b) balance	c) contract
8. межа	a) lever	b) lay	c) level
9. пристосовувати	a) accommodate	b) consist	c) cover
10. можливість	a) opportunity	b) necessity	c) probability

II. Translate into Ukrainian: experience, judgment, balance forces, counteract, factor of safety, icy surface, treaded tire, sides of triangle, parabolic, tangential, shallow, measure, irrational, requirements for curvature, available data, suffer, associate, definition, take into account, accessibility.

III. Find out synonyms:

A	B
1) urban	a) to embrace
2) to influence	b) to determine
3) characteristic	c) need
4) limit	d) term
5) curvature	e) municipal
6) feeling	f) property
7) to define	g) to affect
8) period	h) boundary
9) to cover	i) sensation
10) requirement	j) bend

IV. Match words from columns A and B to make word-combinations:

A	B
1) treaded	a) judgment
2) icy	b) curve
3) road	c) discomfort
4) frictional	d) tire
5) balance	e) force

6) design	f) heating
7) flatter	g) force
8) to cause	h) manoeuvre
9) complicated	i) speed
10) irrational	j) surface

V. Find an appropriate word for each blank space:

1. The speed at which no frictional … is required to maintain the vehicle in … is called the «hands off» speed.
2. Maximum … are based on drivers' feelings of comfort with the higher values causing discomfort.
3. There are the alternatives for … of less than the maximum curvature.
4. Friction … for curvature increase rapidly and drivers are, in effect, presented with two different types of curves, and hence a more complicated judgment … is necessary.
5. This tendency will have to be counteracted by … of steering out of the curve.

VI. Decide whether the statements are true or not. Correct the wrong ones:

1. The value of the coefficient of friction for a treaded tire on an icy surface is about 0,2.
2. The speed at which no frictional force is required to maintain the vehicle in the curve is called the «hands off» speed.
3. Maximum side friction factors are based on drivers' feelings of comfort with the higher values causing comfort.
4. There are the alternatives for superelevating curves of less than the maximum curvature.
5. Method 1 overcomes this latter difficulty by applying superelevation to accommodate the average speed.
6. Method 3 is theoretically logical but does not allow for the common tendency to drive faster on shallow curves.
7. This tendency will have to be counteracted by the irrational manoeuvre of steering out of the curve.

VII. Answer the following questions:

1. What is the value of the coefficient of friction for a treaded tire on an icy surface?
2. How is the speed at which no frictional force is required to maintain the vehicle in the curve called?
3. What are maximum side friction factors based on?
4. What are the alternatives for superelevating curves?
5. When is the method of sufficient superelevation applied?
6. When is the superelevation curvature relationship parabolic and tangential to the sides of triangle?

VIII. Divide the text into some logical parts.

IX. Write out all the key words from the text.

X. Make up a plan of the text; prepare a short report on the text.

3.5 Transition Curves

PRE-TEXT EXERCISES

I. Mind the pronunciation of the following words:

instantaneous	миттєвий
straight	прямий
radius	радіус
infinity	нескінченність
disjoint	відділення
spiral	спіраль
parabola	парабола
arc	дуга
magnitude	величина
negotiate	обмірковувати

II. Word-combinations to remember:

a straight path – прямолінійна траєкторія;
circular curve – кругова траєкторія;
transition curve – перехідна крива;
constant radius – незмінний радіус;
to present a visually pleasing line – представляти візуально приємну лінію;
tangent point – точка дотику;
leading dimensions – основні розміри;
cubic parabola – кубічна парабола;
to be dependent on the vehicle's speed – залежати від швидкості транспортного засобу;
unbalanced sideways force – незбалансована бічна сила;
the magnitude of the force – величина сили;
total length of curve – загальна довжина кривої.

TRANSITION CURVES

A vehicle cannot instantaneously change from a straight path to a circular one of constant radius, and it is usual practice to employ a transition curve changing the radius from infinity at the start to that of the circular one at the end. A transition length is also necessary in order to gradually apply the superelevation as the radius increases and to present a visually pleasing line without a disjoint at the tangent point. Many types of transition curves have been proposed such as the spiral, the

lemniscates and the cubic parabola, but as road vehicles are not confined to a single path the differences between the curves for most practical radii are largely immaterial. The spiral is widely used and the leading dimensions given, in this test refer to its characteristics.

The modified Short formula takes the superelevation into account and the expression reduces to the traditional Short relationship for zero superelevation.

Leeming and Black investigated the path followed by a large number of drivers during the transition movement from straight to circular arc. They found that the path followed depended on the unbalanced sideways force a driver was willing to accept. The magnitude of this force is dependent on the vehicle's speed and on the radius superelevation combination. Drivers proportion the amount of the curve spent in transition and in a constant circular arc according to the speed, the radius superelevation combination, sideways force and the total length of curve to be negotiated.

TEXT-BASED ASSIGNMENTS

I. Give English equivalents: крива, перехідний, круговий, незмінний, нескінченність, радіус, дотик, спіраль, парабола, залежати, розмір, характеристика, вираз, бічний, дуга швидкість, засіб пересування, обмірковувати.

II. Form nouns of the verbs by means of the following suffixes: -tion, -ion, -ment, -ation: to decide, to develop, to apply, to consider, to improve, to operate, to combine, to separate, to transport.

III. Match Ukrainian and English equivalents:

A	B
1) vehicle	a) відділення
2) path	b) дуга
3) constant	c) сила
4) infinity	d) перехідний
5) transition	e) постійний
6) disjoint	f) нескінченність
7) expression	g) траєкторія
8) difference	h) засіб пересування
9) arc	i) вираження
10) force	j) різниця

IV. Match words from columns A and B to make word-combinations:

A	B
1) straight	a) arc
2) to apply	b) dimensions
3) constant	c) parabola
4. usual	d) length
5) pleasing	e) radius

6) transition	f) practice
7) tangent	g) path
8) leading	h) pricing
9) cubic	i) point
10) circular	j) superelevation

V. Complete the following sentences:

1. A vehicle cannot instantaneously change from a straight path to…. 2. A transition length is also necessary in order to …. 3. Many types of transition curves have been proposed such as …. 4. The modified Short formula …. 5. Leeming and Black investigated the path …. 6. They found that …. 7. The magnitude of this force is dependent on …. 8. Drivers proportion the amount of the curve spent ….

VI. Decide whether the statements are true or not. Correct the wrong ones:

1. A vehicle can instantaneously change from a straight path to a circular one of constant radius.
2. A transition length is also necessary in order to gradually apply the superelevation as the radius increases and to present a visually pleasing line without a disjoint at the tangent point.
3. The spiral is not used and the leading dimensions given, in this test refer to its characteristics.
4. Many types of transition curves have been proposed such as the spiral, the lemniscates and the cubic parabola
5. The modified Short formula takes the superelevation into account and the expression reduces to the traditional Short relationship for zero superelevation.
6. The magnitude of this force is not dependent on the vehicle's speed and on the radius superelevation combination.
7. Drivers proportion the amount of the curve spent in transition and in a constant circular arc according to the speed.

VII. Answer the following questions:

1. What is it usual practice to employ?
2. When is a transition length also necessary?
3. What types of transition have been proposed?
4. What is widely used?
5. What does the modified Short formula take into account?
6. What did Leeming and Black investigate?

VIII. Divide the text into some logical parts.

IX. Write out all the key words from the text.

X. Make up a plan of the text; prepare a short report on the text.

UNIT 4 SUPPLEMENTARY TEXTS

EVERYDAY ENGLISH AND TECHNICAL ENGLISH

At present, the contacts between people of different countries are increasing. This enhances the importance of the study of foreign languages. However, sometimes we don't even know which of the world's languages we should take into consideration.

The matter is that the total number of languages in the world is very large. In different reference books it varies from five to eight thousands. The numerical distribution of people speaking different languages is extremely uneven. There are not many languages in the world each of which has more than 50 million people. On the other hand, there are languages spoken by only several thousands of people. To the first group belong such languages as English, Chinese, French, Russian, Ukrainian, etc. At the opposite extreme stand languages like Chitimacha, an American Indian language which in the late 1930's[1] had only two speakers left.

Everyone should understand that for the linguist there are no big or small languages. For each people the language is not only a means of communication, but also an embodiment of national and cultural values. Nevertheless, when we have to decide which of the world's languages to study, we take into consideration the differences in the social and functional status of each language.

When we consider English, we cannot misregard the fact that the English language is spoken by more native speakers than any other language except, presumably, North Chinese. English is native or the first language for the most population of Great Britain, USA, Canada, Australia, and New Zealand. Besides, there are many areas, former British colonies (India, Nigeria, Ghana) where English is not a native language, but a second language with official status in education and administration, and for communication between speakers of other languages. If we take into account the important factor of speakers of English as a foreign language, it is most widely spread of the world's languages.

In Ukraine, higher schools students and postgraduates are trained to have a good knowledge of English, to read and use professional literature in their practical activity. Let us dwell on some peculiarities of technical English

Technical English is often said to be difficult to understand. At first sight this may seem true. There are a number of reasons why technical writing is rather difficult. It concerns first of all its vocabulary.

The scientific and technological progress has enriched the vocabulary with a great deal of new words, new meanings and new word-combinations. Who today does not know such words as computer, transistor, laser, etc.? Scientists and technologists also use many ordinary, everyday words to denote new terminological meanings. For example, the words aroma, and charm with the meaning attractiveness are used to denote the physical characteristics of the quark, a fundamental physical particle.

Each branch of science and technology has its own vocabulary (terminology). Many of them are formed on the basis of Greek or Latin words and are often international. Some technical words, such as power, roll, stress, strain, movement, etc. borrowed from everyday English sometimes cause much greater difficulty than terminology. In addition to terms, a text on some special problem usually contains so-called learned words, such as approximate, compute, feasible, exclude, indicate, initial, respectively, etc.

As to the familiar grammatical patterns and models, they are the same as in everyday English. There is, certainly, a difference in the frequency with which certain grammatical forms occur.

Scientific and technical writing is usually about things, matter, natural processes, and it is impersonal in style. The Passive Voice of verb forms, the constructions Subject and Complex Object are frequently used. The first person singular is not generally used.

Simple sentences are rarely used, for isolated facts of events are seldom dealt with by the engineer. He has to show what the connection is, not only what happens, but also how it happens, when it happens, why it happens, and what is being affected.

The style of most scientific texts, besides being impersonal, is also very concise. It is because the author-scientist is writing primarily for other scientists.

In order to master technical English the learner must first acquire a thorough knowledge of everyday literary English with its grammar, vocabulary and rules of word formation. Then it will be easy for him to learn, step by step, the peculiarities of technical English. It should be born in mind, however, that understanding and translation of scientific-technical literature requires an additional training connected with knowledge of specific terminology.

SCIENCE HELPS MEN TO SURVIVE

The present civilization is on the eve of the third millennium of our era. According to some scientists, man has lived on the Earth for over 2,000,000 years. The development of human life has been very rapid if we consider man's existence as one long uphill struggle for survival in the severe environment.

One of the greatest philosophers of antiquity Lucretius Carus, in his poem «On the Nature of Things», described how human life changed: man learned to use fire, skins and dwellings and established the laws of marriage and good neighbourliness.

It took man some 20 thousand years to learn how to use the energy of fire and how to use clay for making pots, to domesticate animals and to be able to make the simple clothes for himself. It was some 10 thousand years ago that writing was invented, and it became possible for people to record and pass on their knowledge about the environment from generation to generation. It was practically not long ago (in 1454–55) that the printing press was invented, and so books were used to disseminate knowledge.

A scientific explanation of the world surrounding man began in prehistoric times, probably in Egypt and Babylonia, more than 2,000 years B. C. But true progress in science did not begin until the sixth century B. C., when the Greek civilization was in full flourish. Any school student can name many contributions made to the development of science and techniques in the period from the ancient Greeks to the Renaissance. The scholars of ancient Greece and Rome say in their records that by the time they came on the scene humanity had gone a long way and had acquired many skills and a great deal of knowledge. From its first steps, the development of science and technology has influenced the growth of our civilization more and more.

Today we see the world in which social, industrial and even political order has been greatly influenced by science. The achievements of science and technology during the past hundred years have modified our homes, places of work, means of communications and even our enjoyment. In general, although not always, scientific progress has engendered technology and medicine. Solving the problem of the environment – such as global warming, or the depletion of the ozone layer is the task of technology.

Science now is radically changing the instruments of production, the objects of labour and the whole of technology and organization of production. It has become a productive force while production is becoming a technological branch of modern science.

Due to the progress of science and technology in our remarkable age we may speak of an entirely new era of supersonic speeds.

In the twinkling of an eye – which scientists say lasts about one sixth of a second – a modern supersonic plane covers a distance of nearly a quarter of a kilometer, and a space rocket – several kilometers. A special research camera can take more than 100 million shots a second; some very fine chemical reactions take only a thousandth or a ten thousandth of a second, while the fission of uranium nuclei lasts a few millionths of a second.

Man cannot follow, let alone control, such speeds by conventional levers, switches or relays. And so he adopted light for his speedometer. It is the fastest thing there is, and covers 300,000 kilometers a seconds. For his executive man chose the electron, the smallest and most mobile particle of the material world. Its speed and versatility has helped man to make a great number of electronic instruments and devices, the most important of them being the electronic amplifier. Having become the basis of a new field of science and technology known as electronics or radio electronics, it found a wide application.

WILL THE EARTH BE LUCKY A THIRD TIME?

According to one hypothesis, our planet was twice threatened with the fate of becoming a lifeless celestial body and thus sharing the lot of Venus and Mars, our neighbours in the solar system. Four and a half thousand million years ago,

when the Earth's atmosphere had just begun to form, a mere 5 °C separated it from the fatal boundary beyond which begins the greenhouse effect which turned the surface of Venus into a seething inferno. Two thousand million years later a mere +1 °C saved the Earth from freezing under a blanket of ice such as that which covers Mars today.

Now Mars, the Roman god of war, threatens, both literally and figuratively, to reign supreme on the Earth and turn it into an iceberg in space. The sad truth is that the transformation of the common home of all people into an icy desert may be brought about by man himself, who stands at the tree of life with a thermonuclear axe in his hands.

Immense amounts of dust, soot, ash and smoke, thrown up into the Earth's atmosphere by the monstrous force of thermonuclear explosions, would screen out the Sun for a long period of time, and screen it out from people forever. The heaven would turn upside down, so that cold would descend upon the Earth, while heat would be trapped in the upper layers of the atmosphere. All the continents would turn into Antarctic, but their snow and ice would be black. The rays of the Sun would take so long to reach the Earth that none of us would ever find out how long the nuclear winter would last ...

Such in general outline is the description of the thermonuclear Apocalypse, a description, handed down to us not by John the Apostle but computed by American scientists, and later confirmed by their European colleagues. The prospect of a nuclear winter forces us all, both in the East and in the West, to take a sober look at the harsh reality.

That certain truths have become obsolete signifies that we have reached troubled times, when many prenuclear doctrines and postulates must be discarded, once and for all. The only possible continuation of politics in our time is peace.

People everywhere must learn the truth about nuclear war. According to UN experts, its very first explosions would instantly kill 200 million people and inflict grievous wounds on another 60 million. The probable overall number of victims of the first nuclear strikes would be 700–800 million civilians and 70– 80 million combatants. Within just a few days of an all-out nuclear war one third of mankind would perish. The fate of those surviving from radiation poisoning is excruciatingly painful.

Many Western specialists, including authoritative scholars, believe that our civilization may poison itself even without a nuclear war, that we may be suffocated by industrial wastes and wither away amid environmental degradation. The only source of funds for environmental protection is disarmament.

Mankind can no longer live and act in the old way. The universal struggle against war is the only way to preserve peace. Only then will we be able to give a positive answer to the question: will the Earth be lucky for a third time?

All of us, earthlings of the present generation, are a link in the chain of universal human progress. We are answerable both to our ancestors and to future

generations. Our duty is not only to save the Earth from a thermonuclear catastrophe but also to begin, through the joint efforts of all states, to heal its wounds, to save it from another possible catastrophe – an ecological one.

THE ETHICS AND SOCIAL RESPOSIBILITY OF SCIENTISTS AND TECHNOLOGISTS

Modern scientific and technological progress has raised a complicated problem of the social responsibility of scientists. Here are some of them: How far are scientists responsible for the application of their work? If they are how they can best fulfill this responsibility? What is the ethics of scientific exploration, how is it related to the universal ethical values of mankind? Finally a number of scientists have raised the problem of the socio-ethical control of research referring to man, the justification for a moratorium on some fields of research threatening man and the entire mankind. Is such control possible in whatever form? Will it not restrict the freedom of research? How is this freedom related to the social and humanistic responsibility of scientists and technologists?

The very fact that these specific problems are raised at all levels with increasing clarity shows the dissatisfaction with the idea that science is a self-contained and absolute value, a sphere of unadulterated knowledge independent of all other values of humanity and standing above them.

Scientists are realizing more and more clearly the indisputable fact that their social responsibility, the role of the ethical principle in science should grow in geometrical progression, if mankind and science itself are to develop at least in arithmetic progression. The ethics of science is being asserted as a sine qua поп of effective performance of humanistic-oriented scientific research. There is no alternative to this either for science or for humanity.

In mastering nuclear energy man has developed a power which, unless controlled by his intellect, could extinguish life and snuff out our planet's blue glow. This idea is convincingly proved by the disaster at the Chernobyl atomic power station in Ukraine. Such accidents take place from lack of knowledge in the fields of natural and technical sciences or from lack of consciousness about the negative consequences of the application of the scientific and technological innovations.

In the event of war, the last lines of civilization's history will be written in thermonuclear ink.

So it is not without reason that modern science is compared to Pandora's Box. Indeed, its eternal curiosity compels mankind to learn what is there beyond the Pillars of Hercles. But has mankind enough common sense, social responsibility and self-control to resist the temptation of dangerous curiosity? This is, in effect, a life-and-death question for mankind.

Science and technology by themselves are not a source of ethics and values. They can tell you what will happen if you do this or that: for instance, how many people might be killed by a nuclear bomb. But the decision on whether to develop

the bomb cannot be a scientific decision. This can only be judged by something outside science – ethics. Scientists and technologists should be aware of the consequences of their discoveries, projects.

Hence the crucial importance is attached today to the problem of socio-ethical control of science with a view to its humanistic orientation and development as a science for man. We need a new ethics and it must be many-sided. The belief that only one idea is true is tremendously dangerous. If you have only one way of looking at the world you abuse it. The new ethics must recognize that there are many ways out of the human predicament, which present different aspects of the same situation.

Only on the basis of such an ethical attitude can we solve the problems which threaten the world today – the destruction of the environment, drugs, AIDS, totalitarism. It is our duty to share a better world for all of us here on Earth.

POSTGRADUATE RESEARCH WORK AT ENGLISH UNIVERSITIES

The undergraduate course of studies at English universities is completed when students are ready to take their Degree examinations. After graduating they attain the first academic degree or distinction of a Bachelor of Science or a Bachelor of Arts. Those that have a bent for research work may apply for an advanced course of study extending over not less than two academic years for full-time postgraduates and not less than three academic years for part-time graduate students. A Ph. D. course in the United States can seldom be completed in less than four years even by a very brilliant student. The fact is that an American graduate student is usually forced to complete a relatively large number of lecture-courses and examinations before he can even apply for permission to submit a thesis. Some of this lecture-work represents material that the British undergraduate would have covered in his last year.

The British graduate who wants to do research and can get himself accepted by a university at all can cover his living expenses and fees by means of scholarship or a government grant without being specifically required to do any teaching or other work outside his research. Indeed, strict limits are usually set on the amount of teaching he may do, and other work is often forbidden altogether. This contrasts very strongly with the position of the American graduate student, who for the most part is obliged to take some part-time job. Thus he may be appointed a graduate-assistant by his department. A typical stipend would be 1,500 dollars a year, for which he is expected to give almost as much time to teaching as does a full member of the staff. This will usually consist mainly of laboratory demonstrating and supervising classes held in conjunction with the lectures and nearly always includes some formal lecturing. Add to this that a graduate student also has to pass various examinations and to pile up a fairly impressive record of attendance at advanced lectures as well as keeping himself informed in his own special field, and the wonder is that he has time for original thought at all.

Every postgraduate working on a research problem is provided with an adviser and referees for the refereeing and evaluation of his thesis.

On completing his course of study every candidate must submit a thesis which must comply with the following conditions:

a) the greater portion of the work submitted there in must have been done subsequently to the registration of the student as a postgraduate;

b) it must form a distinct contribution to the knowledge of the subject and afford evidence of originality, shown either by the discovery of new facts or by the exercise of independent critical power.

A candidate will be also required to forward a short abstract of his thesis comprising not more than 300 words.

If the thesis is satisfactory on all points the candidate will be awarded the degree of Doctor of Science or a Ph. D. and will continue his work in the academic field.

ENVIRONMENT SHOULD BE OUR COMMON CONCERN

It has been repeatedly said that a society which turns its back on nature is doomed. Many people today believe that the dominant forces of global society are, in fact, ignoring Nature's needs.

Everywhere the natural environment is being over-exploited, weakened and soiled. Man uses atmosphere as both a resource and a place for depositing wastes. He takes from atmosphere oxygen as a necessary ingredient for his industrial activities and for his own biological processes. He returns to it a mixture of gases and solids, the by-products of combustion, respiration and other energy-transmitting activities.

The historical development of urbanization and industrialization has produced geographical regions where the natural balance is disturbed. Evidence abounds that the dangers of uncontrolled industrialization are leading to the pollution of lakes and rivers and human tragedies like those which occurred at Bhopal (India), where thousands of people died as a result of a deadly gas leak from a chemical plant in 1984 or at Chernobyl atomic power plant (Ukraine) in 1986. Just as obvious are the large-scale loss of tree cover, soils and biological diversity as a result of uncontrolled economic development, and the horrors of chemical warfare and nuclear power testing. We have all experienced the result: air pollution, a shortage of drinking water, the ruin of forests, soil degradation, etc. As a result people are affected directly or indirectly.

Some effects are direct and evoke physiological response (eye irradiation, respiratory diseases, etc.); other effects are indirect, but nonetheless disturbing. Women, for instance, have learned that their breast milk is contaminated with dioxin, that pesticides and herbicides are present in ground water. They are told that the life-giving sun is becoming dangerous due to a weakened ozone layer, that children everywhere are vulnerable to genetic disorders caused by contaminated environments.

As the planet's natural resources diminish, and a growing world population increases demands on those resources, competition for access to them will escalate. This struggle for limited resources will result in new resource wars.

The major environmental threat to life on Earth is the weakening of the ozone layer. The Earth's ozone shield – the vital layer of the atmosphere – protects all living creatures from the damaging effects of the Sun's rays.

Recent scientific research proved data that the protective layer of ozone around our planet is under severe attack. The major cause of weakening of the ozone layer is believed to be the increasing amount of harmful chemicals that are being released into the atmosphere by mankind. Many scientists warn that the chemicals in spray cans also add to the destroying of the Earth ozone shield. Scientists stress that a further one per cent drop in the overall ozone layer can cause an increase of skin cancer.

ЕЛЕКТРОННЕ НАВЧАЛЬНО-МЕТОДИЧНЕ ВИДАННЯ

Чехлань Надія Олександрівна
Мудра Тетяна Володимирівна

МЕТОДИЧНІ ВКАЗІВКИ ДО ВИКОНАННЯ ПРАКТИЧНИХ РОБІТ З ДИСЦИПЛІНИ «АНГЛІЙСЬКА МОВА ПРОФЕСІЙНОГО СПРЯМУВАННЯ» (ДЛЯ СТУДЕНТІВ 3-4 КУРСІВ НАПРЯМУ ПІДГОТОВКИ 6.070101 «ТРАНСПОРТНІ ТЕХНОЛОГІЇ (ЗА ВИДАМИ ТРАНСПОРТУ)» ДЕННОЇ ТА ЗАОЧНОЇ ФОРМ НАВЧАННЯ)

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