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Code for Design of Urban Road Traffic Facility

城市道路交通设施设计规范

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1 General Provisions

1.0.1 With a view to maintaining order operation, security, smoothness and low public nuisance of urban road traffic, unifying technical standards of urban road traffic facility design, guiding engineering construction, and achieving comprehensive function of urban road traffic facility, security and practical advanced technology as well as economy and rationality, this code was formulated.

1.0.2 This code is applicable to design of traffic facilities for constructed, renovated and extended roads. Urban road traffic facilities shall include traffic signs, traffic markings, protection facilities, traffic signal lamps, traffic surveillance and control systems, service facilities, road lighting and power transformation and distribution as well as management offices and equipment.

1.0.3 Urban road traffic facility shall be designed according to road nature, environment along the line and traffic flow characteristics; and in addition, it shall meet the requirements of relevant planning, overall design of road and energy conservation and environmental protection in the project location area.

1.0.4 The overall dimensions and load of the design vehicle adopted in the urban road traffic facility design shall meet the requirements of the current national standard "Limits of Dimensions, Axle load and Masses for Road Vehicles" (GB 1589).

1.0.5 The urban road traffic facility shall be designed synchronously with the principal part of the road engineering; and the design is carried out according to the principles of overall design and phased implementation. For the relevant foundation engineering and piping of the principal part of the engineering, they shall be reserved and embedded during implementation of the principal part of the engineering.

1.0.6 The urban road traffic facility design shall meet the requirements of this code as well as those specified in the current national standards.

2 Terms and Symbols

2.1 Terms

2.1.1 Right of way

Right of road user to carry out traffic activities in certain space at certain time according to the requirements of traffic laws and regulations.

2.1.2 Warning sign

The sign used to warn the vehicles and pedestrians for noticing the road traffic.

2.1.3 Prohibition sign

The sign for prohibit or restrict traffic of vehicles and pedestrians.

2.1.4 Mandatory sign

The sign used to direct vehicles and pedestrians.

2.1.5 Guide sign

The sign used to deliver message on road direction, place and distance.

2.1.6 Changeable message sign

Changeable message sign can change its displayed content according to the change of traffic, road and climate.

2.1.7 Active luminous sign

The sign with figures and symbols and can give out light from inside through electric energy or other energy resources; under relatively dark environment, it can be clearly identified.

2.1.8 Retro-reflection

The reflection which the reflecting light reflects from the opposite direction near the opposite direction and returns to the light source.

2.1.9 Delineator

It is used for indicating heading direction of the road and the edge contour, and is designed with retro-reflection characteristics or initiative lighting function.

2.1.10 Roadside clear zone

2.1.20 Delimitation structure

Major structure surrounding clearance of carriage way.

2.1.21 Collision protection facilities for main structure

Collision protection member enhanced on the major structure easy to be collided.

2.1.22 Collision protection facilities for subsidiary structure

Collision protection facility arranged independently ahead of the major structure easy to be collided for protecting the major structure.

2.1.23 Guard fence

Fence arranged for preventing pedestrians and non-motor vehicles from entering into the expressway, ramp or other prohibited area.

2.1.24 Acoustic barrier

A specially designed acoustical baffle placed between the noise source and the sound receiving point.

2.1.25 Traffic surveillance and control

A kind of technical measure for operation and management of road traffic provided for the traffic manager through collection, treatment and launching of traffic message.

2.2 Symbols

E_{av} - average illuminance

E_{min} - minimum illuminance

E_{vmin} - minimum vertical illuminance

SR - surround ratio

TI - increase of glare limitation value

U_E - uniformity of illuminance

U_L - longitudinal uniformity of luminance

U_O - overall uniformity of luminance

3 Traffic Survey

3.0.1 Traffic survey shall be carried out for urban road traffic facility design.

3.0.2 Traffic survey content shall cover the road network state in the location area, the current state of land use along the line, the environment along the line, the road and traffic conditions, the urban planning and the road network planning. Except the design road itself, the surrounding area having effect on the design road shall also be covered.

3.0.3 The following conditions shall be analyzed on the basis of investigation and data collection in design of constructed road traffic facilities:

1 Social economy, traffic development, topography, climate and weather in the located area of the project as well as the land development and utilization conditions along the line of the project;

2 Relevant surrounding road grade, alignment, cross section arrangement and traffic facility arrangement conditions;

3 Main road traffic characteristics, traffic organization and management situation surround the project;

4 Status, function and road grade of the project in the planning of road network;

5 Forecast traffic volume, traffic organization and traffic characteristics of the project.

3.0.4 For design and investigation content of traffic facilities in renovated and extended road engineering, except the information required by the new engineering, the following contents shall also be supplemented in case of need:

1 Conditions of the existing road traffic facilities;

2 Conditions of the existing road traffic;

3.0.5 In renovation engineering design of road traffic facilities, the information such as the existing geometric conditions of road, traffic volume, composition, flow characteristics and accident shall be analyzed comprehensively; and moreover, the predicted traffic information shall be analyzed and judged.

4 Overall Design

4.1 General Requirements

4.1.1 Overall design of the urban road traffic facility shall meet the requirements of the overall objectives such as security, smoothness, environment protection and sustainable development.

4.1.2 Overall design of the urban road traffic facility shall coordinate with the design of the principal part of the road engineering, according to road function and its function in the urban road network, the factors such as design, work, maintenance, operation, management as well as short-term and long-term are comprehensively considered so as to exactly embody the intention of the main design for the road engineering.

4.1.3 Urban road traffic facilities shall not only maintain the respective characteristics and relative independence, but also match and coordinate with each other, so that they become a unified, coordinated and complete system engineering.

4.2 Grading of Traffic Facility

4.2.1 Overall planning and design shall be carried out for urban road traffic facility design according to the grade.

4.2.2 Grade of urban road traffic facility shall be divided into Grades A, B, C and D, and shall meet the following requirements:

1 For Grade A facilities, signs, markings, isolation and protection facilities with improved system shall be arranged; central separate crash guardrail and necessary anti-glare facility must be arranged continuously in the central strip; and crash guardrail must be arranged at roadside for bridge, high embankment as well as road section with side road and side walk beside which may endanger life and structure safety after crash; signs for guiding and prohibition shall be arranged continuously for the grade-separated junction and the surrounding road network; delineator shall be arranged continuously on both sides of main road and ramp carriage way; branching triangle end at exit shall be provided with eye-catching warning and collision protection facility; ramp control signal lamp shall be arranged for actually controlled ramp; the traffic surveillance and control system shall be arranged in accordance with Grade II; and the medium-long, long and super-long tunnels shall be arranged in accordance with Grade I;

2 For Grade B facilities, improved signs, markings, as well as necessary isolation and isolation and protection facilities shall be arranged; road section

4.3.2 The interface and joint between the overall design and the principal part of the engineering design shall be defined, and moreover, the specialized design interface and joint of urban road traffic are coordinated so as to avoid interference among facilities.

4.3.3 In the overall design, professional traffic facility design plan shall be developed by organizing traffic facilities, the connection and assistance between facilities are coordinated.

4.3.4 For the overall design, the road traffic facility design plan shall be optimized and perfected according to the road service level of principal part of the engineering design and security assessment conclusion.

4.3.5 Functional requirements on evacuation, salvage and rescue under special traffic safety or emergency occasions shall be proposed in the overall design.

4.4 Design Interface

4.4.1 When traffic signs, delineators, protection facilities, traffic signal and monitor system field equipment, lighting and power transformation and distribution facilities are arranged on road structure or bridge, tunnel structure, the designer of the traffic facilities shall provide the arrangement stake No., reserved hole size, structural gravity and load-carrying conditions; the design of embedment and reserve shall be carried out by the designer of the principal part of the engineering while he is designing the structure or bridge and tunnel structure. The arrangement and installation of traffic facilities are designed by the designer of traffic facilities.

4.4.2 When protection facilities with crash requirements are arranged on road structure or bridge, tunnel structure, crash grade, geometric size and structure design of collision protection facility as well as design for rigid-soft collision protection transition section at structure end shall be provided with by the designer of traffic facilities; the designer of the principal part of the engineering shall carry out the design of road structure or bridge and tunnel structure.

4.4.3 Communication and signal system piping embedded in road subgrade cross section shall be determined by the designers of traffic facilities and principal part of the engineering and layout position of the piping is determined by the design of the traffic facility designer; the principal part of the engineering designer shall indicate the sizes and positions of reserved piping, manhole and tube-box in the relevant design drawing, and they shall be listed in the design document of the principal part of the engineering.

4.4.4 Service facilities such as taxicab, bus station, pedestrian crossing facility are covered in the design of principal part of the engineering, and their positions, scales and sizes shall be proposed by the traffic facility designer, after

5 Traffic Signs

5.1 General Requirements

5.1.1 Design of traffic signs shall be in accordance with the relevant laws and regulations of road traffic management and traffic organization management plans, and concisely and accurately deliver message such as right of way, rules of road as well as route indication to road users; and guarantee traffic smoothness and travel safety.

5.1.2 Message delivered by other management facilities such as traffic signs and traffic markings shall be consistent and supplement each other.

5.1.3 Traffic signs shall not deliver message irrelevant with road traffic.

5.1.4 Mandatory signs for emergency, fire protection and risk prevention in tunnel shall be active luminous signs or illuminated signs.

5.1.5 Traffic signs shall not intrude into delimitation of road construction.

5.2 Classification and Arrangement

5.2.1 According to the function, traffic signs shall be divided into main one and auxiliary one, the former one covers warning sign, prohibition sign, mandatory sign, guide sign, tourist area sign, operating area sign and announcement sign; the auxiliary sign is attached under the latter one for giving auxiliary description.

5.2.2 According to the display mode of layout content, traffic signs shall be divided into static ones and changeable message ones.

5.2.3 Arrangement of traffic signs shall meet the following requirements:

1 Factors such as urban scale, characteristics, road network facility layout, road grade, geometric conditions, traffic conditions, road user demands, environment and climate shall be considered comprehensively;

2 Traffic laws and safety requirements shall come first in arrangement of signs;

3 Message display of sign shall be explicit, continuous and systematic, the phenomena of insufficient or overloading message shall be avoided; and what's more, important message shall be displayed in repetition;

4 Under dynamic condition, legibility of road user shall be given full consideration, namely the time and advance range necessary for users to find and read signs and then take action under that condition;

5.4.2 Grades 1 ~ 3 reflective films shall be adopted for signs on urban expressway and urban arterial road; and on curve section or other danger road sections, reflective film above Grade 2 is adopted. Reflective film above Grade 4 shall be adopted for signs on urban secondary trunk road and roads of lower grade.

5.4.3 Underplate and supporting structure of sign should be made of light material and structure, and meet the requirements of strength, rigidity, durability and corrosion resistance.

5.4.4 Display mode and material for board of changeable message sign shall be selected according to requirements of type, content displayed, control mode, environmental protection and energy conservation on signs.

5.5 Supporting Mode and Structure Design

5.5.1 According to requirements of importance of message that the sign delivers, layout size, traffic volume lane number, designed wind speed, roadside conditions and suspension position, sign board may be adopted with supporting modes such as column type, cantilever type, frame type or adhesion type.

5.5.2 Design for supporting structure of sign shall be sorted according to supporting mode and board surface size of the sign. The upper structure, post, transom and the connection are designed, and moreover, the deformation and strength are calculated and checked respectively; for the substructure, its design of strength, overturning resistance and anti-sliding are calculated and checked, so is the base stress.

5.5.3 In wind load calculation, the designed wind speed shall meet the following requirements:

1 The 50-year 10 min calculated mean maximum wind speed at place 10 m higher than the flat open area in the location area of the sign shall be adopted;

2 When it is lack of observation data of wind speed, the designed wind speed may be in accordance with the "profile for the National reference wind speed and the reference wind speed", the speed will be adopted after verification in field survey; however, it shall be not less than 22 m/s.

3 Connection between the sign board and the supporting structure shall be firm and reliable with convenient installation, flat and smooth board surface and easy maintenance.

6 Traffic Marking

6.1 General Requirements

6.1.1 Marking shall meet the functional requirements of road usage, and deliver relevant rule, warning and guideline to road users.

6.1.2 Marking may be used in conjunction with the sign or used exclusively.

6.1.3 Marking shall be able to be identified clearly, and meet the requirements of legibility in daytime, rain day and nighttime. Urban expressway and arterial road shall be arranged with reflective traffic markings.

6.2 Marking Arrangement

6.2.1 Traffic markings of general road section of monitor shall meet the following requirements:

1 For urban motor vehicle road of two-way traffic, yellow divisional line for carriage way of opposite direction shall be drawn between lanes for driving of opposite direction;

2 For urban expressway, carriage way edge line shall be drawn at outer side edge (inner side of marginal strip) of motor lane; for road of other grades, carriage way edge line should be drawn at the outer side edge (inner side of the marginal strip) of the motor lane;

3 For road section on which motor vehicle and non-motor vehicle travel separately, carriage way edge line (divisional line of motor vehicle and non-motor vehicle) shall be drawn at the division of motor vehicle lane and non-motor vehicle lane;

4 Arrangement of crosswalk line shall be determined according to the factors such as road grade, pedestrian traversing demands and traffic safety;

5 Marking width shall be determined according to road grade, design speed and width of pavement, and moreover, it shall meet the requirements specified in Table 6.2.1.

turning is equipped with and accommodation lane for left-turning is provided with; however, it shall not hinder the normal straight traveling of vehicle at the opposite direction.

3 On occasions that the at-grade intersection is overlarge and irregular and the traffic organization is complex, and when it is hard for vehicles to find exit lanes, guide line shall be arranged at the junction to assist traveling and turning of vehicles.

4 For over wide and irregular junction or with relatively complex traveling conditions, ramp entrance or other special place of grade-separated junction, guide line shall be arranged, and it shall be designed according to topography, traffic flow and the flow direction at the junction.

5 Entrance/exit marking and guide arrow shall be arranged for branch section and merging section of grade-separated junction. Arranged size and repeated arranged time of guide arrow shall be selected according to those specified in Table 6.2.3. For junction with irregular turning order at entrance lane, repeated arranged time of the guide arrow should be increased.

Table 6.2.3 -- Arranged Size and Repeated Arranged Time of Guide Arrow at Entrance/Exit

Design speed (km/h)	100	80, 60, 50	40, 30, 20
Length of guide arrow (m)	9	6	3
Repeated arranged time	≥ 3	3	≥ 2

6.3 Material

6.3.1 The material shall be durable, abrasion and corrosion resistant, and strongly bonded with the pavement, and moreover, be equipped with favorable identification and anti-slip performance.

6.3.2 Urban expressway and arterial road shall be adopted with reflective marking. Luminance factor of white reflective marking paints shall be greater than or equal to 0.35, and their initial retro-reflection coefficient shall be greater than or equal to $150 \text{ mcd} \cdot 1\text{x}^{-1} \cdot \text{m}^{-2}$; that of yellow ones shall be greater than or equal to 0.27 and their initial retro-reflection coefficient shall be greater than or equal to $100 \text{ mcd} \cdot 1\text{x}^{-1} \cdot \text{m}^{-2}$.

6.3.3 Marking shall be adopted with environmental protection material, and it shall not pollute the surrounding environment and harm the construction personnel.

6.4 Delineator

6.4.1 Arrangement of delineator shall meet the following requirements:

7 Protection Facilities

7.1 General Requirements

7.1.1 Protection facilities shall be adopted with environmental protection material and convenient for installation and repair.

7.1.2 Protection facilities shall not intrude into delimitation of road construction as well as the range of stopping sight distance.

7.1.3 For expressway roadside which is not provided with sufficient clear distance, crash guardrail must be arranged; where width for integral cross-section central strip of subgrade is less than or equal to 12 m, crash guardrail must be arranged continuously for median divider of expressway.

7.1.4 Protection facilities should be concise and generous and coordinate with design style of road, bridge and surrounding building.

7.2 Crash Guardrail

7.2.1 Crash grade and key technical indexes of crash guardrail shall be in accordance with those specified in Table 7.2.1.

Table 7.2.1 -- Crash Grade and Key Technical Indexes of Crash Guardrail

Crash grade		Crash condition				
Roadside guardrail	Median barrier	Crash vehicle	Vehicle mass (t)	Crash speed (km/h)	Crash angle (°)	Crash energy (kJ)
B	Bm	Small passenger car	1.5	80	20	—
		Large passenger car	10	40	20	70
A	Am	Small passenger car	1.5	100	20	—
		Large passenger car	10	60	20	160
SB	SBm	Small passenger car	1.5	100	20	—

2 Roadside of arterial road should be arranged with crash guardrail. Crash grade of roadside guardrail on the arterial road shall meet the requirements of Table 7.2.4-2;

Table 7.2.4-2 -- Application Conditions for Crash Grade of Arterial Road Roadside Guardrail

Application conditions	Design speed (km/h)	
	60, 50	40
General road section and ramp	B	—
High slope, bridge approach, connecting line of tunnel opening and road section near structure	A	B
High steep slope, high retaining wall, road section near river and that on which severe accident may take place when vehicle runs out of it.	SB	A
Road section near adjacent to other expressway and people flow concentrated area and that on which severe secondary accident may take place when vehicle runs out of it.	SA	SB

3 Roadsides of secondary trunk road and branch road are generally not arranged with roadside guardrail. For road section on which severe accident or severe secondary accident may take place when vehicle runs out of it, crash guardrail should be arranged. Crash grade for crash guardrails on roadsides of secondary trunk road and branch road is arranged by reference to the arterial road.

4 For road sections such as trunk line railway, reservoir, oil depot, power plant which require special protection, their crash guardrails shall be specially designed.

7.2.5 Arrangement of median barrier shall meet the following requirements:

1 Crash grade of expressway median barrier shall meet the requirements of Table 7.2.5-1;

Table 7.2.4-1 -- Application Conditions for Crash grade of Expressway Median Barrier

Application conditions	Design speed (km/h)		
	100	80	60
General road section	SBm	Am	Bm
Particularly protected road section such as ramp turn with small radius, median divider with pier and other structure	SAm	SBm	Am

2 Median divider of arterial road whose design speed is greater than or equal to 50km/h should be arranged with crash guardrail. Crash grade of the median barrier on the arterial road shall meet the requirements of Table 7.2.5-2.

to secondary trunk road, branch road or people flow concentrated area.			
Height of the bridge is greater than 20 m, or the bridge crosses or is adjacent to arterial road or expressway.	SS	SA	SB

3 Crash grade for guardrail of secondary trunk road, branch road bridge and culvert may be selected according to the criteria of arterial road with 40km/h design speed in Table 7.2.7.

4 For road sections which are adjacent to or cross trunk line railway, reservoir, oil depot, power plant and require special protection, their bridge guardrail shall be specially designed and reasonable crash condition shall be determined;

5 Small bridge, culvert and channel of expressway and arterial road shall be arranged with crash guardrail with type the same as that of the subgrade section.

7.2.8 Safety treatment shall be carried out for the beginning and ending of the crash guardrail.

7.2.9 Transition section shall be arranged for conjunction of crash guardrail with crash guardrails of different structure types or rigidity, so that rigidity of guardrail can transit gradually thus forming an integrity.

7.3 Crash Cushion

7.3.1 Crash grade of crash cushion shall be divided into 3 grades, and the key technical indexes for each grade shall be in accordance with those specified in Table 7.3.1.

Table 7.3.1 -- Crash Grade of Crash Cushion

Crash cushion type	Crash grade	Crash condition				
		Crash type	Crash vehicle	Crash mass (t)	Crash speed (km/h)	Crash angle (°)
Non-redirective crash cushion	B50	Direct crash	Small passenger car	1.5	50	0
		Oblique crash				15
	B65	Direct crash	Small passenger car	1.5	65	0
		Oblique crash				15

7.4 Delimitation Structure of Collision Protection Facility

7.4.1 During traveling, it is easy for vehicle to run out of the delimitation to collide on the bridge pier stud, main beam, both ends and top of tunnel opening entrance, as well as traffic sign supporting structure, therefore, delimitation facility shall be arranged at the delimitation structure.

7.4.2 For collision protection of delimitation structure at top side of the road, collision protection facilities such as crash cushion, crash island, crash bearer and those for strengthening collision protection of pier stud may be arranged before the road; for that of delimitation structure at side face, crash guardrail may be arranged and strengthened at the roadside; and that of delimitation structure at the top surface, collision protection structure and warning and delimitation signs may be arranged.

7.4.3 When position of combined or concrete wall crash guardrail arranged at the roadside overlaps with that of the delimitation structure, if the delimitation structure itself can meet the crash requirements, integral delimitation structure collision protection which is constructed through combining delimitation structure may be adopted, and moreover, the section shape of the crash side is consistent with the original crash guardrail.

7.4.4 Corrugated beam as crash guardrail is arranged at roadside, where deformation of the corrugated beam fails to meet the requirements for protecting the delimitation structures on both sides, guardrail post with denser spacing or crash guardrail facility with level higher than Grade SB of highway.

7.4.5 When no delimitation structure of crash guardrail is arranged at side face of road, crash cushion, crash island and crash bearer should be arranged at the front crash side.

7.4.6 Delimitation collision protection at top surface may be adopted with collision protection facilities for main structure, auxiliary collision protection facility and warning sign as well as delimitation sign.

7.4.7 Design for collision protection facility of delimitation structure shall be in accordance with the principles of security, economy, duration and be convenient for maintenance, the appearance shall be concise, and simultaneously, warning marks which are consistent with the design style of the road, bridge and surrounding urban landscape and building shall be arranged.

7.5 Pedestrian Guardrail

7.5.1 The following positions shall be arranged with pedestrian guardrail:

- 1 Pedestrian guardrail shall be arranged for places with height difference

the motor vehicle lane.

7.6 Separate Facility

7.6.1 Separate facilities shall be arranged for the following positions:

1 For road with two-way six-lane or above, when there is no median divider and crash guardrail, clear height of rail should be greater than or equal to 1.10 m; at fracture section crossing by pedestrian, height of the guardrail shall be reduced gradually and it shall not be greater than 0.70 m, the reduced length shall be greater than or equal to the stopping sight distance; separate column shall be arranged at fracture section;

2 For road with two-way four-lane or above, motor vehicle lane and non-motor vehicle lane are of one-roadway design, and moreover, separate rail shall be arranged between the motor vehicle lane and the non-motor vehicle lane;

3 When non-motor vehicle flow reaches a saturation or motor vehicle randomly parks by the roadside, motor vehicle lane and non-motor vehicle lane are of a one-roadway cross-section, and separate rail should be arranged between the motor vehicle lane and the non-motor vehicle lane;

4 If motor vehicle lane and non-motor vehicle lane share one cross-section, separate rail for non-motor vehicle and motor vehicle should be arranged within the functional area at the junction; when the cross-section is arranged at the junction, it shall be avoided that after the separate rail is arranged, the traveling of vehicle turning and turning around shall not be hindered;

5 When non-motor vehicle lane and sidewalk share one cross-section, separate rail should be arranged between the non-motor vehicle lane and the sidewalk;

6 When non-motor vehicle lane is higher than the ground at the side, and there is falling risk, separate rail shall be arranged beside the non-motor vehicle lane;

7 According to conditions, separate rail may be arranged between the sidewalk and the green space;

8 Separate rail may be arranged for positions needing functional zoning between the sidewalk and the parking lot and facility belt;

9 Separate column may be arranged at sidewalk edge of junction and edge of pedestrian gathering place.

7.6.2 Design of separate facility shall meet the following requirements:

7.8 Anti-glare Facility

7.8.1 Median divider of urban expressway shall be arranged with anti-glare facilities, however, when width of the divider is greater than 9 m, or the height difference between the two-way pavements is greater than 2 m, such facilities may not be arranged.

7.8.2 Design of anti-glare facility shall meet the following requirements:

1 Anti-glare facility may be selected with plant anti-glare, anti-glare board and anti-glare network according to climate conditions, landscape conditions and light-blocking requirements of road;

2 Design of anti-glare board shall be carried out according to partial light-blocking principle, the cutoff angle of straight road section shall be greater than or equal to 8° , and of horizontal and vertical curve road section shall be between $8^\circ \sim 15^\circ$, the width should be between 8 ~ 15 cm, and the ground clearance should be between 120 ~ 180 cm.

7.8.3 Structure design of anti-glare facility shall meet the following requirements:

1 Structures of anti-glare board and anti-glare network shall be convenient for installation and maintenance;

2 Transition section whose length should be 50 m shall be arranged when height, structure type and layout position of anti-glare facility change;

3 it shall be avoided that any fracture is remained between anti-glare facilities.

7.9 Acoustic Barrier

7.9.1 When result of the acoustic environment evaluation according to the current national standard "Environmental Quality Standards for Noise" (GB 3096) fails to meet the standard, acoustic barrier shall be arranged for the road section when it still fails to meet the requirements after noise reduction measures are taken.

7.9.2 The optimum position of acoustic barrier shall be arranged according to the relative position between the road and the protection object and the surrounding landform.

7.9.3 Structure design of acoustic barrier shall meet not only the requirements of the current national standard "Norm on Acoustical Design and Measurement of Noise Barriers" (HJ/T 90), but also those of structure deadweight and wind load.

9 Traffic Surveillance and control System

9.1 General Requirements

9.1.1 With a view to improving urban road traffic management service level, traffic surveillance and control system should be arranged.

9.1.2 Traffic surveillance and control system shall consist of surveillance and control center, out-field surveillance and control facility and message transmission network, and shall be possessed of wholly or partially functions such as message collection, analysis processing, message display and traffic control management as well as message exchange and resource sharing with other message system.

9.1.3 Construction of traffic surveillance and control system shall be in accordance with the road grade and urban scale, and moreover, comprehensive consideration shall be given to the development stage of urban economy as well as traffic volume and traffic management demand, and is shall meet the requirements of Table 9.1.3.

Table 9.1.3 -- Construction Requirements of Traffic Surveillance and control System

Urban scale	Road grade			
	Urban medium, long and super-long tunnel	Urban extra-large bridge and expressway	Arterial road and secondary trunk road	Branch road
Super-large city	Shall be constructed	Shall be constructed	Shall be constructed	Construction conditions shall be reserved
Large city	Shall be constructed	Shall be constructed	Should be constructed	Construction conditions should be reserved
Medium-sized city	Shall be constructed	Should be constructed	Construction conditions should be reserved	Construction conditions should be reserved
Small city	Shall be constructed	—	Construction conditions should be reserved	Construction conditions should be reserved

9.1.4 Unified planning shall be carried out for traffic surveillance and control system according to the current state of the urban road network as well as planning and traffic management demands, and it may be implemented by stage according to the urban traffic conditions and the construction conditions.

abnormal event; aiming at constant and incidental traffic jams, traffic control scheme and emergency treatment plan as well as appropriate message display guidance scheme can be generated automatically.

9.4 Message Collection Facility

9.4.1 Message collection facility shall mainly consist of traffic parameter tester, video camera and weather detector.

9.4.2 For allocation of the equipment for Grade I traffic surveillance and control system, traffic parameter tester and video camera shall be arranged continuously in the whole road section, and surveillance and control covering the whole road section is implemented. Sound emergency alarm facility shall be arranged in special road section such as urban medium, long and super-long tunnel.

9.4.3 For allocation of the equipment for Grade II traffic surveillance and control system, traffic parameter tester and video camera shall be arranged continuously in the whole road section, and surveillance and control covering the whole road section is implemented. For flyover with large traffic volume, it should be covered with ramp access.

9.4.4 For allocation of the equipment for Grade III traffic surveillance and control system, surveillance and control facilities such as traffic parameter tester, video camera shall be arranged at important sections such as main road crossing and flyover.

9.4.5 For allocation of the equipment for Grade IV traffic surveillance and control system, surveillance and control facility such as video camera may be arranged at main road crossing as required.

9.4.6 Weather message monitor should be arranged for special section such as urban extra-large bridge as well as road section on which the traffic may be threatened by poor meteorological requirements according to climate characteristics, management demands and overall construction requirements for traffic weather service system throughout the country.

9.5 Message Display and Control Facility

9.5.1 Message display and control facility shall mainly consist of changeable message sign, changeable speed limit sign and traffic signal control facility.

9.5.2 Allocation of the equipment for Grade I traffic surveillance and control system shall be carried out along the road and relevant road section, the system shall be able to display guidance message, so as to relieve message display facilities such as changeable message sign and changeable speed limit sign

handling of traffic event shall be developed.

9.7.2 Safety strategy in accordance with the message and application safety demands shall be developed for system link, and moreover, uniform safety management platform shall be developed as well.

9.8 Main Performance Index of Surveillance and control System

9.8.1 Main technical performance index collected as traffic message should cover data detection precision, data collecting cycle and video image quality of traffic, and shall meet the following requirements:

1 Data detection precision of traffic shall be greater than 85 %;

2 Data collecting cycle shall be adjustable between 10 ~ 60 s;

3 Video image quality shall be greater than or equal to Grade 4 in the 5-level damage system.

9.8.2 Main technical performance index in message processing should cover distinguishing and processing response time for traffic state, distinguishing accuracy of traffic state, false alarm rate of traffic event detection and miss detection rate, and shall meet the following requirements:

1 Distinguishing and processing response time of traffic state should be less than or equal to 2 s;

2 Distinguishing accuracy of traffic state shall be greater than 90 %;

3 False alarm rate of traffic event detection shall be less than 20 %, so is the miss detection rate.

9.8.3 Transmission technique performance index of traffic message should cover transmission delay and error rate, and shall meet the following requirements:

1 Transmission delay between the out-field equipment and the surveillance and control center shall be less than or equal to 1 s;

2 Error rate of optical fiber transmission shall be less than or equal to 10^{-9} , and that of transmission over radio shall be less than or equal to 10^{-5} .

9.9 Foundation and Piping of Out-field Equipment, Power Supply, Lightning Protection and Earthing

9.9.1 Design for foundation and piping of out-field equipment shall meet the following requirements:

10 Service Facility

10.1 General Requirements

10.1.1 Pedestrian guide facility, pedestrian crossing facility, non-motor vehicle parking facility, motor vehicle parking facility and bus stop shall be arranged according to planning conditions and road layout conditions. The arrangement of service facility shall be coordinate with the landscape and environment.

10.1.2 Arrangement of service facility shall coordinate with other traffic facilities, so that they will not disturb each other and their use is not influenced.

10.1.3 Arrangement of service facility shall meet the requirements of accessible environmental design;

10.2 Pedestrian Guide Facility

10.2.1 Arrangement of pedestrian guide facility shall meet the following requirements:

1 Pedestrian guide facility and guidepost shall be arranged within the facility belt, and shall not occupy the effective walking space of pedestrian;

2 Pedestrian guide facility and guidepost shall be planned and arranged uniformly, so as to be convenient for use.

10.2.2 Arrangement of pedestrian guide facility shall meet the following requirements:

1 Pedestrian guide facility should be arranged at people flow concentrated area such as pedestrian street, business district, competition venue, station and traffic hub as well as road intersection and near public traffic transferring places; arranged spacing between guide facility on road section shall be between 300 ~ 500 m;

2 Content on guide facility shall be explicit and understandable, and with favorable visibility; it shall not be blocked and the sign surface shall be maintained clear and tidy;

3 Pedestrian guide facility on junction, square, competition venue and road surrounding large building shall be arranged in combination with the internal pedestrian system;

4 Guide facility may be arranged artistically in combination with the surrounding environment; however, it shall be clear, understandable and easy to be recognized;

6 For man-car-concentrated area such as business district and traffic hub, successive spatial crossing facility shall be arranged in combination with the pedestrian passageway inside the building to form pedestrian vestibule underground or in the air.

10.3.2 Arrangement of plane crossing facility shall meet the following requirements:

1 Crosswalk shall be arranged at position easy to be distinguished by vehicle driver, and it should be vertical to the carriage way;

2 Signal lamp-regulated junction shall be drawn with crosswalk marking, and corresponding pedestrian signal lamp shall be arranged. Regulated crossing without signal lamp and give-way regulated crossing shall also be drawn with crosswalk marking, and moreover, warning sign for giving attention to pedestrian shall be arranged; on upstream motor vehicle lane of crosswalk, tag line for indication shall be drawn on crosswalk;

3 When street crossing of opposite angle is adopted for road intersection, whole green light phase must be arranged for pedestrian

4 Width of crosswalk is related to the quantity of street crossing pedestrian and the signal display duration, width of the postponed arterial road crosswalk should be greater than or equal to 5 m, and of others should be greater than or equal to 3 m, the width is increased or decreased with 1 m as the unit;

5 When inlet and outlet motor vehicle lane of road section or junction is greater than or equal to 6, or length of crosswalk is greater than 30 m, safety island shall be arranged, its width should be greater than or equal to 2 m, and shall be greater than or equal to 1.5 m under difficult conditions;

6 When the pedestrian safety island is provided with median divider, rail-induced type should be adopted; otherwise inclined open type should be adopted;

7 Road design for residential area should be adopted with quiet traffic measures to guarantee safety of pedestrian; and retardation angle, deceleration strip, bending road section and roundabout shall be arranged for reducing the speed;

8 Crosswalk adjacent bus station shall be arranged at the vehicle-entering end of the bus station, and beyond the parking area of bus.

10.3.3 crosswalk signal lamp on road section is arranged according to the following requirements:

1 Where quantity of two-way motor vehicle lane is greater than or equal to

10.5 Parking Facilities for Motor Vehicle

10.5.1 Arrangement of parking lot for motor vehicle shall meet the following requirements:

1 Position and scale of public parking lot for motor vehicle shall meet the urban planning requirements, and constructed by combining the traffic organization the area parking demands, land and road traffic conditions;

2 Parking lot with certain scale may be arranged for places such as business district, large sports venue and large building with relatively large parking demand according to their traffic organization;

3 Length of parking lot entrance and urban road connecting passage shall meet the requirements of queue length of vehicles approaching the site during peak hours;

4 Multiple toll gates should be arranged for parking lot with relatively large vehicle volume; service capacity of the toll gate shall meet the passing in and out demands of vehicle;

5 vehicle flow line and pedestrian flow line in the parking lot shall be arranged reasonably and intersecting shall be avoided, pedestrian entrance of parking lot with large pedestrian volume shall be arranged dispersedly;

6 Internal traffic constitution of the parking lot shall correspond to the peripheral traffic conditions of the site, traffic sign and marking for pointing passage and parking space within the site shall be arranged for the entrance/exit and in the parking lot;

7 Internal walking system of the parking lot shall be connected with its surrounding walkway; pedestrian flow line should be marked with marking, and traffic sign and marking shall be arranged when the pedestrian flow line intersects with the motor vehicle flow line;

8 Entrance/exit of parking lot shall be provided with favorable sighting conditions, and moreover, traffic sign shall be arranged with.

10.5.2 Arrangement of parking space shall meet the following requirements:

1 As supplement of parking lot, roadside parking space shall be arranged reasonably;

2 In arrangement of roadside parking space, the effect on normal traffic of non-motor vehicle shall be avoided, and the space shall not occupy the non-motor vehicle traffic space;

1 The length of the bus station should not be less than that of 2 parking spaces. When the station is used by multiple lines of bus, its capacity shall be applicable to the total traffic of all the lines under the maximum departure frequency. When the length of the parking space is greater than that of 6 vehicles or the station is shared by more than 6 lines of bus, the station may be arranged by group and section;

2 The harbor-shaped bus stop shall be adopted on the urban arterial road, and it should be adopted on the secondary trunk road with large traffic flow; the bus stop arranged on the expressway shall meet the requirements of the current professional standard "Specification for Design of Urban Expressway" (CJJ 129);

3 The paving width of the conventional bus station is determined by the volume of pedestrians waiting for vehicles. It shall not be less than 2 m under general condition and 1.5 m under limited conditions. As for the two types of the BRT station, the width shall not be less than 5 m for the two-side station, and 3 m for the one side station;

4 For bus station arranged on the main road, the pedestrian crossing facilities shall be arranged on the side road. The facilities shall be arranged on the main road as required;

5 As for the mixed traffic section of motor vehicles and non-motor vehicles, non-motor vehicle lane should be arranged at the outer side of the station;

6 As for the bus station for over 2 bus lines, a pedestrian guardrail should be arranged for queuing.

10.6.3 The arrangement of bus shelter shall meet the following requirements:

1 The design of the bus shelter shall be safe, practical, economical and aesthetic, prevent passengers from the blazing sunshine, falling rain and snow, and harmonize with its surrounding landscape. Seats and leaning posts should be arranged inside the shelter for passengers' convenience;

2 Entrance of the bus shelter shall be with good view. The size of the bus shelter shall be designed according to the requirements. It shall also coordinate with the station;

3 The arrangement of the stop board shall be convenient for the observation and search of the bus drivers, stewards and passengers. The stop boards shall be arranged according to whether bus shelter is available;

4 In the case that the bus station is arranged by group and section, the stop board shall be arranged inside the corresponding section.

11 Road Lighting and Power Transformation and Distribution

11.1 Road Lighting

11.1.1 Artificial lighting facilities shall be arranged on the urban road.

11.1.2 There are two types of urban road lighting criteria, respectively motor vehicle road lighting criterion and non-motor vehicle and sidewalk lighting criterion. The motor vehicle road lighting criterion shall be divided into three grades according to expressway and arterial road, secondary trunk road and branch road.

11.1.3 The evaluation indicators for motor vehicle road lighting shall be the average pavement luminance (or average pavement illuminance), overall uniformity and longitudinal uniformity of pavement luminance (or uniformity of pavement illuminance), glare limitation, surround ratio and guidance.

11.1.4 The design standard of the urban road lighting shall be determined according to the road function and grade. The lighting standard values shall be in accordance with those specified in Table 11.1.4. High-grade and low-grade values shall be chosen according to the urban nature and scale as well as the completeness of the traffic control system and road separate facilities.

Table 11.1.4 -- Standard Values for Motor Vehicle Road Lighting

Grade	Road type	Pavement luminance			Pavement illuminance		Maximum initial value of increase of glare limitation value T_l (%)	Minimum value of surround ratio SR
		Maintained average luminance L_{av} (cd/m ²)	Minimum value of overall uniformity U_o	Minimum value of longitudinal uniformity U_L	Maintained average illuminance E_{av} (lx)	Minimum value of uniformity of illuminance U_E		
I	Expressway and arterial road	1.5/2.0	0.4	0.7	20/30	0.4	10	0.5
II	Secondary trunk road	0.75/1.0	0.4	0.5	10/15	0.35	10	0.5
III	Branch road	0.5/0.75	0.4	—	8/10	0.3	15	—

Notes: 1 Average illuminance in this table is only applicable to bituminous pavement. The values of average illuminance may be reduced for about 30 % correspondingly in the case of cement concrete pavement;

2 In the table, two standard values are provided for both average luminance and

11.1.11 Tunnel lighting shall be arranged for the urban road tunnels. The tunnel lighting section may be divided into entrance, transition, middle and exit section.

11.1.12 The design standard of tunnel lighting shall be determined by the vehicle speed and traffic volume, and the standard values for the middle section of the tunnel lighting shall be in accordance with those specified in Table 11.1.12.

Table 11.1.12 -- Standard Values for the Middle Section of the Tunnel Lighting

Design speed (km/h)	Double lane with one-way traffic $N > 2400/h$ Double lane with two-way traffic $N > 1300/h$			Double lane with one-way traffic $N \leq 700/h$ Double lane with two-way traffic $N \leq 360/h$		
	Average luminance L_{av} (cd/m ²)	Minimum value of overall uniformity U_o	Minimum value of longitudinal uniformity U_L	Average luminance L_{av} (cd/m ²)	Minimum value of overall uniformity U_o	Minimum value of longitudinal uniformity U_L
100	9	0.4	0.6 ~ 0.7	4	0.3	0.5
80	4.5			2		
60	2.5			1.5		
40	1.5			1.5		

Note: In case that traffic is fallen into the medium scope, the average luminance is 80 % of the high value in the table; the minimum value of overall uniformity and the minimum value of longitudinal uniformity are evaluated via interpolation method.

11.1.13 Strengthening of lighting shall be carried out for the tunnel entrance section and exit section. The brightness value of the entrance section shall be determined by the luminance outside the tunnel, and it shall be transited to that of the middle section from that of the transition section. The brightness value of the exit section shall be determined by that of the middle section.

11.2 Lighting Control

11.2.1 Automatic control shall be adopted for road lighting.

11.2.2 As for the control mode of road lighting, time control should be primary, and light control secondary.

11.2.3 As for the road lighting controlled by time, the switch duration should be determined by the geographic location and seasonal variation of the place, and it should be carried out according to the time bucket.

11.3 Power Transformation and Distribution System

11.3.1 Lighting for the ordinary road shall be Grade III load, and Grade II load for the important roads, traffic hubs and squares with large people flow.

12 Management Office and Equipment

12.1 General Requirements

12.1.1 To adapt the requirements of urban road traffic management in different types and grades, appropriate traffic management office and management equipment shall be arranged.

12.1.2 The management office shall comply with the arrangement criteria of layout reasonable, land saving, environmental protection and energy conservation.

12.1.3 Equipping for the management equipment shall comply with the principles of economy, practicality and convenience.

12.2 Management Office

12.2.1 As for the engineering such as the important city expressway, bridge and tunnel, the road management office shall be arranged according to the requirements of scale, function, importance and geographic location.

12.2.2 The arrangement of the road management office shall meet the following requirements:

1 The construction position of the road management office shall be in combination with the urban planning, be adjacent to the managed road traffic facilities, and be in harmony with the surrounding environment;

2 The construction scale of the road management office shall be determined according to the factors such as the traffic volume in road design, traffic composition, natural conditions and specific circumstance of the engineering;

3 Office and living facilities of the law enforcement officials may be arranged in the road management office according to the need;

4 The road management office shall meet the requirements of storage for various equipment and necessary goods and materials;

5 The road management office sets up convenient legal inspection facilities as required;

6 The harmless discharge of the wastes such as the wastewater and garbage shall be considered.

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