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Design specification for highway alignment

公路路线设计规范

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1 General

1.0.1 In order to guide highway design, reasonably determine highway's functions, technical classes, construction scale, main technical indicators, this specification is hereby formulated.

1.0.2 This specification is applicable to the design of newly constructed, reconstructed, expanded highways.

1.0.3 For the highway design, it shall determine the highway function, through comprehensive analysis, based on regional characteristics, traffic characteristics, highway network structure. It shall be based on the highway functions, combining the traffic capacity and terrain conditions, etc., to select technical grades and main technical indicators.

1.0.4 All classes of highways shall be subject to overall design. The overall design shall run through all stages of the highway construction project, from the feasibility study to the construction drawing design; cover all relevant disciplines of the highway construction project.

1.0.5 For the highway design, it shall be based on highway functions, use tasks, roles in the highway network, comprehensively consider multiple transportation modes, such as railways, waterways, aviation, pipelines, etc., as well as the relationship between highways and cities & towns, farmland planning, to implement the comprehensive transport development requirements, AND reasonably demonstrate and determine the route direction and corridor belt.

1.0.6 For the alignment plan, it shall, based on the selected corridor belt AND the main control points, carry out the layout and overall design, to rationally use the technical indicators. The feasible alignment plan shall be compared and selected, to determine the design plan. When different design speeds, technical indicators or design plans have obvious impacts on operational safety, engineering cost, natural environment, social and economic benefits, etc., THEN, it shall carry out the technical and economic demonstrations, of the same depth.

1.0.7 For the line position of the alignment, it shall make full investigation on the engineering geology, hydrogeology, meteorological conditions, natural disasters, highway construction materials, ecological environment, natural landscapes, etc., according to the topography and ground conditions. It shall be selected based on the study of regional climate characteristics, along the

2 Highway classification and class selection

2.1 Highway functions and classification

2.1.1 Highways are classified, according to the traffic functions, into arterial highways, distribution highways, branch highways. Arterial highways are divided into primary arterial highways and secondary arterial highways. Distribution highways are divided into primary distribution highways and secondary distribution highways.

2.1.2 Highways are classified into five technical classes: expressways, first-class highways, second-class highways, third-class highways, fourth-class highways, according to traffic characteristics and ability to control interference.

1 The expressway is a multi-lane highway, exclusively for vehicles to drive in different directions and lanes, wherein all accesses are controlled. The designed traffic volume of the expressway should be more than 15000 small passenger cars/day.

2 The first-class highway is a multi-lane highway, where cars can drive in different directions and lanes, access can be controlled as needed. The designed traffic volume of the first-class highway should be more than 15000 small passenger cars/day.

3 The second-class highway is a two-lane highway for vehicles to drive. The designed traffic volume of the second-class highway should be 5000 ~ 15000 small passenger cars/day.

4 The third-class highway is a two-lane highway, for mixed driving of automobile and non-automobile traffic. The designed traffic volume of the third-class highway should be 2000 ~ 6000 small passenger cars/day.

5 The fourth-class highways are two-lane or single-lane highways, for mixed driving of automobile and non-automobile traffic. The designed traffic volume of a two-lane fourth-class highway should be less than 2000 passenger cars/day; the design traffic volume of a single-lane fourth-class highway should be less than 400 small passenger car/day.

2.1.3 For the geometric design of the crossing between highway alignment and alignment, the design vehicles used shall be selected according to factors such as highway functions, vehicle composition. The outline dimensions are as shown in Table 2.1.3, which shall meet the following requirements:

1 Arterial highways and primary distribution highways shall meet the traffic requirements of all designed vehicles.

comprehensive transportation system, within the corridor belt.

2.2.2 The selection of highway's technical class shall be determined, on the basis of demonstration and determination of highway functions, combined with the demonstration and determination of the comprehensive transportation system, long-term development plan, design traffic volume, in the region where the project is located. Meanwhile, it shall follow the following principles:

1 When the primary arterial highways are the main passages, which have the highest structural level in the highway network, it shall select the expressways.

2 When the secondary arterial highway is used as a supplement to primary arterial highways, it shall select the highways of second-class and above.

1) When the designed traffic volume reaches 15000 small passenger cars/day, it shall select the highways of the first-class and above.

2) When the designed traffic volume reaches 10000 small passenger cars/day, meanwhile there is large interference in longitudinal and lateral direction along the route, it should select the first-class highway.

3) When the designed traffic volume is less than 10000 small passenger cars/day, it may select the second-class highways. When there is a high mixing rate of trucks, it should set overtaking lanes at intervals, to reduce longitudinal interference.

3 When the primary distribution highways connect the arterial highways and the branch highways, it should select the first-class and second-class highways.

1) When the designed traffic volume reaches 15000 small passenger cars/day, it may select the first-class highway.

2) When the designed traffic volume is 5000 ~ 15000 small passenger cars/day, it may select the second-class highway. When the designed traffic volume reaches 10000 small passenger cars/day, meanwhile the longitudinal and lateral interference along the route is large, it should select the first-class highway.

3) When the designed traffic volume is less than 5000 small passenger cars/day, it should select the second-class highways.

4 When the secondary distribution highways serve the regional traffic of the county and township, it should select the second-class highways and third-class highways.

restricted by topography and geological conditions, it can be 20 km/h.

2.2.4 Different technical levels can be selected segmentally, for the same highway project. Different design speeds can be selected segmentally, for the same technical level. Between the designed segments, which have different technical levels and different design speeds, it shall select reasonable connection position or location; the transition shall be smooth; the connection shall be coordinated.

2.2.5 When using the running speed for testing, the difference between the running speeds of adjacent segments shall be less than 20 km/h. The difference between the design speed and the running speed, in the same segment, should be less than 20 km/h.

2.2.6 For the speed limit of highway, it shall be determined, based on comprehensive demonstration of factors such as design speed, running speed, roadside interference, environment.

2.3 Control access

2.3.1 The expressway shall be a highway that controls all the access. It only provides access to the selected service facilities of the intersected highway, urban highway or expressway. In the intersections with the highway, urban highway, country road, railway, pipeline, etc., it must set vertical crossing. It must provide isolation facilities, to prevent pedestrians, vehicles, livestock, etc. from entering.

2.3.2 The access control of the first-class highway shall meet the following requirements:

1 When a first-class highway is used as a secondary arterial highway, partial access control shall be implemented.

2 When the first-class highway is used as a distribution highway, it shall implement the access management; reasonably control the location, quantity, form of entrances and exits.

2.3.3 When adopting access control measures, the installation of isolation facilities shall meet the following requirements:

1 The isolation facilities at the following locations can be in various forms, such as no-entry fences and green fences:

1) The boundary of land used for the highways at both sides of the segment, where the access is controlled;

increases, it shall be increased by an even number.

4.2.5 For the highways at all classes, it may, according to the topography, geology and natural conditions along the alignment of project, select the segmented design speed. Meanwhile, it shall meet the following requirements:

1 The length of the highway segment of the same design speed should not be too short; the change of different design speeds, in the same highway, shall not be frequent.

2 The locations or sites, where highway segments of different technical levels and different design speeds are connected, shall be selected in front of or behind the large structures, interchanges, level crossings, the main village and town nodes along the route, or where the roadside environmental conditions change significantly.

4.2.6 It shall, according to the factors, such as the design speed of the segment, topography along the route, geology, environment and traffic needs, etc., reasonably determine the main control indicators, such as the horizontal and vertical plane, line of sight, superelevation, widening of the route.

4.2.7 It shall determine comprehensively the composition and width of the lateral section of the highway roadbed, according to the technical level of the highway, the designed traffic volume, the environment along the route, the functions of the various components of the lateral section.

4.2.8 For the reconstructed and expanded highway, it shall adopt the technical standards and indicators of the reconstructed and expanded highways. For highway segments that use the original highways, if the increase in design speed may induce engineering geological diseases, increase engineering costs, or adversely affect environmental protection and cultural relics, THEN, through demonstration, it may maintain the original design speed and indicators, at these local highway segments. However, the length should not exceed 15 km for the expressway; it should not exceed 10 km for the first and second-class highways. The technical level shall not be lowered.

4.3 Construction scale and construction plan

4.3.1 It shall, based on highway network planning and highway functions, comprehensively consider the layout and planning of railways, waterways, aviation, pipelines and other integrated transportation systems, within the corridors belts of the route, the status quo and development plans of cities and industrial and mining enterprises, the development and utilization of natural resources. It shall determine, through study, the start and end points of the route, the main control points, the length of the route, the number of crossings, the

3 The second-class highway, third-class highway, fourth-class highway shall select the form of integral roadbed section.

4 For the first-class and second-class highways, it shall demonstrate the conditions for setting up slow lanes, based on the functions, mixed traffic volume, traffic composition; meanwhile determine their setting methods, lateral section forms, widths.

5 For different section forms and width changes of highways, it shall set necessary transition segments, the location of which should be selected at nodes such as cities & towns and crossings.

6 The layout of the lateral section of the highway roadbed shall meet the requirements for setting the traffic engineering and safety facilities, etc.

4.3.4 For the mutual arrangement relationship between highways, neighboring railways and pipelines, it shall be reasonably determined, on the basis of investigating and grasping the direction and location of railways and various pipeline facilities. Meanwhile it shall meet the following requirements:

1 It shall reasonably reduce the number of crossings, between highways and railways, pipelines, etc. When crossing is necessary, it shall determine, through demonstration, the location and method of crossing; use a larger crossing angle. At the same time, it shall be ensured that, the railways, pipelines and ancillary facilities shall neither intrude into the boundary of highway construction, nor affect the visual distance of highway.

2 When the highway is adjacent to the railway and pipeline facilities in parallel, it shall maintain the necessary distance, meanwhile ensure that, the railway, the pipeline and its auxiliary facilities shall not enter the construction control area on both sides of the highway.

4.3.5 For the crossing method between the highway project and the related highways along the route, it shall be determined comprehensively, according to the function, class and traffic organization method of the highway. Meanwhile, it shall meet the following requirements:

1 For highways, that assume the function of arterial lines, they shall fully integrate existing highway network conditions; reduce the number of various crossings AND increase crossing spacing, through measures such as merging, diversion, setting up auxiliary lanes, to improve the efficiency and safety of highway traffic.

2 When an expressway crosses highways of other classes, it must use the vertical crossing method. It shall be based on the conversion needs of traffic flow, to demonstrate the use of interchange or separate vertical crossing.

priority to the plans, which have less resource occupation and little environmental impact.

4.4.3 It shall reasonably set the borrowing yards. The sol borrowing from roadside should not be too close to the roadbed. For the borrowing yard, it shall avoid direct excavation of the roadside hillside slope. When the soil or slag spoil from roadbed and tunnel is large, it shall, combining the construction program of the project, maximize the utilization of the spoil soil and slag. Where it is hard to make use of them, it shall reasonably set up the spoil yard; do well in item design, to ensure its stability and prevent soil erosion.

4.4.4 It shall enhance the topsoil collection and utilization, within the highway construction scope AND the soil borrowing & spoil yard. It shall do well in the protection and recovery of the plant, in the temporary land, such as the soil borrowing & spoiling yard and construction ramp.

4.4.5 It shall enhance the treatment capacity of the production and domestic sewage, from the highway ancillary facilities such as service areas and parking areas; adopt advanced technology, to ensure that sewage meets the standard before reuse OR centralized collection and storage, thereby achieving the water recycling. In the design of highway operation, management and service facilities, it shall make rational use of the renewable energy, such as wind energy, solar energy, geothermal energy.

4.4.6 It shall enhance the recycling of steel and composite materials. It shall promote the comprehensive utilization of fly ash, construction waste, etc. in highway roadbed filling and concrete pouring. It shall advocate the recycling of asphalt and cement concrete payment AND members which are dismantled from structures.

4.5 Design inspection and safety evaluation

4.5.1 The highway design shall use the running speed method, to analyze and inspect the alignment design, geometric indicators, combination design of line shapes, to inspect the coordination and consistency of the running speed.

4.5.2 For the expressways, first-class highways, second-class arterial highways, it shall carry out the traffic safety evaluation, during design. For other highways, when conditions permit, it may also carry out traffic safety evaluation. It shall, according to the conclusions of the traffic safety evaluation, adjust and optimize the selection and use of the line shape design and the geometric indicators; inspect and improve the traffic safety facilities and management measures. Meanwhile, it shall meet the following requirements:

1 For the uphill direction of the continuous long and steep longitudinal slope

segment, it shall, focusing on the traffic volume, vehicle composition, change of running speed, analyze and evaluate the traffic capacity and service level of the uphill segment; propose the traffic organization and management measures plan; demonstrate the addition of climbing lane, if necessary.

2 For the downhill direction of the continuous long and steep longitudinal slope segment, it shall, focusing on the comprehensive performance conditions including the traffic volume, the vehicle composition, the types of main trucks, analyze and evaluate the traffic safety of the continuous downhill of vehicles; improve and strengthen the traffic work of the segment and the roadside safety facilities, accordingly; propose the traffic organization management and speed control measures plan of the segment; demonstrate the addition of the truck escape ramp, if necessary.

3 In the highway segments where there is roadside water, cliff, high filling, it shall, combining with such factors as the project functions, design speed, traffic volume, according to the setting plan of safety facility, analyze the roadside safety risks; improve the roadside safety protection design; propose the traffic safety management facilities AND improve the roadside safety protection grade, if necessary.

5 Route selection

5.0.1 Route selection shall include the whole process, of determining the basic direction of the route, the corridor zone of route, the route plan to the selected route position.

5.0.2 The route direction and the selection of main control points shall meet the following requirements:

1 For the starting and ending points of the route, the locations of towns, important parks, industrial and mining enterprises, comprehensive transportation hubs, special extra-long bridges and extra-long tunnels, that must be connected, they shall be the control points for the basic direction of the route.

2 For the locations of extra-large bridges, large bridges, extra-long tunnels, long tunnels, interchanges, railway crossings, etc., they shall be the control points of route direction, which, in principle, shall obey the route's basic direction.

3 For the locations of medium and small bridges and culverts, medium and short tunnels, as well as general structures, they shall follow the route.

5.0.3 In different design stages, the route selection work shall have different

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