Annex II

# ASIAN HIGHWAY CLASSIFICATION AND DESIGN STANDARDS

## I. GENERAL

The Asian Highway classification and design standards provide the minimum standards and guidelines for the construction, improvement and maintenance of Asian Highway routes. Parties shall make every possible effort to conform to these provisions both in constructing new routes and in upgrading and modernizing existing ones. These standards do not apply to built-up areas.[1]

## II. CLASSIFICATION OF ASIAN HIGHWAY ROUTES

Asian Highways are classified as shown in table 1.

Table 1. Asian Highway classification

| Classification | Description | Pavement type |
|---|---|---|
| Primary | Access-controlled highways | Asphalt or cement concrete |
| Class I | 4 or more lanes | Asphalt or cement concrete |
| Class II | 2 lanes | Asphalt or cement concrete |
| Class III | 2 lanes | Double bituminous treatment |

"Primary" class in the classification refers to access-controlled highways. Access-controlled highways are used exclusively by automobiles. Access to the access-controlled highways is at grade-separated interchanges only. Mopeds, bicycles and pedestrians should not be allowed to enter the access-controlled highway in order to ensure traffic safety and the high running speed of automobiles. At-grade intersections should not be designed on the access-controlled highways and the carriageway should be divided by a median strip.

"Class III" should be used only when the funding for the construction and/or land for the road is limited. The type of pavement should be upgraded to asphalt concrete or cement concrete as soon as possible in the future. Since Class III is also regarded as the minimum desirable standard, the upgrading of any road sections below Class III to comply with the Class III standard should be encouraged.

## III. DESIGN STANDARDS OF ASIAN HIGHWAY ROUTES

### 1. Terrain classification

Terrain classification is shown in table 2.

1 The Party should indicate built-up areas in accordance with its requirements.

Table 2. Terrain classification

| Terrain classification | Cross slope |
|---|---|
| Level (L) | 0 to 10 per cent |
| Rolling (R) | More than 10 to 25 per cent |
| Mountainous (M) | More than 25 to 60 per cent |
| Steep (S) | More than 60 per cent |

2. Design speed

Design speeds of 120, 100, 80, 60, 50, 40 and 30 kilometres per hour are to be used. The relation between design speed, highway classification and terrain classification is shown in table 3. A design speed of 120 km/h should be used only for Primary class (access-controlled highways), which has median strips and grade-separated interchanges.

Table 3. Design speed, highway classification and terrain classification

(Unit: km/h)

| Terrain | Primary | Class I | Class II | Class III |
|---|---|---|---|---|
| Level (L) | 120 | 100 | 80 | 60 |
| Rolling (R) | 100 | 80 | 60 | 50 |
| Mountainous (M) | 80 | 50 | 50 | 40 |
| Steep (S) | 60 | 50 | 40 | 30 |

3. Cross-section

The dimensions, such as right-of-way width, lane width, shoulder width, median strip width, pavement slope and shoulder slope for each highway classification, are shown in table 4.

Pedestrians, bicycles and animal-drawn carts should be separated from through traffic by the provision, where practical, of frontage roads and/or sidewalks for the sections where smooth traffic is impeded by the existence of such local traffic.

Table 4. Asian Highway design standards

| Highway classification | | Primary (4 or more lanes) | | | | Class I (4 or more lanes) | | | | Class II (2 lanes) | | | | Class III (2 lanes) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Terrain classification | | L | R | M | S | L | R | M | S | L | R | M | S | L | R | M | S |
| Design speed (km/h) | | 120 | 100 | 80 | 60 | 100 | 80 | 50 | | 80 | 60 | 50 | 40 | 60 | 50 | 40 | 30 |
| Width (m) | Right of way | (50) | | | | (40) | | | | (40) | | | | (30) | | | |
| | Lane | 3.50 | | | | 3.50 | | | | 3.50 | | | | 3.00 (3.25) | | | |
| | Shoulder | 3.00 | | 2.50 | | 3.00 | | 2.50 | | 2.50 | | 2.00 | | 1.5 (2.0) | | 0.75 (1.5) | |
| | Median strip | 4.00 | | 3.00 | | 3.00 | | 2.50 | | N/A | | N/A | | N/A | | N/A | |
| Min. radii of horizontal curve (m) | | 520 | 350 | 210 | 115 | 350 | 210 | 80 | | 210 | 115 | 80 | 50 | 115 | 80 | 50 | 30 |
| Pavement slope (%) | | 2 | | | | 2 | | | | 2 | | | | 2 - 5 | | | |
| Shoulder slope (%) | | 3 – 6 | | | | 3 – 6 | | | | 3 – 6 | | | | 3 - 6 | | | |
| Type of pavement | | Asphalt/cement concrete | | | | Asphalt/cement concrete | | | | Asphalt/cement concrete | | | | Dbl. bituminous treatment | | | |
| Max. superelevation (%) | | 10 | | | | 10 | | | | 10 | | | | 10 | | | |
| Max. vertical grade (%) | | 4 | 5 | 6 | 7 | 4 | 5 | 6 | 7 | 4 | 5 | 6 | 7 | 4 | 5 | 6 | 7 |
| Structure loading (minimum) | | HS20-44 | | | | HS20-44 | | | | HS20-44 | | | | HS20-44 | | | |

*Notes*: Figures in parentheses are desirable values.
Minimum radii of horizontal curve should be determined in conjunction with superelevation.
The recommended width of the median can be reduced with the proper type of guard fence.
The Parties should apply their national standards when constructing structures such as bridges, culverts and tunnels along the Asian Highway.

4. Horizontal alignment

The horizontal alignment of the road should be consistent with the topography of the terrain through which it passes. Minimum curve radii should be applied only when necessary and should be used in conjunction with transition curves. Compound curves should be avoided whenever possible. The minimum radii of horizontal curves are shown in table 5 for each highway class.

Table 5. Minimum radii of horizontal curve

(Unit: m)

| Terrain | Primary | Class I | Class II | Class III |
|---|---|---|---|---|
| Level (L) | 520 (1 000) | 350 (600) | 210 | 115 |
| Rolling (R) | 350 (600) | 210 (350) | 115 | 80 |
| Mountainous (M) | 210 (350) | 80 (110) | 80 | 50 |
| Steep (S) | 115 (160) | 80 (110) | 50 | 30 |

Note: Figures in parentheses are desirable values.

It is recommended that the application of the minimum curve radii be limited to unavoidable cases and values larger by 50 to 100 per cent be applied.

It is recommended that the combination of distance, radius and gradient of hairpin bends in the mountainous and steep terrain be considered.

Transition curves should be applied to connect curves with radii smaller than the values shown in table 6. It is also recommended that transition curves be applied even in cases where the radii are as large as twice the values in table 6.

Table 6. Radii for which transition curves should be applied

(Unit: m)

| Terrain | Primary | Class I | Class II | Class III |
|---|---|---|---|---|
| Level (L) | 2 100 | 1 500 | 900 | 500 |
| Rolling (R) | 1 500 | 900 | 500 | 350 |
| Mountainous (M) | 900 | 500 | 350 | 250 |
| Steep (S) | 500 | 500 | 250 | 130 |

The minimum transition curve length shown in table 7 is recommended.

Table 7. Minimum transition curve length

(Unit: m)

| Terrain | Primary | Class I | Class II | Class III |
|---|---|---|---|---|
| Level (L) | 100 | 85 | 70 | 50 |
| Rolling (R) | 85 | 70 | 50 | 40 |
| Mountainous (M) | 70 | 50 | 40 | 35 |
| Steep (S) | 50 | 50 | 35 | 25 |

The maximum superelevation should be 10 per cent for all terrain classifications.

5. Vertical alignment

The vertical alignment of any highway should be as smooth as economically feasible, that is, there should be a balance of cutting and filling to eliminate the rolling nature of land. In the use of the maximum vertical gradient, it should be kept clear in the mind of the designer that, once constructed to a given vertical grade, the highway cannot be upgraded to a lesser gradient without the loss of the entire initial investment.

The maximum vertical grade shown in table 8 should be used for all highway classes.

Table 8. Maximum vertical grade

| Terrain classification | Maximum vertical grade |
|---|---|
| Level (L) | 4 per cent |
| Rolling (R) | 5 per cent |
| Mountainous (M) | 6 per cent |
| Steep (S) | 7 per cent |

It is desirable to provide a climbing lane to up-gradient highways with heavy truck traffic where the length of the gradient exceeds the values in table 9.

The critical length of gradient section for the provision of a climbing lane is recommended for highway classifications Primary and Class I, as shown in table 9.

Table 9. Critical length of gradient section for the provision of a climbing lane

| Terrain classification | Primary | Class I |
|---|---|---|
| Level (L) | 3 per cent – 800 m | 3 per cent – 900 m |
| | 4 per cent – 500 m | 4 per cent – 700 m |
| Rolling (R) | 4 per cent – 700 m | 4 per cent – 800 m |
| | 5 per cent – 500 m | 5 per cent – 600 m |
| Mountainous (M) | 5 per cent – 600 m | 5 per cent – 700 m |
| | 6 per cent – 500 m | 6 per cent – 500 m |
| Steep (S) | 6 per cent – 500 m | 6 per cent – 500 m |
| | 7 per cent – 400 m | 7 per cent – 400 m |

6. Pavement

Carriageways should be paved with cement concrete or asphalt concrete. However, Class III may be paved with double bituminous treatment.

The pavement of many road sections in the Asian Highway member countries is damaged owing to insufficient load capacity. The design load for pavements should therefore be determined carefully to prevent damage to the road surface and consequently to reduce maintenance costs.

However, road pavements should be designed taking into account:

(a) Axle load;

(b) Traffic volume;

(c) Quality of materials to be used for basecourse and subgrade (as the quality of road construction materials varies from country to country, the pavement load specification was not included in the Asian Highway standards).

7. Structure loading

Increasingly heavy traffic, particularly container traffic, requires properly designed load capacity (maximum axle load). In order to prevent serious damage to road structures, and also to reduce maintenance costs, the Asian Highway network, as an international road network, should have a high design load capacity.

The minimum design loading of HS 20-44, which is the international standard corresponding to full-size trailer loading, should therefore be used for the design of structures.

8. Vertical clearance

Minimum vertical clearance should be 4.5 metres, which is the requirement for safe passage of standard ISO containers. However, in cases where sufficient clearance cannot be secured because of the high cost of rebuilding existing structures such as bridges, gooseneck trailers with low vehicle bed clearance may be used.

9. Environment

An environmental impact assessment, following national standards, should be carried out when new road projects are prepared. It is also desirable to extend this provision to include reconstruction or major improvements of existing roads.

10. Road safety

While developing the Asian Highway network, Parties shall give full consideration to issues of road safety.