Section 3

Intersections and Grade Separators

SECTION 3

INTERSECTIONS AND GRADE SEPARATORS

3.1 Introduction

3.1.1 Subject to the provisions of this Manual, properly designed intersections shall be provided at all road crossings/junctions. The types and locations of Interchanges and Grade-separated Intersections without ramps shall be specified in Schedule-B of the Concession Agreement. The intersections to be provided shall be one of the following types:

(i) At-grade intersections

(ii) Grade separated intersections without ramps

(iii) Interchanges

3.1.2 The existing intersections, which are deficient with respect to the minimum requirements shall be improved to the prescribed standards. Additional land, if any, required for improving the existing intersections shall be provided by the Government.

3.2 At-grade Intersections

3.2.1 *General*

(i) The majority of the intersections to be encountered will be of At-grade type. These are most economical and are provided at crossing locations, where the traffic on cross roads is low to moderate. These intersections should be properly designed as per details below.

(ii) Type of intersections to be adopted shall be decided on the basis of parameters like number of intersecting legs, traffic volume/ speed, available right of way, type of traffic control (signalized/non-signalized) etc. Necessary traffic surveys for the design of road junctions shall be carried out as per IRC:SP:19.

(iii) Normally, the type of intersection shall be:

(a) Three leg intersection.

(b) Four leg intersection.

(c) Multi leg intersection/rotary.

(iv) The design of different elements of intersection shall be done as per IRC:SP:41 including other design criteria given in the subsequent paras. MOSRTH - Type Designs for Intersection on National Highways, 1992 may also be referred to, wherever required, to develop suitable lay out and design of At-grade Intersections.

(v) The design shall aim at simplicity and uniformity in design standards. Complex designs which may involve complicated decision making by drivers shall be avoided.

(vi) The intersection control shall be of 'Stop Control' unless specified otherwise. This will mean that traffic on the minor road must stop prior to entering the major road. Where roads of equal importance intersect, priority will be given to the traffic on the right.

(vii) At the intersection, the alignment should be as straight and the gradient as flat as practicable. Gradients in excess of 2 per cent will normally not be allowed at intersections.

(viii) Any deficiency in the alignment and grade of intersecting roads shall be corrected to improve traffic conditions and safety.

(ix) The sight distance to be adopted shall normally be intermediate sight distance as specified in Section 2. However, in exceptional situations it should not be less than minimum stopping sight distance specified in Section 2. At such locations, cautionary speed limit signboards shall be displayed.

(x) At multi leg intersections, the points of conflict should be studied carefully and possibilities of realigning one or more of the intersecting legs and combining some movements to reduce the conflicting movements shall be examined. The objective shall be to simplify the design and appropriate control devices added to ensure more efficient and safe operation.

3.2.2 *Design Standards*

Design standards shall be as per IRC:SP:41. Salient features are given below:

(i) Design Speed: The approach speed shall be taken as the design speed adopted for the section of Project Highway on which the intersection is located. The design speed for various elements of the intersection shall be taken as 60% of the approach speed.

(ii) Design Traffic Volume: The traffic volume for the design of intersection and its distribution at peak hours shall be assessed, up to the operation period, taking into consideration the past trend, likely new development of land, socio-economic changes, etc.

(iii) Design Vehicle: Semi-trailer combination (refer IRC: 3) shall be used in the design of intersections.

(iv) The number of lanes to be provided at the intersection shall be governed by peak hour traffic volume in each direction of travel. For single lane movements, a minimum width of 5.5 m is to be adopted. For two-lane roads between kerbs, a minimum 7.5 m width shall be provided. Widening of carriageway shall be achieved by a taper of not less than 1 in 15.

(v) Type and radius of curve of intersection: The type and radii of curves would depend upon the types of vehicles turning at the intersection and shall be decided based on the traffic data.

(vi) Visibility at intersection: A minimum safe stopping sight distance, appropriate for the approach speeds, shall be available for the traffic on the Project Highway.

3.2.3 *Traffic Control Devices*

(i) Road markings: Typical road markings for road intersection as given in IRC:SP:41 and IRC:35 shall be followed. The specifications of road markings shall be as given in Section 9 of this Manual.

(ii) Signs: Traffic signs at the junctions shall be provided as per IRC: 67 and Section 9 of this Manual.

(iii) Reflectors: To guide the traffic, reflectors in the form of cat's eyes, delineators, etc shall be provided, in addition to the road markings, especially at the channelising islands.

3.2.4 *Detailed Designs and Data for Review by IE*

The Concessionaire shall submit the details of the ground surveys, traffic data, traffic forecast, design and drawings of the intersections showing all safety features to the Independent Engineer for review and comments, if any.

3.3 Grade Separated Intersections Without Ramps

3.3.1 *General*

(i) Grade separated intersections, without ramps provide an intermediate solution (between At-grade Intersections and

Interchanges) for traffic segregation. These are relatively cheaper as compared to Interchanges. These could preferably, be provided at locations where traffic on cross roads is moderate to heavy and segregation though essential, cannot be provided by an Interchange due to cost constraints. Under this type, two cross roads separate at different grades (as Road Under Bridge or Road Over Bridge) and all turning movements for transfer of traffic between the intersecting roads including merging, diverging, etc. shall be either not catered to or shall be accomplished at surface level through parallel service roads or through similar other mechanism.

(ii) Grade separated intersections without ramps shall be provided at the locations indicated in Schedule-B of the Concession Agreement. The road to be carried over or under the structures shall be specified in Schedule-B of the Concession Agreement.

(iii) All features pertaining to structures for this type of grade separator will be same as provided in Section 2 of this Manual.

3.3.2 *Geometric Standards for Design of Various Elements*

The geometric design standards for various elements of this type of grade separators shall be as given in paras 3.2.1 and 3.2.2.

3.3.3 *Design of Structures*

For design of structures of grade-separated structures, the details given in Sections 7 and 8 of this Manual shall be followed. Minimum length of viaduct required to be provided at various grade separated structures shall be specified by the Government in Schedule-B of the Concession Agreement.

3.3.4 *Traffic Control Devices*

Details given in paras 3.2.3 and 3.4.6 shall apply.

3.3.5 *Detailed Design and Data for Review by IE*

The Concessionaire shall submit the details of the ground surveys, traffic data, traffic forecast, design and drawings of the grade separated intersections and the structures, showing all safety features, to the Independent Engineer for review and comments, if any.

3.4 Interchanges

3.4.1 *General*

(i) An Interchange is a grade-separated intersection with connecting roadways (ramps) for turning traffic between highway approaches. Such an Interchange will be necessary at all crossings of a highway, which is to be developed to completely access controlled standards. An Interchange may also be justified at locations where traffic on cross roads is heavy and when an At-grade intersection fails to handle the heavy volume of turning, merging and diverging traffic leading to excessive delays and fatal and major accidents. Cost effectiveness will decide whether to provide full Interchange or grade separated intersection without ramps.

(ii) An Interchange may be justified at the crossing of the Project Highway with another highway, and where the total traffic on all the arms of the intersection is in excess of 10,000 PCUs in peak hour.

(iii) The decision to provide Interchange at such locations shall be taken by the Government and the requirement shall be clearly spelt out in Schedule-B of the Concession Agreement, which shall also indicate specifications and traffic streams to be grade separated.

(iv) The detailed design and layout of the Interchange shall conform to broad parameters and requirements specified by the Government in Schedule-B of the Concession Agreement.

Based on detailed survey and investigations, the Concessionaire shall develop appropriate detailed drawings and designs and submit to the Independent Engineer for review and comments, if any.

3.4.2 *Types of Interchanges*

(i) Interchanges are generally described by the pattern of the various turning roadways or ramps, which determine their geometric configuration. The common geometric configurations of Interchanges are the trumpet, diamond, cloverleaf, rotary and directional. Within each type of Interchange, there can be several variations such as split diamond, partial cloverleaf, etc. depending on the ramp arrangements.

(ii) The type of Interchange, the shape and pattern of the Interchange ramps and loops and their designs shall be governed by factors such as the importance of the intersecting highway, the number of intersecting legs, the design volumes of through and turning traffic movements including their composition, the design speeds, available right of way and topography. The Interchange site shall be studied in detail and alternative designs made, to determine the most suitable arrangement of structures and ramps satisfying the specified requirements.

3.4.3 *Geometric Design Standards for Interchange Elements*

The geometric design standards shall be as per IRC: 92 appropriate for the design speed adopted for the Project Highway. The design speed for ramps shall not be less than 40 km per hour. The desirable values of various parameters given in IRC: 92 shall be adopted, unless there are severe site constraints.

3.4.4 *Design Traffic*

The traffic volume for the design of various elements of Interchange including ramps shall be assessed up to the end of the Concession Period or twenty years, whichever is more, taking into consideration the past trends, likely new development of land, socio-economic changes, etc.

3.4.5 *Design of Structure*

For design of structures of grade-separated structures comprising of main structure and ramps, the details given in Sections 7 and 8 of this Manual shall be followed. Minimum length of viaduct required to be provided at various grade-separated structures shall be specified by the Government in Schedule-B of the Concession Agreement.

3.4.6 *Traffic Control Devices*

Traffic signs (refer IRC: 67) shall be provided at suitable locations to:

(i) Serve as advance notice of the approaches to the Interchange;

(ii) Direct drivers into appropriate lanes for diverging/merging movements;

(iii) Identify routes and directions;

(iv) Provide other information of importance to the drivers; and

(v) Show distances to destinations.

The specifications of road markings shall be as given in IRC:35 and as prescribed in Section 9 of this Manual.

3.4.7 *Detailed Design and Data for Review by IE*

The Concessionaire shall submit details of the ground surveys, traffic data, traffic forecast, design and drawings of the Interchange, showing all safety features, to the Independent Engineer for review and comments, if any.