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DESIGN OF FULL CLOVER LEAF

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A B S T R A C T

An intersection is the area shared by the joining or crossing of two or more roads. Since the main function of an intersection is to enable the road user to make a route choice, it is a point of decision. Hence the problems that are encountered by the motorist while passing through an intersection must be recognized and the design should be in such a way that the driving task is as simple as possible. Intersection is also a point of large number of major conflicts, besides a point of decision. These conflicts may be due to the crossing maneuvers of vehicles moving in different directions. Good intersection design results from a minimization of the magnitude and characteristics of the conflicts and a simplification of driver route selection process.

Keywords*: traffic flow, full cloverleaf, Glades Road*

1. OBJECTIVE

The objective of a design of full cloverleaf is to allow two highways to cross without the need for any traffic to stopped by red lights, even for left and right turns. The limiting factor in the capacity of a design of full cloverleaf interchange is traffic weaving. A configuration with loop ramps to safely accommodate left – turning movements that is well suited for the intersection of two freeways. Well suited for in rural or suburban locations where space is available

1.1 Structure

In order to improve traffic flow conditions the partial cloverleaf configuration currently in place can be upgraded to a full cloverleaf. The right of way in the case study is limited in both the North Eastern and South-Western quadrant. The construction costs of this alternative would be immense considering the overpasses that probably need to be built as well. Still, the full cloverleaf is simulated to compare this design with the partial cloverleaf on the different traffic parameters. the differences between the current partial cloverleaf interchange and the proposed full cloverleaf interchange. Two loops are added to replace the left-turning movements which interfere with the through traffic in Glades Road. The Southbound I-95 On-Ramp for traffic going Eastbound on Glades Road had to be replaced to make room for the new loop in the South-West quadrant. In order to improve traffic flow conditions the partial cloverleaf configuration currently in place can be upgraded to a full cloverleaf. The right of way in the case study is limited in both the North Eastern and South-Western quadrant. The construction costs of this alternative would be immense considering the overpasses that probably need to be built as well. Still, the full cloverleaf is simulated to compare this design with the partial cloverleaf on the different traffic the differences between the current partial cloverleaf interchange and the proposed full cloverleaf interchange. Two loops are added to replace the left-turning movements which interfere with the through traffic in Glades Road. The Southbound I-95 On-Ramp for traffic going Eastbound on Glades Road had to be replaced to make room for the new loop in the Roads with grade separation generally allow traffic to move freely, with fewer interruptions, and at higher overall speeds; this is why speed limits are typically higher for grade-separated roads. In addition, reducing the complexity of traffic movements reduces the risk of accident Advantage Road with Grade-separated roads that permit for higher speed limits can actually reduce safety due to 'weaving' (see below) as well as a perceived sense of safety. Roads with grade separation generally allow traffic to move freely, with fewer interruptions, and at higher overall speeds; this is why speed limits are typically higher for grade-separated roads. In addition, reducing the complexity of traffic movements reduces the risk of accidents. Disadvantages Grade-separated road junctions are typically space-intensive, complicated, and costly, due to the need for large physical structures such as tunnels, ramps, and bridges. Their height can be obtrusive, and this, combined with the large traffic volumes that grade-separated roads attract, tend to make them unpopular to nearby landowners and residents. For these reasons, proposals for new grade separated roads can receive significant public opposition. Rail-over-rail grade separations take up less space than road grade separations: because shoulders are not needed, there are generally fewer branches and side road connections to accommodate (because a partial grade separation will accomplish more improvement than for a road), and because at-grade railway connections often take up significant space on their own. However, they require significant engineering effort, and are very expensive and timeconsuming to construct..

1.2 Classification of Intersection

Intersections are classified depending upon the treatment of crossing conflicts as follows

1. At Grade Intersection and

2. Grade Separated Intersection. > Grade Separated Intersection.

It is a bridge that eliminates crossing conflicts at intersections by vertical separation of roadways in space. Grade separated intersection are otherwise known as Interchanges. Grade separated intersections cause less hazard and delay than grade intersections. Route transfer at grade separations is accommodated by interchange facilities consisting of ramps. Interchange ramps are classified as Direct, Semi-Direct and Indirect. Interchanges are described by the patterns of the various turning roadways or ramps. The interchange configurations are designed in such a way to accommodate economically the traffic requirements of flow, operation on the crossing facilities, physical requirements of the topography adjoining land use, type of controls, right-of-way and direction of movements. The ultimate objective of grade separated intersections is to eliminate all grade crossing conflicts and to accommodate other intersecting maneuvers by merging, diverging and weaving at low relative speed. The relative speed of the conflicting vehicle streams is an important factor affecting the significance of a conflict. The benefit of providing for low relative speed is twofold. First, events unfold more slowly allowing more judgement time and second, in case of an impact the total relative energy to be absorbed are less and hence, the damage is less

1.3 Classification of Grade Separated Intersection

One of the distinctions made in type of interchange is between the directional and the nondirectional interchange. Directional interchanges are those having ramps that tend to follow the natural direction of movement. Non directional interchanges require a change in the natural path of traffic flow. A comprehensive classification plan for grade separated intersection design which includes all possible geometric patterns has not yet been developed. The design and operational characteristics of each of the major interchange types are mentioned as follows and are discussed in the following sections.

- Underpass
- Overpass
- Trumpet Interchange
- Diamond Interchange
- Cloverleaf Interchange
- Partial Cloverleaf Interchange
- Directional Interchange
- Bridged Rotary

2. DESIGN FACTORS OF FULL CLOVERLEAF INTERCHANGE

Various factors to be considered in the design of a traffic cloverleaf interchange

- Design speed
- Shape of central island
- Radius of cloverleaf roadway
- Weaving angle and Weaving distance
- Width of carriage way at entry and exit
- Width of cloverleaf roadway
- Radius of entrance and exit curves
- Capacity of the cloverleaf interchange
- Channelizing island
- 10.Camber and super-elevation
- 11.Sight distance and grade
- .Lighting
- Traffic signs.

1. **Design speed**: Vehicles approaching at intersection at grade have to considerably slow down their speed when compared to the design speed standard of the highway under consideration. With these in view the design speed for traffic in India is taken as 40kmph for cloverleaf in rural areas when one or more converging roads from part of an important highway. In all other cases a speed 30kmph is adopted for design

2. **Shape of central island**: The shape of the central island depends on the number and the layout of the intersection road. The outline of the island consists of a number of curves of large ii, without corners.

3. **Radius of cloverleaf roadway**: The one-way cloverleaf road round the central island has a different radii at different points depending on the shape and radius of the central island at the respective sub stretches. Radius of cloverleaf roadway is calculated as follows R-V2 /(127f) here, R design coefficient of friction (f) are taken as 0.43 and 0.47 in overleaf interchange for the speeds 40 and 30kmph respectively.

4. **Weaving angle and Weaving distance**: The angle between the path of a vehicle entering the cloverleaf and that of another vehicle leaving the cloverleaf at adjacent road, thus crossing the path of the former is termed as the weaving angle. The weaving operation including merging and diverging van take place between the two-channelizing island of the adjacent intersecting legs and this length of the cloverleaf roadway is known as weaving length. The recommended value of weaving length is 40 to 90m for design speed f40kmph and 30 to 60m for 30kmph speed.

5. **Width of way at entry and exit**: The carriage way width at the entrance and exit of a cloverleaf is governed by the volume of traffic entering the cloverleaf from the road or that leaving the Cloverleaf to the road. The IRC recommends that where the radius of entry curve 25 to 35m the width of carriageway at entry and exit should be 6.5.7.0, 8.0 and 3.0 m respectively. When the carriage way of the approach road has two, three, Four. or six lands where the radius of entry curve is 15 to 25m the width of Carriageway may be 7.0, 7.5. 10 and 15m respectively for the same set of approach road. 10

6. Width of cloverleaf roadway: All the traffic entering the traffic cloverleaf have to go round the one way cloverleaf roadway for at-least for a short distance. The minimum width of the roadway between edge of the central island and adjoining kerb is the effective width of the cloverleaf roadway or of the weaving section and this by and large determines the capacity of the cloverleaf. W = [(e1 + e2) / 2 + 3.5] m Where e1= Width of the weaving section. e2= Width of non-weaving section.

7. Entrance and exit curves: The curve trace by the inner rear wheel of vehicles determines the radius and shape to which the curve line is to be set. For suggested sign speed of 40kmph the suggested radius at entry curve is 22 to 35m and for 30kmph. 15 to 25m. therefore the recommended radius of exit curve is 1.5 to 2.0 times the radius of entry curve.

8. Capacity of cloverleaf: The practical capacity of the cloverleaf is dependent on the minimum capacity of the individual weaving section. The capacity is calculated from the formula Qp= [280W(1 + e / W)(1 - p / 3)] / (1 + W / L) Where, Qp= Practical capacity of the weaving section of a cloverleaf in PCU per hour. W= Width of weaving section(6-18m) e = Average width of entry e1, and width of non- weaving section e2 for the range, e/W=0.4 to 1.0 L-Length of weaving section between the ends of channelizing islands in metre for the range of V / L = 0.12 to 0.4. P Proportion of weaving traffic given by, P (b+c)/(a+b+c+d) in the range 0.4 to 1.0. a = left turning traffic moving along left extreme lane. b = crossing traffic turning towards right while entering the cloverleaf. c = crossing traffic turning towards left while leaving the cloverleaf. d = right turning traffic moving along right extreme lane.

9. The IRC has recommended the following PCU values: Cars, light commercials vehicles and three wheelers = 1.OPCU Buses, medium and heavy commercial vehicle = 2.8 PCU Motorcycles, scooters = 0.75 PCU Pedal cycles= 0.50 PCU Animal drawn vehicles = 4-6 PCU 9. Channelizing island: Channelizing island should be provided at the entrance and exit of the cloverleaf to prevent undesirable weaving or turning and to reduce area conflict. The channelizing island are generally provided with kerbs 152 to 210mm height.

10. .Camber and Super elevation: A vehicle passing along a clover leaf traverses curve while changing from one way path of to the exit of the radial road. The cross slope of the cloverleaf at the point of change in direction should be minimum. The inwards slope of the cross slope or camber serve as super elevation for the traffic around, where outer slope of the camber helps the vehicles turning left towards the exit curve to the radiating road.

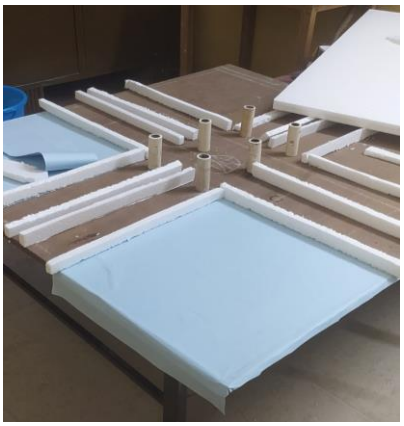
11. Sight distance and gradient: The sight distance in the clover leaf should be as large as possible and in no case less than the safe stopping distance for the design speed. The minimum sight distance should be 45 and 30m for design speeds of 40 and 30 kmph respectively. It may also be located on the area which is in the single sloping plane, with slope not exceeding 1 in 50 with the horizontal.

12. Lighting: The minimum lighting required is one in each on the edge of central island facing each radiating road. Additional light may be provided when the central island is larger than 60m.

13. Traffic signs: The standard traffic signs indicating the presence of cloverleaf intersection should be installed on al approach roads to give advance information to traffic. Vertical black and white stripes of with 250 to 300mm painted on kerb of central island and channelizing island improve visibility.

3. CONCLUSION

Traffic intersections are problem spots on any highway, which contribute to a large share of accidents. For safe operation, these locations should be kept under some level of control depending upon the traffic quantity and behaviour. Based on this, intersections and interchanges are constructed, the different types of which were discussed in the project.



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