

Optimization Strategy Entrance Interchange in Mountainous City

Huimin MENG

Chongqing Jiaotong University, Chongqing, 400047, China

Abstract: Urban Interchange is one of the major city intersections about crowded. Are entrances designed is the important factor of the relationship between transport traffic capacity of interchanges. Taking Chongqing as the research object, research Chongqing interchanges traffic congestion causes and methods of analysis of Chongqing Interchange design indicators, to identify mountain city interchange congestion reasons and put forward improvement measures to improve the traffic capacity of interchanges.

Keywords: Interchange entrance; Congestion measures; Capacity

1. Introduction

Interchange hubs take a lot of conversion tasks about traffic merge, split and travel route, with the rapid increasing of vehicles, which is likely to cause Interchange burdens of traffic, causing traffic jams generated; while lower interchange capability of dealing with traffic accidents, when a traffic accident happening at the intersection, the vehicle lane and it is difficult to deal with problems in a timely manner, it is very likely to cause reduced the ability to divert traffic, causing traffic congestion generated. Intersections are generally two different modes of transport organization, Figure 1 and Figure 2 are plan views of two kinds of intersection types.

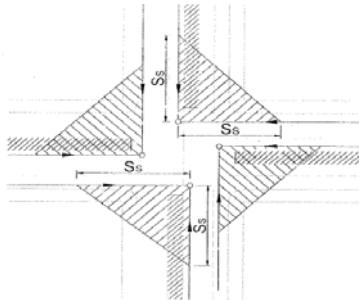


Figure 1. Two-way traffic

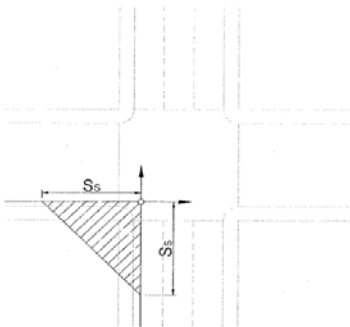


Figure 2. One-way traffic

In the mountain city intersection, because of the required traffic conditions and the ability to design the interchange, just to meet the mountain city intersections for traffic distribution needs, so interchange account for a large proportion in the mountain city intersection, so interoperability overpass traffic congestion is one of the key problems of mountain city Interchange congestion. The setting of interchange entrance is the key places throughout the interchange design, entrance design is reasonable is an important factor intersection traffic control capacity; The paper analyzes design requirements about the cross-sectional design of the entrance to the intersection of regulations, to identify the main cause of the intersection congestion problems, analyzing the reasons causing congestion intersection, to propose appropriate solutions that improves the ability to interchange traffic control port.

2. Standards about Mountainous City Entrance Interchange Design

The cross section of Urban Interchange entrance ramp may include lane, curbs, car with points, the roadside strip, lane distribution, crash and other facilities. In the interchange ramp at the entrance, these should be set vehicle speed change lanes. Interchange ramp entrances pattern should be uniform and should be arranged in the right side of the main line. The export should be laid in the upper reaches of interchanges structure, when exports laid at the downstream of interchange structures, these should be set up distribution lane to advance to the distribution points will be diverted upstream of structures. The design of ramp imports widened should be based on the value of the adjacent lane width, setting import broadening Table 1, the following table can be found corresponding to different vehicle width broadening coefficients of import channel is not the same.

The spacing of intersections about adjacent interchange should be greater than the length between the upstream

and downstream transmission lane entrance ramp and weaving section length, and meet requirements of setting the necessary traffic signs, and not less than 1.5km.

Table 1. Import Broadening Coefficients

Lane With(m)	3.00	3.25	3.50
Broadening Coefficients	1.00	0.85	0.71

Interchange Ramp cross-sectional design is essential for capacity ramp .The below Figure3 is the chart of composition of ramp cross-section.

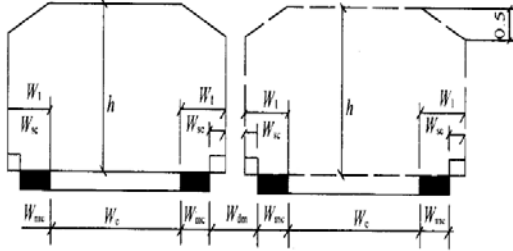


Figure 3. Composition of Ramp cross-section

While interchange Ramp biting a driveway, the ramp roadway should be one-way traffic, one-way single-lane ramp width should not exceed 7m, and is preferable to use single horizontal section, an annular ramp should adopt the bicycle paths, organize two-way traffic should use bicycle paths, organize two-way traffic should double width or separate section.

When the import and export having a short distance, distribution lanes should be set, the traffic between import and export and the main line should be laid isolated entity. Design speed of distributed lane ramp shall be determined in accordance with the design speed. Lane dual carriageway should be distributed. Different ramp widths correspond to different design speed, setting the width of the ramp is shown in Table 2 below.

Table 2. The Width Interchange Ramp lane

Type lane	Design Speed (km/h)	Lane Width (m)
Large car or mixed lane	>60	3.75
	<60	3.5
Small car lanes	>60	3.5
	<60	3.25

When the ramps on the main line does not guarantee a balance between downstream lane and the upstream, which should be laid in the main lane assist lane on the right plan.

The same width as main lane assist, and the curb is not provided between the main line of the lane, the right auxiliary lane should be located with parking, parking should be the normal width of the main sections of the same parking zone, using the emergency parking bay under special conditions and the width of lane not less than 2.5m.

Entrances of ramp end should include ramp gradient segments, shifting lanes; off-ramp exit end, while the slowing down car arriving to the finish, set easement curve; For the radius of curvature of the Transition Curve at traffic diversion point and swing the curve parameters specified in Table 3 should be filled.

Table 3. The radius of curvature and maneuver curve parameters of the diversion point of entrance

Main design speed (km/h)	Split point traveling speed (km/h)	Minimum radius of split point (m)	Cyclotron parameters A(m)	
			General value	Limit
120	80	250	110	100
	60	150	70	65
100	55	120	60	55
80	50	100	50	45
60	≤40	70	35	30

On special sections of the Interchange Main Line and entrance at the diversion point of exit ramps, when need to provide a misjudged vehicle return leeway , The edge of the lane widening bias should be set, the specific width value should be based on the actual situation according of security and transportation needs. The below Figure4 is entrance ramp ends horizon.

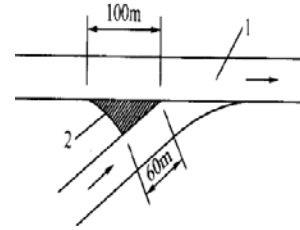


Figure 4. Entrance ramp ends horizon

The adjacent entrance ramp minimum spacing is shown in Table 3, for special sections, the adjacent spacing between into the exit ramp and exit ramp should also consider the distance required between the transmission path the length and determine the flag. While the into-ramp next to off-ramp, Interchange hub takes the maximum spacing, generally go to the lower limit, the Table 4 is the minimum spacing of adjacent entrance ramp.

Table 4. The minimum spacing of adjacent entrance ramp

Road design speed	100	80	60	50	40
Limit	140	110	80	70	55
General value	280	220	160	140	110

3. Analysis of Interchange Congestion

For congestion problems in the city, the interchanges congestion is one of the main problems of urban congestion, especially in the mountain city, because of the special topography, urban interchanges occupy most of the city intersection, interchange congestion become a major

part of urban traffic congestion problems, and entrance design is the main reason of interchange congestion problems, urban interchange congestion is a serious problem, solve urban interchange hold to alleviate the traffic pressure on the intersection plays an important role, Figure 5 shows the status quo of urban interchange congestion.



Figure 5. Congestion in Urban Interchange

The every mountain city interchange has a corresponding traffic control capabilities, the basic traffic flow Interchange on main Line also has relevant provisions, the following Table 5, shown the capacity of each ramp in the Table 6.

Table 5. The basic capacity of interchange main line

Design speed (km/h)	50	60	70	80	100
Possible capacity (pcu/h)	2050	1950	1870	1800	1760

Table 6. Interchange basic capacity

Design speed (km/h)	40	50	60
Possible capacity (pcu/h)	1700	1730	1750

According to the above table, there are provisions for the appropriate traffic capacity of interchange ramp, urban interchange design speed is mainly 40km / h, the basic capacity for respective main is 2020pcu / h, and the corresponding capacity to ramp is 1700. The survey shows that traffic of interchange in the period of morning rush and evening peak are higher than the capacity of the main line, so that the capacity of interchange ramp lowered, at the same time reducing the ability to interchange traffic control, resulting in congestion of vehicles problem.

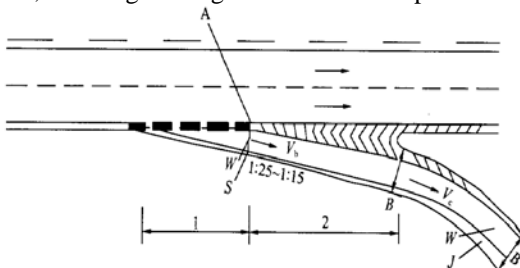


Figure 6. Direct single lane entrance

As the above Figure6, it is the direct single lane entrance. The width of the ramp is one of the factors of traffic capacity, research shows that too broad or too narrow width of the ramp will cause a decline in traffic capacity, so a reasonable width to improve the capacity of the ramp is quite important. The distance between the different types of imports has different requirements, the below Figure7 is the minimum spacing ramp.

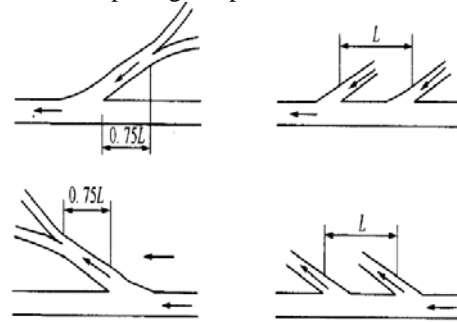


Figure 7. The minimum spacing ramp

The vehicle is involved to merge and split in the interchange at the entrance, which causes interference for the surrounding vehicles, but also receive interference from surrounding the vehicle, the vehicle confluence or diversion point is also related to the impact on the capacity, and reasonable spacing can improve the capacity of the interchange [1].

Since interchange of own characteristics, so the ability to interchange for emergency treatment is low while vehicle failed , resulting the vehicle can't move outside the lane in time, causing lane carriageway, causing interchange capacity is reduced, resulting in congestion of the vehicle.

4. Improvements of Interchange Entrance

Through analysis, the reason of causing major traffic jams is a reasonable cross-section of the entrance design specifications and design, as well as capacity to ease the traffic flow is not enough to meet the needs of the intersection, causing congestion of the vehicle ,from a few above problems, madding for improvement advice.

a) When you need to set the same side of left the ring ramp, you should set up distribution lane between adjacent annular ramps, and interchange that turns left at the traffic should not use a large ring interchange. Figure 8 is the slope maintenance.

b) Distributed lane should be provided at the right on the main line, and should set median between different carriageways on the main road. Width of median should be meet requirements to set up the necessary transport infrastructure, and should not be less than 1.5m. When there are special difficulties, width of median should not be less than 0.5 m, these must be set Security isolation facilities at median. Distributed lane should be in contact with mainline lanes through the shift lane [2].

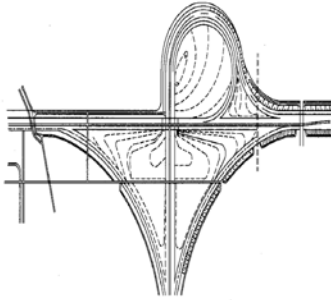


Figure 8. Slope maintenance

- c) Setting auxiliary lane, the length of the lane is preferably 1000m at the end of the shunt, but not less than 600m. If the auxiliary lane of entrance in interchange set up auxiliary lane and the distance of different gradual start of the segment and exit is less than 500, should be extended auxiliary lane and connected to the adjacent entrance.
- d) Direct exit alignment should be consistent with lane track ,its export aspect ratio should be Connected with main phase by 1:25 ~ 1:15 uniform fade rate , the dispersion angle is preferably $2^{\circ} - 5^{\circ}$ [3].
- e) Urban Intersection design should be people-oriented, harmony with the surrounding roads, under ensuring safe conditions, to increase road capacity.

5. Conclusion

Optimization about the ramp of mountain city interchange entrance, it plays an important role on improving urban intersection congestion. The urban interchange congestion is the key of intersection congestion in major cities, taking much industry attention. By analyzing the root causes of urban interchanges and exits congestion, to make relevant improvement measures to enhance the capacity of urban interchanges and exits, and provide a reference for the improvement of interchanges and exits. Interchanges and exits connected with the convergence of the road, in terms of design, has been in a lot of problems, there is a great research value.

References

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