

The Application of “Humanized” Concept in Urban Road Design

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Abstract: In order to promote the development of urban roads, enhance urban road design, and fully maximize the role of urban roads, this study first discusses the fundamental requirements of urban road design, the “humanized” concept in urban road design, and the importance of “humanized” urban road design, as well as proposes several “humanized” design strategies for urban roads as references.

Keywords: Humanized concept; Urban road design

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1. Introduction

Urban development areas have been expanding year by year, and so too has the number of urban streets and roads. Time directly affects people’s lives and work, reducing efficiency and subjective experience. In the past, urban roads used to be primarily driveways, but they can no longer accommodate modern people’s travel requirements. In modern society, urban roads serve as more than just a means of transportation; they also play a significant part in the everyday lives of individuals, having an impact on their productivity at work and quality of life. Introducing humanistic ideas into road planning and design may provide scientific guidance and support for the construction and development of “harmonious” buildings.

2. Basic requirements of urban road design

2.1. Safety

The traffic volume on roads registered an increase with accelerating urbanization. Therefore, it is of great practical significance to create a safe passage in road design. Theoretically, safety is the most fundamental aspect in road design, and it is also an important guarantee for project designs and construction activities. In order to improve the design effect of roads, it is not only important to ensure smooth traffic, but also improve the safety of people’s travel activities, so as to lay a good foundation for building a harmonious society.

2.2. Economy

In order to better meet the needs of economic and social development, there has been a significant increase in the scale of urban road construction. The requirements for quality road construction are rising steadily. Investments are considered as an important basis for realizing the ideal construction results. Hence, actively considering ways to increase the economic benefits of road design projects should be paramount. For

example, when planning and designing road routes, it is necessary to formulate a reasonable cost plan based on existing road conditions and traffic flow, so as to ensure the economic feasibility of commercial investment to a certain extent, and form traffic organizations in relevant areas, which must be scientifically determined ^[1]. For roads with low traffic flow, implementing innovative designs can meet the traffic demand of the real world, improve the economy of road operation, promote reasonable investment, and maximize project benefits.

2.3. Environment

The economic income of the people in China has seen a significant increase, and the number of private cars has also reached a pinnacle. In the face of frequent urban traffic congestion, relevant national departments have begun to advocate green and low-carbon travel. Therefore, when designing urban roads, environmental protection requirements must be considered, and the rationality of the design scheme must be improved at a constant rate. For road boundaries close to residential areas, noise barriers can be installed to reduce the negative impact of transportation noise from vehicles travelling around the area. While advocating the “humanized” concept in urban road design, environmental protection should be taken as the starting point to improve road greening design, reduce or avoid unnecessary pollution, and maintain stable societal development.

3. The concept and importance of “humanized” design in urban roads

3.1. The concept of “humanized” design

The basic idea of “humanized” design is that it is people-oriented, which is one of the key components of modern urban road design. In traditional road design, designers tend to prioritize the convenience of automobiles over the needs of pedestrians and other non-vehicles ^[1]. The “humanized” concept makes up for the shortcomings of the traditional road design, enhances the visual appeal of roads, and ensures a more reasonable planning while guaranteeing the safety and convenience of people for travelling. Additionally, trees are planted on both sides of the road using reasonable and scientific methods, and the design of the road is evocative of the surrounding buildings. Depending on the city’s climate, installing flower beds of different shapes and planting colorful flowers in the center of the road may both, improve the air quality and lift people’s spirit. Smart city construction brings convenience to people’s lives. When designing urban roads, designers can incorporate smart city elements and use smart lighting and smart transit systems to make people’s life more convenient and improve the overall development level of the city.

3.2. The importance of “humanized” design

First of all, urban roads reflect the development status of a city and the degree of urban civilization. With “humanized” design, they can intuitively reflect the economic level of a city. As a future design trend for roads, “humanized” design plays a very important role in urban planning. It promotes a more pristine and attractive city. Secondly, “humanized” design can better relieve traffic pressure and provide people a safer environment and more comfortable experience ^[2]. As an important part of transportation, urban roads play a very important role in the development of urban economy. “Humanized” design better reflects the development of a city, attracts more investors, and contributes to the advancement of urban economy. The final step is to strengthen the idea of environmental protection. Environmental protection has become China’s basic national policy. The harmonious development between man and nature promotes sustainable development. “Humanized” design plays a significant role in environmental protection by including more greenery and improving the overall aesthetic feeling and road conditions.

In short, the “humanized” design concept mainly adheres to the people-oriented principle, integrates with the local natural conditions, incorporates diversified elements to the design scheme, and emphasizes on environmental protection. It has laid the foundation for the sustainable development of cities.

4. “Humanized” design strategies for urban roads

4.1. Overall road design

The overall road design mainly includes horizontal and vertical design as well as road structure design. Its graphic design should not only meet the parametric design of current standards, but also the aesthetic, driving comfort, and each traffic participant’s requirements for the passage space. It is worth noting that the division of motor vehicle lanes cannot be done at an expense of sidewalks or non-motor vehicle lanes. Specifically, in the installation of inspection wells, a design that ensures that the wheels of vehicle can roll over the manhole cover is needed. Reducing road damage will not only improve driving comfort, but also extend the service life of a road. When designing the profile, it is necessary to consider the elevation, drainage conditions, pipeline layout, and other factors of the plots on both sides of the road, so as to minimize the slope change and ensure driving convenience^[2-10]. Road section design is a major component in road design, which is closely related to the traffic environment of pedestrians and bicycles, as well as the road landscape and ecological environment quality. Cross-section design is generally divided into single-lane roads and multi-lane roads. In terms of design, multi-lane roads should be given priority. The main factors include the following:

- (1) the setting of isolation belt (central separation belt, side belts, and green space facility belt) for multi-lane roads enables the planting of more low-lying vegetations and trees, which improves the greening and shading of roads;
- (2) from the perspective of traffic participants, multi-lane roads reduce the actual width of narrow roads and enhance the road landscape effect;
- (3) in terms of environmental quality, multi-lane roads can improve the rate of road greening and alleviate the heat island effect; air pollution can be reduced by attaching harmful substances and decomposing dust;
- (4) multi-lane roads can also effectively reduce road infringement between automobiles and non-automobiles, as well as improve road capacity.

Road pavement structure can be divided into asphalt pavement, concrete pavement, and block pavement. At present, asphalt pavement and concrete pavement are used for urban pavement, while block pavement is usually used in scenic spots and ancient cities. Using fine-grained asphalt concrete for the surface can effectively reduce the noise produced from driving. Hence, asphalt pavement should be given priority in road design to reduce sound pollution and ensure riding comfort. The shock absorption and cushioning performance of non-motor vehicles are worse than those of passenger vehicles, and the pavement roughness is higher.

4.2. Sidewalk design

In addition to the traffic function, the leisure and entertainment function of walking must also be considered. The first factor that should be considered in sidewalk design is the width. Pedestrian safety can be guaranteed with sufficient width. Considering the road plane and cross section design, the width of sidewalk should not be lesser than the minimum requirements of current national standards. The effective passage space of sidewalk and the location of relevant municipal facilities and equipment are directly related to the safety and comfort of the passage. At present, many roads have reduced the width of sidewalks at intersections to create more lanes, which is not recommended. The road construction or reconstruction design must ensure that the sidewalks at intersections are not narrower than the standard sidewalk width.

Additionally, traffic engineering mandates that two traffic modes travelling at radically different speeds must use separate lanes and sidewalks must have clear boundaries with other lanes. The maximum speed of a car should not exceed 25 kilometers per hour, but it is still several times of a person's walking speed, which can easily result in traffic accidents. By strengthening the boundaries between sidewalks and driveways, it is possible to prevent occupying sidewalks, alert pedestrians, promote sidewalk drainage, reduce the effect of ponding on sidewalks, and provide safe and comfortable walking conditions for pedestrians. There should be no gap between the curb and trees. In the design of trees, tree canopy should be taken into consideration, in which it should have water permeability features. The top surface of the sidewalk and the sidewalk itself should be level. For the benefit of pedestrians, placing a tree grate next to the curb will provide more walking space within the narrow sidewalk.^[3] There should be no obstacles in the pedestrian space; traffic signs, streetlights, electric boxes, and other facilities should be placed on the roadside. The facilities and equipment should be designed as small as possible and should not obstruct blind spot areas. The distance from blind areas should be at least 0.25 meters.

4.3. Barrier free design

In the current barrier free design of urban roads, blind areas are set up, but the width and color are unreasonable. Second, these blind areas are not continuous, and they are cut off when there are obstacles. Third, there is no slope or insufficient slope width at the junction between the blind area and the road. Fourth, the blind sidewalk is not continuous from the sidewalk to the ramp. Fifth, there is almost no blind area design.

The aforementioned problems have affected the normal use of roads by the disabled. Several "humanized" suggestions have been proposed for designing roads for the visually impaired. For urban roads near areas that cater to the blind, such as visually impaired schools and Braille libraries, continuous blind spots should be set at the center of the crosswalk, connecting with the sidewalk's blind spots, as medium yellow^[4]. Roadside ramps should be built at both sides of the crosswalk and at the connection points between bus stations and the sidewalks on the separation belt, with the sidewalk lines drawn; the roadside ramps and lanes should be smoothly connected. Curb ramp areas should not be used as road drainage channels. It is also inappropriate to install manhole covers that conform to the longitudinal design of the intersection. When designing inspection wells on roads, it is important to avoid colliding with the blind tracks. Double hole covers should be designed if it is necessary to invade into blind tracks. The shape of the cover plate must be square, matching the pavement of the blind area and the sidewalk.

4.4. Non-motorized vehicle lane design

Non-motorized vehicle lanes are usually located between motor vehicle lanes and the sidewalks. Depending on whether the lanes and the slabs are shared or not, they are separated as independent driveways, which do not share with motor lanes and slabs. The key points in designing exclusive lanes and independent non-exclusive lanes sharing with slabs are continuity and width, which should be set on both sides of the road. The non-motorized vehicle lanes on all roads must be continuous and wide enough. Since there is a demand for non-motorized vehicles waiting at light-controlled intersections, the width of these intersections should not be less than that of ordinary vehicles. In view of the advantages of independent non-motorized lanes, priority should be given to multi-lane roads in the road section design. At large intersections and those with left-turn traffic lights, when non-motorized vehicles cross the road, the left-turn traffic lights and vehicles need to be set in the same phase to shorten the travel time of non-motorized vehicles.

The width of non-motorized vehicle lanes should be determined according to the gradient of the road and the actual flow of non-motorized vehicles. Generally, the width of these lanes should not exceed 2.5 meters, and the width of independent non-motorized vehicle lanes should not exceed 4 meters. If they

exceed 4 meters, the non-motorized vehicle lanes' parking will affect the traffic. Parking spaces, bus stops, and other facilities should not occupy non-motorized vehicle lanes, and bus stops must be equipped with non-motorized vehicle lanes for detour. This is to guarantee the rights of vehicles other than automobiles. There should be a few inspectors for the special pipes in non-motorized vehicle lanes. When it is necessary to install, reinforcement and flattening designs should be carried out around the inspectors to ensure the smoothness of non-motorized vehicle lanes. Non-motorized vehicle lanes are usually equipped with valleys, and grids perpendicular to the direction of non-motorized vehicles must be used to prevent the tires of non-motorized vehicles from being pinched. The parking spaces in non-motorized vehicle lanes should be set on the trellis of sidewalks with clear signs, and they should not occupy the passage space of those sidewalks.

4.5. Pedestrian crossing design

Crosswalks are mainly divided into plane crosswalks and three-dimensional crosswalks (underground tunnels, overpasses, and others). In designing pedestrian crossing, the pedestrian crossing must be flat. When there are many pedestrian crossings or heavy traffic flow at the intersection, three-dimensional pedestrian crossing can be used. With the three-dimensional pedestrian crossing, the main road, the highway, the railway, and the fully enclosed ground railway transportation can be used. When crossing the road, the corner radius of the intersection curb should be set to a small radius to reduce the distance for pedestrians crossing the road. If the crosswalk distance is too long, in some cases, people will still be crossing when the traffic light turns red. There should be no height difference between the safety island and the adjacent expressway; the road surface must be leveled. The pedestrian crossing of the physical island used as an anti-collision barrier must be isolated from the heavy traffic intersections by traffic signs or paved with materials different from the road surface. Traffic lights for pedestrian crossing should be installed on the safety island of large intersections, where the waiting time should be within 90 seconds. Pedestrian crossing voice guidance devices, with a noticeably different sound, should also be installed at pedestrian crossings.

4.6. Road separation design

The road separation belt can be divided into central separation belt, separation belts on both sides, street tree facility belt, and green space facility belt. The plantation belt was discussed under the sidewalk design section, and the green belt generally does not affect the traffic order, so they will not be discussed in this section. Considering the integrated design of the pedestrian island, the width of the median refuge is 2.0 meters. The plant configuration at the central zone must ensure safe driving and efficiency in traffic. In addition, it must be simple in form, neat in shape, and consistent in layout. Transparent factory configuration should be used at a specific distance before and after pedestrian crossings and intersections, in order to ensure adequate safety visibility. The central width of the central zone is only planted with shrubs and grass or taller trees with lower branches, together with shrubs, lawn flowers, and lawns, so as to offer visual appeal without interfering with the line of sight. The external separation line must extend to the intersection stop line so that taller trees can be planted at the intersection. In order to improve waiting comfort, shorten crossing distance, and improve crossing safety, bicycles require shade when parked at intersections or while waiting for traffic lights. Bus stops should be situated near the intersections in the exit direction to reduce the distance between them. They should also be situated near lush trees because people who are waiting at these bus stops may wait longer than expected.

4.7. Relevant auxiliary design

Road greening design should be in line with the overall design of the street view to provide pedestrians with friendly street space and increase the sense of naturalness, seasonality, habitability, and comfort from

the street view. The shade from trees improves the spatial scale relationship of the road, prevents people from being exposed to the sun, and reduces the sense of openness by creating a visually pleasing road view [10-15]. In terms urban furniture, a design that is in line with the principle of miniaturization should be pursued. Additionally, the floor area of facilities should be reduced on the basis of meeting the functions, and chairs and seats should be set based on actual needs. Urban roads must be within administrative areas, and there should be a restriction on the speed of motor vehicles around residential areas, hospitals, schools, and large public facilities; appropriate signs and lighting devices must also be installed to meet visibility requirements during the day and at night. Road lighting must meet the needs of pedestrians and cyclists for safe passage at night. The layout of road lighting must be satisfactory and consistent, so that the visual guidance provided will be comfortably and well-received by drivers and pedestrians.

5. Conclusion

In urban road design, it is necessary to consider the safety, economic, and environmental requirements in designing sidewalks, barrier-free elements, non-motorized vehicle lanes, pedestrian crossings, road separations, road-related infrastructures, and other facilities, as well as integrate the “humanized” concept in these designs, so as to meet the requirements of urban road use.

Disclosure statement

The author declares no conflict of interest.

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