

Design and Application of Practical Guidance System for Civil Airport

-- Taking Shenyang Taoxian International Airport as an Example

Jian Wu*

Liaoning Communication University, Shenyang, China

*Corresponding author

Abstract

With the continuous expansion of the scale of civil aviation passenger transport, the spatial structure and functional zoning of the terminal building are becoming increasingly complex. As the "spatial language" of passenger travel, the practicability of the guidance system directly determines the traffic efficiency and travel experience. The traditional airport guidance design is mainly oriented by building layout and operation management, and pays insufficient attention to the real use scenarios and differentiated needs of passengers, which is easy to cause problems such as low efficiency of path finding, confusion of moving lines and poor experience. Taking the "passenger practicability perspective" as the core research position, taking Shenyang Taoxian International Airport as an empirical case, combining with civil aviation design specifications and field research, this paper analyzes the functional weaknesses of the existing guidance system, and puts forward the practical optimization design strategy and landing path from four dimensions of information level, crowd adaptation, wisdom empowerment and scene details, so as to provide practical reference for the humanized upgrading of the guidance system of hub airports in Northeast China.

Keywords

Civil airport, guidance system, practical design, passenger perspective, Shenyang Taoxian International Airport.

1. Introduction

In recent years, China's civil aviation industry has maintained a high-speed development trend. In 2025, the national civil aviation passenger throughput will exceed 700million, and the airport terminal will continue to evolve towards large-scale, comprehensive and intelligent. The terminal integrates multiple functions such as departure, arrival, transfer, commerce, and transportation transfer. The spatial streamline is complex and the passenger flow density is high. The guidance system undertakes the core functions of spatial guidance, information transmission, and order guidance, and is the key link between airport services and passenger demand.

For a long time, most domestic airport guidance designs follow the logic of "building first, standard first", focusing on the standardization and visual unity of signs, and relatively lack of research on the dynamic travel scenes of passengers, the needs of multiple groups, and the pain points of actual use. Some airports have problems such as information stacking, guidance breakpoints, and insufficient adaptability, resulting in long time for passengers to find their way, high risk of missed flights, inconvenient travel for special groups, and failure to fully release the practical value of the guidance system.

Shenyang Taoxian International Airport, as the core aviation hub in Northeast China, is an important gateway to the opening up of Liaoning and even northeast China. Currently, it operates T3 terminal, with a passenger throughput of 4500 person times in peak hours. The passenger group covers ordinary travelers, transit passengers, foreign passengers, elderly and disabled special groups. The passenger flow structure is complex and the travel demand is diverse. In recent years, the airport has completed the intelligent transformation of the terminal building, but the guidance system still has the tendency of emphasizing form and neglecting practicality. Based on the perspective of passenger practicability, this paper analyzes the existing problems of Taoxian Airport guidance system with the demand of the whole process of passenger travel as the yardstick, and explores the design optimization path that fits the real scene of passengers, which has practical significance for improving the service quality of regional hubs and promoting the humanization construction of intelligent civil aviation.

2. Definition of Relevant Concepts and Research Perspectives

2.1. Connotation and Composition of Civil Airport Guidance System

The civil airport guidance system is a visual information dissemination system serving the whole process of passengers' travel. Through standardized symbols, words, colors and media carriers, it transmits information such as spatial orientation, functional zoning, flight dynamics and service tips to ensure passengers' efficient and orderly completion of all links such as departure, security check, waiting, transfer, arrival and transfer. Divided from the carrier form, its core composition includes three categories: first, static fixed signs, such as direction signs, function area door signs, warning signs, etc., are the basic carrier of the guidance system; Second, dynamic information signs, such as flight information screen, boarding gate prompt screen, passenger flow warning screen, etc., carry real-time variable information; Third, intelligent interactive guidance, such as self-service query terminal, indoor positioning and navigation, mobile terminal applet, can provide personalized and accurate information services.

2.2. Core Connotation of Passenger Practicability Perspective

From the perspective of passenger practicability, that is to break through the traditional design thinking of "management led and architecture led", take passengers as the only core user of the guidance system, and take the behavior habits, real needs and use pain points of passengers in the whole travel process as the design starting point. Its core evaluation criteria include four points: first, recognition efficiency, whether passengers can quickly capture core information in dynamic walking and crowded scenes; The second is the cost of finding the way, whether it can reach the destination with the shortest path and the least time; Third, the whole group adaptation can cover the needs of passengers of different ages, physical conditions and nationalities; The fourth is the scene adaptation, whether it can adapt to the changes of different scenes such as day and night, passenger flow density, and spatial environment. This perspective emphasizes weakening the decorative and formal design, returning to the functional essence of the guide system, and realizing the accurate matching of guide service and passenger demand.

[1]

3. Shenyang Taoxian International Airport Guide System Status and Practical Shortcomings

3.1. Basic Architecture of Existing Guide System

At present, Shenyang Taoxian International Airport has built a guidance system with "static signs as the main body, dynamic signs as the supplement, and intelligent facilities as the auxiliary". In terms of static signs, the code for the setting of public information signs system

for civil airports is strictly followed, and the color matching specifications of white words on blue background and black words on yellow background are uniformly adopted, which are arranged according to the classification of "terminal entrance - general map - channel guidance - functional area positioning", covering the main traffic routes and core functional areas. In terms of dynamic identification, large flight information screens are set up in the departure hall, security check-in gate and baggage claim area, and each boarding gate is equipped with a real-time status display screen to synchronously release flight time, boarding time, delay notice and other information. In terms of intelligent guidance, the terminal is equipped with a self-service query terminal, and the official applet is launched with basic functions such as flight query and boarding gate navigation, which has preliminarily completed the intelligent exploration. [2]

3.2. Existing Problems based on Passenger Practicability

Information hierarchy imbalance, low efficiency of dynamic scene recognition

From the perspective of passengers' dynamic travel, the existing guidance system has the contradiction of information overload and guidance breakpoints. On the one hand, the guide signs of some core channels also carry a number of information such as boarding gates, toilets, shops, catering, service desks, etc., which are not prioritized according to the core needs of passengers, and the information is piled up seriously. In the dynamic scene of walking and crowded traffic, passengers cannot quickly extract the core guidance such as boarding gate and security check, and the identification cost has increased significantly. On the other hand, the layout density of key node signs such as long-distance pedestrian channels, floor corners and channel forks is insufficient, and there are nearly 100 meters of "visual blind areas" without guidance in some areas, which are prone to route deviation and detour for first-time visitors, resulting in low road finding efficiency.

Insufficient differentiated supply and poor adaptability of multiple groups

The existing guidance system takes young and middle-aged ordinary passengers as the default design standard, which does not cover the needs of diverse groups adequately. For the elderly and visually impaired passengers, some public areas have small sign sizes and low hanging heights, and barrier free facilities such as blind path guidance, tactile signs and voice prompts only cover a small number of areas such as elevators and barrier free toilets, so the overall adaptability is insufficient. For transit passengers, the identification degree of transit channel entrance signs is low, the guidance of domestic transit and international transit routes is indistinct, and there is no clear separation from the normal arrival and departure flow lines. Transit passengers are prone to take the wrong route, and the connection time is prolonged. For foreign tourists, the bilingual signs in some areas are disorderly, the English translation is not standardized, the foreign language labels of the core information are missing, the multilingual guide service in the international area is insufficient, and it is difficult for foreign tourists to find their way.

Intelligent guidance is shallow, and its practical value is not fully released

Although the airport has been equipped with intelligent guidance facilities, the function landing is more formal and does not really meet the needs of passengers. The self-service query terminal only supports static information retrieval and plane map display, and lacks indoor positioning, optimal route planning, voice broadcast and other functions, so passengers cannot obtain accurate pedestrian navigation. The scope of dynamic information release is limited. Emergency information such as flight change, gate adjustment, security check congestion prompt is only displayed on the large screen in the core hall. There is no synchronous prompt at key points such as passages, escalators and waiting areas, and passengers are prone to miss important information. In addition, the function entrance of the mobile terminal guidance applet is hidden, the navigation accuracy is insufficient, the operation process is complex, and

the utilization rate of passengers is low, which fails to give full play to the portable advantage of mobile guidance.

Lack of scene adaptability and weakness in detail experience

The guidance adaptability under different travel scenarios is insufficient, which affects the use experience of passengers. In the commercial area, the visual brightness and size of shop signs and advertisements generally exceed the guide signs, and the guide information is blocked or interfered by the commercial content, so passengers are easy to ignore the passage guidance and deviate from the line of action in the commercial area. In the low light scene, the signs at the edges of some underground passages, corridors and baggage claim areas are not illuminated enough, the color contrast is reduced, and the visibility is greatly reduced. In addition, the number and location of guidance signs for convenience facilities such as mother and baby room, drinking water room and medical emergency point are small and hidden, and most of them are not included in the main channel guidance system, making it difficult for first-time passengers to quickly locate.

4. Practicability Optimization Design Strategy of Guidance System from the Perspective of Passengers

4.1. Reconstruct the Information Hierarchy and Build a Coherent Guidance System for the Whole Process

With the passenger departure line as the core, establish four levels of information, namely "overview - zoning - Guidance - positioning", to achieve information simplification and consistent guidance. The level-1 overview signs are set at the terminal entrance, security entrance, floor transfer and other core nodes, and are equipped with a clear space overview map, marking the current location, core functional areas and main traffic routes, so as to help passengers quickly establish their spatial cognition. The secondary zone signs shall be set with boundary signs according to the four functional zones of departure, arrival, transfer and traffic transfer to clarify the regional attributes and avoid confusion of flow lines. The three-level guidance signs are arranged at the passage, corner and bifurcation, which only retain the core guidance information such as boarding gate, security check, baggage claim and exit, highlight the visual priority in the form of large arrow+minimalist text, and eliminate redundant business and service information. The four-level positioning signs are set at the entrance of the functional area to clearly mark the area name and service content, so as to realize the closed-loop road finding.

At the same time, the layout of points is optimized according to the walking speed of passengers and the best observation distance. A guide sign is added at an interval of 80-100 meters for the long passage, and a warning sign is set at the corner and bifurcation 30 meters in advance to eliminate the blind area of guidance. Unified high contrast color scheme is adopted to ensure visibility in strong light, night, rain and other different environments.

4.2. Focus on Multiple Needs and Promote Humanized and Precise Adaptation

According to the demand characteristics of different groups of passengers, the refined guide design is implemented to achieve full crowd coverage. For elderly and disabled passengers, enlarge the sign size in public areas, optimize the hanging height and perspective of signs, fully lay blind lane guidance signs, add Braille signs and voice prompt devices in elevators, toilets, service desks and other areas, and provide barrier free guide booking services to improve the travel convenience of special groups. For transit passengers, set up eye-catching and exclusive transit guidance signs at the core nodes of the terminal, distinguish domestic and international transit routes with different colors, and mark the estimated walking time and connection process synchronously, so as to shorten the transit route finding time. For foreign tourists, we

will standardize the layout of bilingual signs, unify English translation standards, achieve the equivalent display of core information in Chinese and foreign languages, and add a multilingual self-service query terminal in the international zone to support interactive navigation in English, Japan, South Korea and other languages. [3]

4.3. Deepen Intelligent Empowerment and Improve the Practical Efficiency of Intelligent Guidance

Relying on the intelligent construction foundation of the airport, promote the upgrading of intelligent guidance from "available" to "easy to use". Upgrade the function of self-service query terminal, integrate indoor high-precision positioning technology, and add real-time route planning, voice navigation, and pedestrian time estimation functions. Passengers can enter the destination to generate the optimal route and avoid the congestion area synchronously. Build a global dynamic information release network. In addition to the large screen in the core hall, a small dynamic display screen is added at key points such as passageway entrance, escalator entrance and boarding gate to synchronize flight changes, boarding reminders, security congestion warning and other information in real time, so as to achieve global access to important information. Optimize the mobile terminal guide applet, simplify the operation process, open the wechat and Alipay applet entrance, and combine the positioning technology to push the flight dynamics and boarding reminders to create a "guide in the pocket". At the same time, based on the big data of passenger movement routes, dynamically analyze the passenger flow concentration areas and the pain points of road finding, and continuously optimize the logo layout and information content. [4]

4.4. Strengthen Scene Adaptation and Improve the Practical Design of Details

Optimize the guide design for different travel scenarios to enhance the detail experience. Clarify the visual priority of guide signs, standardize the size and brightness of advertisements and signboards in commercial areas, and prohibit blocking guide signs to ensure that guide information can be quickly identified in a complex visual environment. Optimize the lighting of signs in low light areas, and adopt the combination of self luminous signs and ambient supplementary lighting to ensure the contrast and visibility of signs in underground passages, corridors and other areas. Sort out the convenient service facilities, include the mother and baby room, medical point and drinking water room into the main channel guidance system, and add unified icon guidance in the core guidance signs to improve the accessibility of convenient facilities. In addition, for the scene of large passenger flow in holidays, temporary diversion signs and passenger flow early warning tips are added to cooperate with manual guidance to improve the efficiency of passenger flow guidance.

5. Application Implementation and Expected Results

Combined with the actual operation of Shenyang Taoxian International Airport, the practical design optimization can be carried out in three stages: the first stage is the basic optimization period, giving priority to the rectification of the information level and identification points of the core lines, supplementing the guidance of convenient facilities, standardizing the bilingual signs, and solving the problem of finding the way most intensively reflected by passengers; The second stage is the smart upgrade period, which upgrades the self-service query terminal and dynamic information screen, optimizes the guidance function of the mobile terminal, and builds a global intelligent guidance network; The third stage is to improve the promotion period, fully cover the barrier free guide facilities, and form a normalized guide service improvement mechanism based on the continuous iterative optimization of passenger data.

Through the practical design optimization, it is expected to achieve three results: first, the traffic efficiency will be improved, the average time for passengers to find their way will be

shortened by more than 20%, the connection efficiency of transit passengers will be significantly improved, and the number of missed flights and missed rides caused by finding their way will be greatly reduced; Second, the service experience has been optimized, the adaptability of the whole population has been enhanced, the travel convenience of special passengers and foreign passengers has been significantly improved, and the satisfaction of passengers with the airport guidance service has increased by more than 15%; Third, the hub value is strengthened. The humanized guidance service helps Shenyang Taoxian International Airport improve the service quality of regional aviation hub and enhance its attraction and radiation to passenger flow. [5]

6. Conclusion

The core value of civil airport guidance system is to serve passengers' travel, and practicability is its essential attribute. From the perspective of passenger practicability, the key to improving the efficiency of the airport guidance system is to jump out of the traditional architectural oriented design thinking and focus on the real needs of passengers in the whole travel process. Taking Shenyang Taoxian International Airport as an example, this paper analyzes the practical shortcomings of the current guidance system in terms of information level, crowd adaptation, intelligent landing, scene details and so on, and puts forward systematic design strategies such as information level reconstruction, multiple crowd adaptation, smart empowerment upgrade, scene details optimization and so on. In the future, with the in-depth promotion of smart civil aviation construction, the airport guidance system should further deepen the concept of "Passenger Center", integrate more technical means, continue to improve the level of practicality and humanization, and create a more warm air hub travel experience.

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