

Reflections on Age-Friendly Design and Accessible Space Construction for Cruise Interior Outfitting

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Abstract: *Against the backdrop of the continuous expansion of the global elderly cruise passenger market, the construction of age-friendly and fully accessible cruise interior space has become a core demand that determines the inclusive service level and operational safety performance of modern cruise products. Different from ordinary land senior care facilities and general accessible public buildings, cruise interior space operates in the dynamic marine navigation environment for a long time, with the constraints of strict maritime safety specifications, narrow limited space and complex hull motion state. For a long time, the accessible design of global cruise interiors mostly stays at the basic level of meeting the minimum requirements of international regulations, and has not formed a systematic and comprehensive age-friendly design system that fully adapts to the physiological and behavioral characteristics of elderly passengers. This study breaks through the previous single analytical framework that only focuses on the design of accessible cabins, systematically constructs a complete inclusive design system covering multi-dimensional physiological and psychological demands of elderly passengers, full-ship accessible space network construction, special technical adaptation under dynamic marine environment and full lifecycle operation and maintenance guarantee. Drawing on verified practical data of accessible cruise operation from CLIA 2024 Global Cruise Industry Status Report and China Cruise and Yacht Industry Association 2025 Cruise Elderly Passenger Behavior Survey, this paper sorts out the global development trend of elderly cruise market, analyzes the typical pain points of existing cruise interior design that cannot meet the needs of elderly passengers, and proposes a targeted phased implementation path suitable for the actual engineering constraints of large cruise interior outfitting. The research results show that the optimized full-ship age-friendly accessible system can improve the independent activity safety of elderly passengers by more than 82%, reduce the accidental fall risk at sea by more than 76%, and increase the elderly passenger satisfaction level to 4.7 out of 5 points. The conclusions of this study can provide solid theoretical support and practical guidance for China's subsequent batch construction of large cruise ships to build a world-leading inclusive cruise interior system, effectively improve the service quality of cruise products for the huge elderly passenger group, and expand the market coverage and social welfare value of China's independently built large cruise products.*

Keywords: Cruise interior outfitting, Age-friendly design, Accessible space construction, Elderly passenger experience, Maritime safety specification, Dynamic marine environment, Inclusive cruise service.

1. Background and Introduction

According to the public statistics and annual industry survey data released by the China Cruise and Yacht Industry Association, the proportion of elderly passengers in the domestic cruise market is even more remarkable, reaching as high as 62.3%, which is far higher than the global average level and reflects the distinctive demand structure of China's rapidly expanding cruise consumer market. This extraordinarily high proportion means that in the process of China's subsequent large cruise independent design and batch construction, age-friendly interior design and comprehensive accessible space construction have risen from being supplementary optional configurations to one of the most urgent and fundamental practical demands that directly determine the market competitiveness, service quality level, and social welfare value of domestically built large cruise products.

In 2024, the Cruise Lines International Association officially released the latest comprehensive global cruise industry operation data report, which systematically documented the overall recovery trajectory and structural evolution characteristics of the global cruise market after the pandemic. According to this authoritative report, the total number of global cruise passengers throughout the year exceeded 31.5 million, a figure that represents a substantial rebound from the historical low point experienced during the global public health crisis. The overall market scale has recovered to

approximately 92% of the pre-pandemic peak level recorded in 2019, demonstrating the strong resilience and inherent growth momentum of the global cruise tourism industry. What is particularly noteworthy is that within this recovering market, the passenger structure has undergone a profound and irreversible shift. Among all passenger groups, the proportion of elderly passengers aged 60 and above has reached an unprecedented 38.7%, officially surpassing other demographic segments to become the single largest core consumer group in the global cruise market. This structural transformation is directly driven by the accelerated global population aging process, the continuous improvement of elderly people's health conditions and consumption capacity, and the growing preference of this demographic for slow-paced, comfortable, and safety-guaranteed long-distance travel products.

As a highly enclosed floating public space sailing on the ocean for a long time, the cruise ship carries passengers to stay on board for several days or even dozens of days. Elderly passengers have significant physiological characteristics different from young people, including gradual decline of mobility, weakened balance ability, degradation of visual and auditory perception, and increased demand for continuous rest and convenient medical care. However, for a long time, the interior design of mainstream international cruises only passively meets the minimum mandatory requirements for accessible cabins stipulated by the International Maritime Organization, and there is no systematic and universal

age-friendly optimization design for a large number of public activity spaces, passage spaces and service facilities that all passengers can access. This situation leads to a large number of elderly passengers facing great safety risks in the cruise voyage, and their independent activity space is extremely limited, which seriously reduces the travel experience of this huge passenger group.

According to the 2025 China Cruise Elderly Passenger Behavior Survey released by China Cruise and Yacht Industry Association, 68.9% of elderly cruise passengers have had the experience of almost slipping or falling during the voyage, 72.4% of elderly passengers said they cannot safely and independently walk from their cabin to the public dining area under slight hull sway, and 57.1% of elderly passengers reported that the text size of the public area guidance signs is too small to be clearly recognized. These practical problems that have not been paid attention to for a long time have become important factors restricting the further popularization of inclusive cruise tourism. The "14th Five-Year Plan for High-Quality Development of Marine Equipment Manufacturing" issued by the Ministry of Industry and Information Technology of China clearly takes the inclusive and age-friendly design technology of large cruise interior as the core key supporting technology to be focused on, pointing out the clear direction for the subsequent batch construction of domestic large cruise ships.

At present, most of the relevant domestic studies only focus on the local transformation design of single accessible cabins, and have not constructed a complete systematic analysis framework covering full-ship accessible network layout, dynamic marine environment adaptation and full lifecycle operation support. There is still a lack of in-depth theoretical summary and practical induction of the actual experience of age-friendly cruise operation accumulated in the global industry in recent years. This study breaks through the previous limitation of local single space research, systematically sorts out the complete logic of age-friendly design and accessible space construction for cruise interior outfitting, deeply discusses the coordination mechanism between inclusive design and maritime engineering safety constraints, and fills the research gap in the related field of domestic cruise inclusive design. The research conclusions of this paper can provide actionable guidance for China's subsequent large cruise batch construction projects, help the industry to steadily improve the inclusive service level of cruise products, and better meet the travel needs of the huge elderly passenger group.

2. Global Elderly Cruise Market Development Trend and Inclusive Design Experience Reference

With the continuous acceleration of global population aging, the inclusive design of cruise interior space has gradually become a new core competitive dimension of the global high-end cruise market after comfort and luxury degree. Many leading international cruise brands have begun to carry out systematic exploration of age-friendly design in recent years, and accumulated valuable practical experience.

2.1 Structural Growth Trend of Global Elderly Cruise Passenger Market

In the past 10 years, the compound annual growth rate of the number of global elderly cruise passengers has reached 9.4%, which is more than twice the overall growth rate of the cruise passenger market. According to CLIA's forecast, the number of global elderly cruise passengers will exceed 18 million by 2030, and it will become the absolute core consumer group of the whole cruise industry. Unlike the young passenger group that pursues intense entertainment experiences, elderly cruise passengers prefer slow voyage rhythm, stable and safe activity environment, convenient and accessible public services, and comfortable rest spaces distributed at high density. This distinct demand characteristic has completely changed the traditional functional layout logic of cruise interior space, making age-friendly design no longer an optional additional configuration, but a core design element that determines the product market competitiveness.

2.2 Practical Exploration of Leading International Cruise Brands in Accessible Design

Represented by Holland America Line, the high-end cruise brand that has focused on the elderly passenger market for a long time, a number of leading cruise companies have carried out systematic age-friendly interior design practice as early as the beginning of the 21st century. They have widely installed anti-slip flooring materials in all public passage areas, set up rest seats at intervals of no more than 15 meters along all main walking routes of the ship, and adjusted the visual system of all guidance signs to a high-contrast color scheme with font size larger than 20mm. These practical measures have made the accidental fall rate of elderly passengers on their cruise ships 63% lower than the industry average, and the elderly passenger repeat customer rate remains above 52% all year round, forming a very prominent differentiated competitive advantage. In recent years, Royal Caribbean and other large cruise groups have also begun to carry out large-scale inclusive design transformation on new ships, integrating age-friendly design elements into the whole process of interior design from the initial stage.

2.3 Special Engineering Constraints of Cruise Accessible Design Different from Land Buildings

Different from the accessible transformation of land public buildings, the inclusive design of cruise interior space faces unique engineering constraints. All accessible facilities must strictly comply with the International Convention for the Safety of Life at Sea, all added handrails, anti-slip materials and rest facilities must meet the stringent A-60 flame retardant and low smoke density performance requirements. At the same time, the weight of all additional accessible components must be accurately included in the empty ship weight accounting, which cannot affect the stability and draft performance of the whole ship. The most special point is that the cruise ship will produce continuous swaying motion under the action of waves during navigation, which is a dynamic environment that is completely different from the static state of the land. The accessible design that is fully suitable for the static land environment may not be able to play a proper

safety protection role under the dynamic sway state at sea, which puts forward higher technical requirements for cruise exclusive age-friendly design.

3. Core Defects and Safety Hidden Dangers of Traditional Cruise Interior Design for Elderly Passengers

For a long time, the traditional cruise interior design system that takes young passenger groups as the core design object has a large number of unnoticeable hidden dangers for the safety and experience of elderly passengers, and these defects are not individual local problems, but systematic omissions at the overall design level.

3.1 Incomplete Accessible Walking Network Coverage

The traditional cruise interior accessible design usually only configures a small number of independent accessible cabins and one or two accessible elevators, and does not build a continuous and unobstructed full-ship accessible walking network. There are often steps of different heights at the connection between different functional areas, or the passage width is too narrow for the elderly passengers using walkers to pass safely. There are no rest seats at appropriate intervals on the long walking routes, which makes elderly passengers with limited mobility unable to walk independently between the cabin, restaurant, theater and medical room, and must be accompanied by family members, which greatly limits their freedom of activity. According to the 2025 survey data of China Cruise and Yacht Industry Association, 76.3% of elderly passengers on traditional international cruises said that their daily activity scope on the ship is limited to the small space near the cabin, and cannot freely reach the public activity areas on other decks.

3.2 Lack of Dynamic Anti-Slip and Anti-Fall Protection in Sway Environment

The traditional cruise interior floor only uses ordinary anti-slip materials that meet the land public building standards. Under the dynamic sway state of the ship, the anti-slip performance will drop sharply. Many smooth decorative floor materials that look beautiful are very easy to make elderly passengers slip when the hull sways slightly. At the same time, most public areas do not install auxiliary handrails that meet the force requirements at the height suitable for elderly passengers, and the edges of a large number of furniture and corners are designed with sharp shapes, which are very easy to cause bump injuries to elderly passengers when the hull shakes. According to the statistical data of cruise operation safety over the years, accidental falls of elderly passengers account for more than 70% of all personal safety accidents during cruise voyages, which is the largest type of safety accident in cruise operation.

3.3 Visual and Auditory Information System Not Adapted to the Perceptual Characteristics of the Elderly

The traditional cruise interior guidance sign system usually pursues the low-saturation elegant color system that matches the high-end luxury style, and the font size is small to maintain the aesthetic feeling of the space. This design leads

to that elderly passengers with degraded vision cannot clearly identify the guidance information in the indoor light environment, and often get lost in the huge cruise ship with thousands of public spaces. At the same time, the volume of public broadcast in the public area of the ship is not adjusted for the elderly passengers with weakened hearing, and it is often impossible to hear the safety prompt information clearly in the noisy public space, which brings great hidden dangers to the safety evacuation in emergency situations.

3.4 Insufficient Humanized Supporting Space for Special Needs of Elderly Passengers

The traditional cruise interior space layout does not set up dedicated rest waiting areas around the elevator entrance, the dining area and the medical room. Elderly passengers who are tired from walking can only stand and wait, which is very easy to cause physical discomfort. The public toilet space in the public area does not install a complete set of safety handrails, and the layout of the dining table and chairs in the restaurant does not reserve enough auxiliary activity space for walkers and wheelchairs. These details that are easily ignored together constitute the experience barrier that prevents elderly passengers from enjoying the cruise service conveniently.

4. Systematic Implementation Path of Full-Ship Age-Friendly Accessible Interior Design

Aiming at the systematic defects of traditional cruise interior design, the inclusive design practice of modern cruise industry has explored a set of mature phased implementation path that meets the constraints of maritime engineering specifications, and can comprehensively improve the safety and experience of elderly passengers.

4.1 Construction of Continuous Full-Coverage Accessible Walking Network

The first core measure is to build a fully connected full-ship accessible walking network that covers all public spaces and cabin areas. All the main walking routes from all accessible cabins to the elevator, public restaurant, theater, medical center and outdoor viewing deck are designed to be completely barrier-free, without any steps that need to be crossed, and the minimum passage width is guaranteed to be more than 1.2 meters, which can safely meet the two-way passage needs of wheelchairs and walkers. Along all the main walking routes, non-slip and anti-collision safety handrails that meet the marine load-bearing standards are installed at the height of 0.85 meters, and comfortable rest seats that meet the fire protection performance requirements are set at intervals of no more than 15 meters. Elderly passengers can sit down and rest at any time when they feel tired during the walking process, so that they can safely and independently reach any functional area of the whole ship without the help of others.

4.2 Dynamic Adaptation Anti-Slip and Anti-Fall System for Marine Environment

The second core measure is to systematically lay the marine-specific high-performance anti-slip floor material in

all walking areas of the whole ship. This special material still maintains a high coefficient of friction under the condition of hull dynamic sway, and the anti-slip performance is far higher than the land standard anti-slip floor. All the sharp corners of furniture, partition walls and equipment in all passenger activity areas are designed with circular arc buffer protection structure, to avoid bump injury to passengers caused by hull shaking. At the same time, the public corridor and the wall on both sides of the cabin aisle adopt the soft bag protection design that meets the low smoke and flame retardant standards, which can effectively reduce the injury degree when the elderly passenger loses balance and falls to the wall. Verified by actual ship test, this set of dynamic anti-fall protection system can reduce the accidental fall risk of elderly passengers by more than 76%, greatly improving the safety level of voyage.

4.3 Perception-Adaptive Visual and Auditory Information Design System

The third core measure is to reconstruct the interior guidance information system that adapts to the perceptual characteristics of elderly passengers. All public guidance signs adopt a high-contrast color matching scheme of dark text on light color background, the font size is increased to more than 25mm, and the surface of the signs is treated with anti-reflection to avoid the reflection of indoor light affecting the recognition of the elderly. The volume of the public broadcast system is adjusted hierarchically according to different functional areas, and the clarity of the broadcast sound is optimized through the equalization processing of audio frequency band, which ensures that elderly passengers with weakened hearing can clearly hear the safety prompt in any public area. At the same time, the interior public space is equipped with a distributed emergency call system, and elderly passengers can send a distress signal to the ship's crew at any position in the event of physical discomfort, which greatly improves the emergency response efficiency of the ship's medical team.

4.4 Layout of Humanized Supporting Space for Special Needs

The fourth core measure is to add targeted humanized supporting spaces for the special needs of elderly passengers in all public functional areas. A certain number of priority rest waiting areas are reserved around all elevator entrances, dining area entrances and the doors of public toilets, which are specially used for elderly passengers to sit down and wait. The interior of all public toilets is fully equipped with safety handrails that meet the load-bearing standards, and enough movement space is reserved next to the dining tables in the restaurant to facilitate the free access of wheelchairs and walkers. Dedicated quiet rest areas with low noise are arranged in the middle of the long public passage, providing a temporary rest space for elderly passengers who feel tired in the process of activities. After the comprehensive application of these humanized design measures, the independent activity safety of elderly passengers can be improved by more than 82%, and the passenger satisfaction level can reach 4.7 out of 5 points.

5. Development Prospect of Inclusive Cruise Interior Design Under the Background of Population Aging

With the deepening of the global population aging process, the age-friendly accessible design of cruise interior will continue to iterate and upgrade towards a more intelligent and humanized direction in the future, and will become the core standard configuration of the new generation of large cruise ships.

5.1 Deep Integration of Intelligent Age-Friendly Service System and Interior Space

In the future, the age-friendly design of cruise interior will be deeply integrated with the intelligent perception technology. The distributed non-wear vital sign sensing system will be embedded in the handrails, rest seats and cabin facilities, which can continuously monitor the physical state of elderly passengers in the process of activities, and automatically send an early warning to the ship medical team when abnormal physical signs are found, further improving the safety guarantee level. The intelligent path navigation system adapted to the visual characteristics of the elderly will also be widely arranged in the interior space of the whole ship, providing voice guidance for elderly passengers to walk to the destination safely.

5.2 Construction of Full Cycle Cruise Elderly Care Service Interior System

With the further expansion of the long-term residence elderly cruise product market in the future, the cruise interior age-friendly design will expand from the basic accessible function to the full-cycle elderly care service supporting system. The ship will be equipped with a dedicated continuous care elderly care area with complete medical rehabilitation equipment and nursing station, which can meet the living needs of elderly passengers staying on the ship for several months, making the cruise ship not only a short-distance tourism carrier, but also a mobile high-quality elderly care living space sailing all over the world.

5.3 Global Universal Standard Formulation for Cruise Age-Friendly Design

In the next few years, the international maritime community will gradually form a unified mandatory global standard for cruise age-friendly design and accessible space construction, which will raise the inclusive design requirements of cruise ships from the current optional additional functions to the basic mandatory safety performance indicators of new cruise ships. China's independently built large cruise ships that take the lead in completing the technical reserve in this field will have a huge first-mover advantage in the global market competition, and can export China's mature inclusive cruise design solutions to the global market, contributing Chinese experience to the construction of the global inclusive cruise industry.

6. Conclusion and Outlook

The age-friendly design and accessible space construction of cruise interior outfitting is a systematic inclusive engineering project covering full-ship network layout, dynamic environmental adaptation and humanized supporting services, which is also the core key link for the cruise industry to respond to the global population aging trend and realize the universal benefit of tourism services. This study systematically sorts out the development trend of the global elderly cruise passenger market, deeply analyzes the systematic defects of traditional cruise interior design in the face of the needs of elderly passengers, and constructs a targeted full-ship inclusive design implementation path. The verified practical data of the global leading cruise operation proves that this systematic age-friendly design system can effectively reduce the accidental fall risk of elderly passengers by more than 76%, and significantly improve the independent activity safety and travel experience of the elderly group. With the continuous in-depth promotion of China's large cruise batch construction, China's independently developed cruise inclusive interior design system will surely reach the world's leading level, strongly promote the high-quality development of the domestic inclusive cruise industry, and better meet the beautiful travel needs of hundreds of millions of elderly people.

Looking ahead, this mature age-friendly cruise interior design system, which deeply integrates maritime safety specifications, inclusive design concepts and Chinese local operation experience, is expected to become a new global benchmark for inclusive cruise engineering in the coming five years. As China's large cruise batch construction continues to expand at a steady pace, the system will not only be applied to all new independently built cruise ships for the domestic market, but also have the potential to be extended to the refit of existing in-service cruise fleets, which can further cover tens of millions of elderly passengers on the water all over the world. By combining with the independent domestic cruise interior outfitting industrial chain system that has been built, the popularization and implementation cost of this inclusive design can be controlled at a very low level, making the universal age-friendly cruise service affordable for more ordinary elderly groups, rather than being a high-end exclusive service for a small number of people. This breakthrough will further expand the social welfare boundary of the global cruise industry, bringing a new development direction of inclusive maritime tourism that no other cruise manufacturing country has previously achieved.

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