

# Study on the Design of Garbage Removal Products for Alpine Scenic Spots

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**Abstract.** Due to the constraints of the alpine terrain and other objective factors, at present, the garbage collection and removal in China's alpine scenic areas are in a relatively backward situation, which makes the garbage removal more difficult, thus leading to the high risk and difficulty for the sanitation workers to operate. By using the unique ropeway facilities in alpine scenic areas, the article makes a tentative plan for the improvement of the garbage removal facilities in alpine scenic areas, and gives the design verification based on the relevant knowledge of mechanical principle and Theory of mechanics.

## 1. Introduction

Tourism activities will produce all kinds of rubbish. Garbage produced in the alpine scenic spots if not timely removed, not only will bring visual, taste and other sensory damage, affecting tourists' travelling mood, but also may jeopardize the local biological chain structure, destroying the balance of the ecological system of tourist attractions. In the alpine scenic areas, the problem of garbage removal is how to quickly and efficiently collect the waste and then easily bring it back to the ground from the peak of the mountain scenic areas [1]. Therefore, a lot of useful attempts have been done in many scenic spots in these areas, such as the classification of garbage bins, refuse transfer station, logistics center, etc., but the effect is not ideal. The main reason is that people always think that waste reuse value is low and the cost of recycling is high, so the attention to this aspect is not enough [2]. In fact, the impact of waste on tourist attractions is very large. If not recycled, the waste will have a greater negative impact on tourist attractions, eventually affecting the number of tourists [3].

Therefore, it is of great importance to analyze the function design and application of the new type of garbage bins by investigating and studying the use methods and functions of the existing bins in the market, so as to efficiently organize the garbage removal work in the alpine scenic areas.

## 2. Topographic Features of Alpine Scenic Spots and Analysis of Garbage Removal Methods

The alpine Scenic areas, also known as mountain-type tourist scenic spots, are scenic spots characterized by high, medium and low mountains and rivers, which are composed of various landforms, such as mountains, hills, steep slopes, cliffs, canyons, ravines and other geologic structures. Mountainous area is the aesthetic region complex of the main scenic resources and landscape elements [4]. The height, topography and terrain limitation of the alpine scenic areas, especially the traffic



convenience of garbage removal, have become the important factors restricting the sustainable development of alpine scenic spots.

With the development of economy, the way of living rubbish removal has changed. To achieve “reduction, harmlessness and resourcefulness” to control the pollution of solid waste, on the basis of constant exploration and research, the United States, Germany, Japan, France and other countries put forward the way of sorting and reprocessing of domestic garbage and establish a relatively complete system of receiving and transporting [5]. The safe operation and integrity management of ropeway transportation has accumulated some experience at home and abroad. And at home and abroad, the development of the closed-type garbage storage equipment, such as the development of environmental sanitation equipment, is maturing, but for the mountain-type scenic area of garbage removal methods little research can be found. Although the theory of using ropeway to run garbage is proposed, the actual product is not made. If the problem of configuration selection of facilities and equipment, such as, garbage storage box with ropeway transportation can be effectively solved [6], the problem of garbage removal in the mountain scenic areas will be improved.

The garbage removal project of scenic spots is of great labor intensity and low efficiency, so it is worth studying the new mode of garbage removal with the help of ropeway technology. Road forms (e.g.: curved roads, ladders, bridges, ropeways, etc.) and distribution (e.g.: surround, straight-line) for the collection and transportation of domestic waste has caused great difficulty, but also increased the labor intensity of sanitation workers and the risk and difficulty of the operation industry [7]. Most alpine scenic areas, usually configured with one or more cruise cableways. As long as the planning and design is appropriate, environmental pollution (garbage scattering, sewage leakage, etc.), smell pollution (cleaning up not timely, emitting odor) and visual pollution (the appearance of the container is not clean, etc.) caused in the traditional human handling process can be effectively avoided. Significantly reducing workload, decreasing labor intensity and minimizing labor difficulty comprehensively advance the mechanized level of the system, thus improving the efficiency of garbage removal. The use of ropeway transportation of garbage is the extension of the function of passenger ropeways. This efficient and economical way can promote the optimal allocation of scenic resources [8].

### **3. The Principle of Garbage Removal Product Design in Alpine Scenic Areas**

#### *3.1. Design Principle*

The difficulty of garbage removal in alpine scenic areas mainly lies in the safety and difficulty of the sanitation workers. The sanitation workers need to bring their own cleaning tools from the foot of the mountain to the top of the hill, and then gather rubbish together and transport rubbish back to the city waste center. It's inefficient. With the maturity of ropeway transportation technology, in addition, in order to enable sanitation workers to collect rubbish regularly and timely clean up rubbish, the products can be given its automatic reminder function, so that achieve the purpose of “one thing, more use” and increase the practicality of products. The design of a new type of garbage collection containers [9], is characterized with less pollution, high efficiency, low cost, easy to operate and other characteristics. Considering the difficulty of garbage removal, the product design of garbage removal should focus on the safety of transportation, practicability and reliability of material endurance.

*3.1.1. Functionality and Practicability.* With ropeway transportation as a new way of transportation, the danger of it need to be considered in the removal process. So in the design of products, a strong connection between products and ropeways should be made and more functions should be designed to improve the ease of work of sanitation workers. The functional combination improves the use value of the product, is the mission of the new product design, and adapts the design principle of the social development.

*3.1.2. Modelling Conciseness and Smoothness.* Influenced by the design of modern German design, the purpose and use of things are emphasized, the “simplicity prior to complication” design principle is kept to and the requirement of batch production is taken into account, so concise and smooth modelling is one of the elements of the container design. Moreover, in order to improve the efficiency of the operation, concise modelling can ensure easy switch between the structure transform mode and storage mode of the product.

*3.1.3. Structural Security and Stability.* The structure design of the refuse collection container must conform to the processing capability of the technical equipment, and the effect of gravity and high pressure on the structure quality of the refuse collecting vessel should be paid attention to. Structural design requires the structure endurance strengthening, in line with safety requirements. General and standardized design of the parts makes convenience for production and interchange to fit batch production. The garbage collection container, suspended at high place, will not only overcome the influence of gravity, but also overcome the pressure on the internal waste, so in the design, mechanical principles should be full considered and product support system should be reasonably constructed, so that the product is featured with good structural stability as well as the safety strength of the frame structure.

*3.1.4. Material Environment-friendliness and Airtightness.* Product materials are the material basis for the realization of product function. The properties of product materials not only affect the appearance of products, but also promote or restrict the realization of product function. The new garbage collection container should hide as far as possible, coordinate the surrounding landscape, and be strictly airtight to eliminate the phenomenon of rubbish spilling, seeping dripping and smell overflow. In the choice of materials, in order to avoid affecting the tourism health, while choosing closed airtight materials for edge wrapping, pressure and gravity bearing and rigid materials are selected as the overall surface. To unify scenic facilities and beauty, materials with easy cleaning feature can be used, such as the use of aluminium plastic plate is featured with good sealing and easy cleaning. At the same time, the application of new materials can also bring people a different feeling.

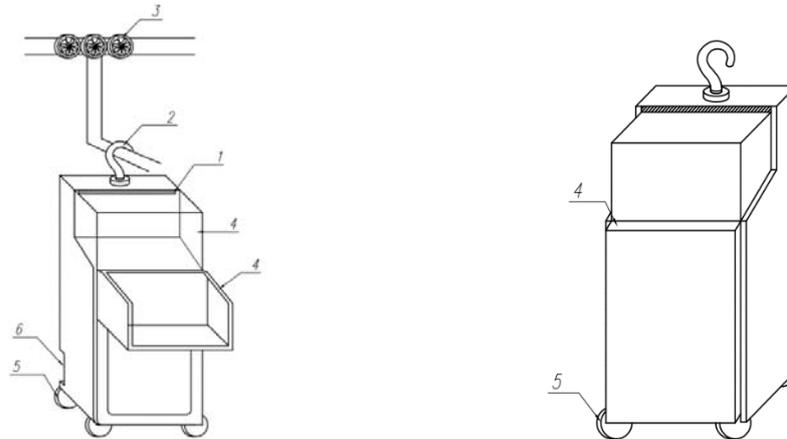
#### **4. The Design Demonstration of the Garbage Removal Products for the Alpine Scenic Spots**

In the alpine scenic areas, it is difficult for the sanitation workers to work. First, in collecting garbage, some tourists litter everywhere, so sanitation workers need to take the cleaning tools at all times to pick up garbage of high frequency, thus increasing the workload. Furthermore, while a lot of garbage collection containers are filled and not processed timely, more waste leachate drips, so the new garbage collection containers is given the function to automatically remind the sanitation workers of the full container. Besides, especially important is the way of transporting garbage collection containers by ropeways in the garbage removal and the rollers need to be pushed and reduced in the process of transporting the rubbish bin to the ropeways.

In view of the above problems, a removable garbage can are designed that can be suspended in the ropeways (fig. 1), Simple in design with functionality and no superfluous decoration. Functionally, a hook on the ropeway is designed above the product to ensure its firmness (code 2 in fig. 1). Given that the ropeways are often low on the high, the top of the dustbin design roller (Fig. 1 Code 3), controlling the ropeway ensures that the transporting speed of the trash can decline uniformly. To reduce the burden of sanitation workers, there is no need to take the cleaning tools every moment, for brooms and dustpans are available on each dustbin (Fig. 4, fig. 5). Brooms and dustpans are embedded in the front and back of the dustbins (Fig. 2, fig. 3), in which the dustpans also act as an extension of the garbage cover.

To allow sanitation workers to carry out garbage removal in time, in the garbage cover (Fig. 1 code 1) is designed infrared scanners automatically scanning garbage weight. When the rubbish exceeds the weight or the rubbish is thrown onto the flush infrared scanning line, a bell can be issued to remind the sanitation workers to close the lid of the dustpan and cover the dustbin to indicate that the dustbin is

full and can no longer be thrown. After the scenic areas close, ropeways are used to transport the garbage down the mountain to process. The author design wheels under the garbage bucket so that the sanitation workers can push the trash to the ropeways on the plank road in the scenic areas, so that the work intensity of the sanitation workers can be reduced.

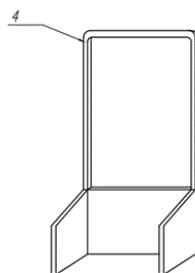


**Figure 1.** The whole diagram of the suspended trash can. **Figure 2.** Positive figure (dustpan removed).



**Figure 3.** Back figure (broom removed).

**Figure 4.** Dustpan model.



**Figure 5.** Broom model.

There are three ways to use the dustpans: First, the dustpans can be turned downward and is inverted when using the trash cans without the dustpans (fig.1 code 4); Second, the dustpans can be used as garbage covers when the infra-red scanning reminds the sanitation workers that the garbage cans are filled with trash; Third, the sanitation workers remove the dustpans when the dustpans are needed (Fig. 4).

To ensure the cleanliness in the transportation process and prevent the leakage of odor, the airtight aluminum-plastic plate material is a good choice. As a new type of materials, aluminum-plastic plate

is widely used in building, and its pressure and gravity are strong and rigid. And to guarantee the unity and beauty of scenic facilities, colors should be coordinated with the scenic spots and the materials should be also easy to clean ensuring the cleanliness of the garbage cans.

## 5. Conclusion

Because of the special terrain conditions in the alpine scenic areas, the tourism rubbish cannot be simply copied like the municipal refuse treatment, nor should it be filled in place or burned, so travel garbage is normally outward transported. Therefore, the removal link becomes the most important part of the whole waste management system, and the transportation problem of garbage is especially prominent in the alpine scenic areas. However, the deep research on the technical means of garbage removal is rare at home and abroad, and the use of ropeways to transport garbage is a new concept. Engineering ropeway transporting technology in China is maturing, and ropeways in various alpine scenic areas are widely used. By using this concept and characteristics, the design of a new type of garbage cans demonstrates the feasibility of the ropeway garbage transporting. According to the natural characteristics of different alpine scenic spots, the production characteristics of garbage and the different configuration of ropeways and other facilities, the way of transporting rubbish can also be improved. But different types of ropeways and transportation plans need to be further explored.

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