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To cite this article: Zhao-Bing Chen, Guan-Nan Li, Xing-Yang Liu & Xin-Yu Liu (2017) The structure form layout and installation design about car-based photonics mast, Journal of Discrete Mathematical Sciences and Cryptography, 20:1, 231-238, DOI: [10.1080/09720529.2016.1178924](https://doi.org/10.1080/09720529.2016.1178924)

To link to this article: <https://doi.org/10.1080/09720529.2016.1178924>



Published online: 27 Dec 2016.



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## **The structure form layout and installation design about car-based photonics mast**

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### **Abstract**

For the overall layout and installation of car type photoelectric mast theoretically design. According to the specific requirements of photovoltaic masts were set cars and shelter in the form of choice, the specific form of the photovoltaic installation masts were discussed, matching photonics mast with its support of the photoelectric detection system installed analyzed, the final completion of the car type Optical mast design the overall layout and installation of photoelectric detection.

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*Keywords:* Optical mast, Mast layout, Photoelectric detection, Structure design

### **1. Introduction**

In order to enhance the role of ground-based optical detection equipment to develop a certain type of car distance photoelectric detection equipment using overhead mast type way. Development of such equipment is the first time in our country, which involves a number of key issues need to be addressed, and how to choose the form of the mast and load the car and the layout of the equipment installation is one that must be developed to solve the problem. In this paper, the issue was discussed in this context.

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For a certain type of photoelectric detection photoelectric mast and load the car selection, layout and installation problems, theoretical research. Firstly applied to photovoltaic installation in the form of mast carrying cars and shelter compared with the choice to explore, and the overall form of the photonics mast and installation were analyzed, and finally the photonics mast and load the car and matching design and optoelectronic Matching detection system design. In this study provides an important reference for the development of a certain type of vehicle-mounted mast type photoelectric detection system.

### **The photoelectric detection system application requirements of the mast and the carrier vehicle**

General requirements contained in the entire photovoltaic mast car system is: to meet the requirements of real mobility, railways, air transport regulatory compliance; design avoid the extra weight to ensure the unity of three heart (the center of rotation, the center of gravity, the best wind moment center); note that the system miniaturization and lightweight and stiffness, strength, electromagnetic compatibility, reliability, maintainability comprehensive requirements; carrier car cabin structure and rational arrangement of the mast, cable routing, lighting; the service to have visually up, up entity, operating space up etc. reachability. When you need to do to facilitate disassembly and repair should be considered maintenance man-machine safety, have the right to check the window, carrying lubricating and other maintenance work can be very convenient, standardized modules designed to maximize the use of design methods; electromagnetic shielding and grounding design quality for optical detection systems have a significant impact at the top of the mast. Due to a combination of carrier vehicle is made by a variety of optoelectronic devices, in order to improve the environment adaptability of the photovoltaic devices, these devices need to electromagnetic mutual interference between the possible effective treatment<sup>[1]</sup>. For example, the power and signal cables to distinguish traces and add shielding on the cable. Also in some of the larger openings for heat dissipation with metal mesh can meet observation, shielding and ventilation requirements; on the electrical interface to configure HDLC, Ethernet, RS-232-C, RS-458 and other types The interface to accommodate different test site data exchange requirements; maintainability design of the main objectives is to shorten the repair time, that is, reduced fault location time, troubleshooting time and verify the recovery time. To achieve these goals need to enhance the

ability of fault diagnosis and self-test system, fault location using two diagnostics, troubleshooting methods used to replace the backup plate; providing the necessary maintenance on the structure needs to improve the accessibility of the design, and space chassis with quick-lock, quick opening mechanism, hanging rails for quick repairs; the trolley car transport subsystem to be achieved, the car work, transport stability, good performance, can provide a good basis for the work when the car working, Vehicles should have a good seal, ambient temperature adaptability (install air-conditioning)<sup>[2]</sup>. Expand and dismantling work at work should be done to facilitate the rapid post (for changing battlefield environment).

This paper explores the mast system and the trolley system application, optical detection system uses the overall coordination and cooperation in the form of unit operations, so the design of optical detection system in this article does not specifically discussed. However, due to their specific detection parameters directly related to the design and application of mast systems and carrier vehicle systems, it is necessary to analyze some of the tactical and technical indicators to effectively determine the parameters of the system as a whole. Mast above the trolley system and system design principles and indicators are summarized as follows mast available with the carrier vehicle requirements<sup>[3]</sup>.

### **The mast mode selection and layout design**

Forms can be divided into vertical mast and folded mast. The last kind is divided into two bottom folding shelter and shelter at the top. The following discusses each of these three forms.

Vertical: This structure is the mast stands in direct load the car, through direct lift to achieve their goals at the top of the lift mast photovoltaic equipment. This form can also be fixed directly into the mast top surface of the carrier vehicle frame to frame and mast settlement following two scenarios. Advantages of vertical structure is its drive form simple, no upright and tilt drive mechanism, set up and dismantling fast, do not take up additional space on the car carrier, to provide the conditions for optimizing the layout of other equipment and control shelter<sup>[4-7]</sup>. The disadvantage of this structure is to remain after dismantling the mast upright stand carrier vehicle, and therefore its height still higher than the carrier vehicle more, which requires high mobility and high throughput in terms of the field device is operational very unfavorable. As in railway transport, due to the height of the mast after dismantling still cannot meet the requirements of rail transport, so a direct result of such a device is

limited maneuvering on the railway. Optoelectronic device is a high precision device, in transport or other occasions often do not require it sank into the carrier vehicle cabin interior, which further exposed the shortcomings of its highly restricted (Fig.1, Fig.2). Despite this deficiency can be used to carry out the settlement mast way to make up, but due to the settlement of the height chassis height restrictions is a certain range, and the settlement after the car's chassis rigidity load will be destroyed, and pose a threat to the independence of the other cabins. For these reasons, such a high degree of vertical mast structure is generally not more than 10m, and the numbers of sections of their movements in general are more than four sections.

**Folding mode:** Folding mast feature is first of all to turn the folded state before lodging its erection into the upright position after dismantling will be transferred from its upright position to a reclined state. Due to the need of a separate body upright and lodging, so its structure is more complex, but the height restrictions on the mast of a small, generally after the erection can reach ten meters to tens of meters height. This structure also has two forms, one after lodging their entire mast located

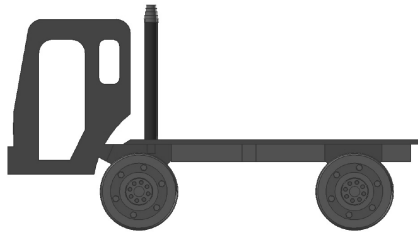


Fig. 1

Ordinary car upright mast installation form

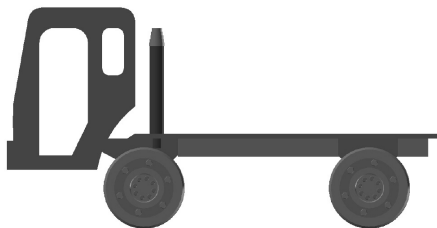
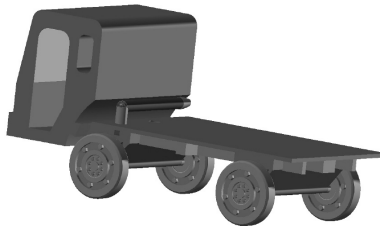


Fig. 2

Settlement type vertical mast installed onboard form

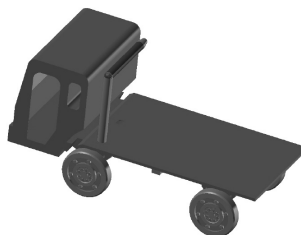
upload trailers, the advantages of this approach is to reduce the center of gravity of the vehicle, and the disadvantage is occupied cabin space than the layout of the vehicle great. And because the shelter as part of the activities of control personnel, are generally not allowed to be cut off from the middle, so this form of mast generally located load side of the car, in order to ensure the integrity of shelter space. And this way for a side-mounted vehicle weight is a problem. Another form of folding mast structure sucked folded cabin lodging at the top of this form to ensure that the vehicle is also able to achieve a good increase in erect mast height and mobility through the premise of this form The disadvantage is that on the one hand to improve the vehicle's center of gravity is not conducive to the stability of the vehicle, on the other hand for the protection of high-precision requirements of the photovoltaic system is poor, you cannot sink into photovoltaic systems inside the shelter. (Fig.3, Fig.4)

Taking into account the overall system application requirements mast, the mast installation we choose some form of settlement type vertical installation. It is shown in Figure 2 installation form. Because mast installation complete settlement for the mechanical structure of the front



**Fig. 3**

**Folding in car form at the bottom of the mast installation**



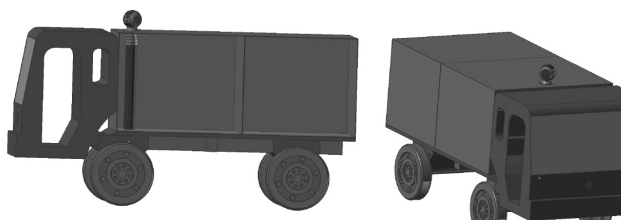
**Fig. 4**

**Fold the top of the car mast installation form**

wheel drive vehicle changes too large, it will cause the overall strength of the problem, so this issue is part of the settlement adopted by the way, is about to drive the motor vehicle chassis portion of the settlement to the following, and transmission , hand over the organization and its mast section are located above the chassis, thus taking into account the vehicle minor changes, while increasing the effective height of the contradictory relationship between mast. The chassis stiffness resulting damage is to be improved by the carrier vehicle chassis manufacturer specializing in the design. Since the entire mast-type photovoltaic systems not only the needs of their work in the case of stationary and reconnaissance capabilities required to detect its implementation across the road, so photonics mast system contained both affected by the vehicle engine vibrations will load the car travels between the bumps, so the fixed and carrier vehicles must strengthen the way. Overall installation form is used to install the mast top and bottom and the top of the vehicle cabin fixed manner. Due to the need for reconnaissance at the mast collapsed state, so the mast is fully retracted after photoelectric detection equipment should be still in the upper part of the shelter. (Fig.5) Optoelectronic devices usually a separate protective shield to complete.

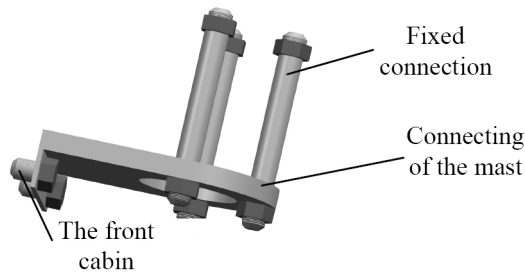
The connection design of the photoelectric detection mast and set cars

Photonics mast installed in the car the whole load semi settlement mode, using the bottom of the mast and the mast while the vehicle chassis fixed to the upper bracket of the top ways to achieve solid company with cabin on a fixed way, so the overall stiffness of the mast will have more greatly improved. The photonics mast system taking into account the ability to travel between the probes, to strengthen the overall stability in this case, the vehicle will be customized using a special form of the process of making the chassis structure, the chassis using a special reinforced girder and Special pieces of the frame structure. In this sub-frame to



**Fig. 5**

**Mast and load the car mounting solutions map**

**Fig. 6****Upload vehicle cabin installation form and structure of the mast**

isolate road sports car load fluctuation caused by shaking the frame to ensure the vehicle is in motion detection transport and flexibility, while providing adequate foundation stiffness precision photoelectric detection equipment when working in a carrier vehicle. In order to enhance the stiffness of the bottom of the mast installed together with the subprime. Photonics mast top and set cars on top of the shelter is fixedly connected, in order to better achieve the upper end of the fixed, in the design of a single ring frame to hold the ring structure. This structure plays a role in the connected party tank top and photonics mast upper part of the first paragraph. The structure of the front cabin with a fixed connection plate and fixed mast sleeve connections are aluminum alloy, and the bolts and nuts using standardized components. Specific form of the structure is shown below.

Between the carrier vehicle and photonics mast bolts in the form of rigid connection. The shelter has a portion in contact with the mast are designed with ribs to improve the rigidity of the shelter locally, in order to better fixed mast. As the photonics mast system design manual lifting devices, and therefore should be considered when installing roll toward the mouth behind the car carrier, in order to protect personnel in space activities. The cabin and the cable connecting structure also need to set aside perforated to facilitate the lifting cables when the telescopic mast.

**Acknowledgment**

In this paper, the development of a vehicle-mounted mast photoelectric detection system as the background for optical detection system for the mast and load requirements of the vehicle load vehicles, shelter and mast selection and layout are discussed. Then the layout and installation of



photovoltaic mast is analyzed to obtain the application program applies to the system. Finally, the connection with the optical detection system to match the mast and the trolley system's design, provide a reference for subsequent designs.

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*Received November, 2015*

*Revised February, 2016*