

The development of the safety analysis system for Chinese home-made ropeway machine-electrical equipment

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With the developing of travel ropeways for passenger transport, The analysis work of safety travelling ropeways has becoming more and more important to Chinese people. However, our safety analysis system can not meet the need of the development of travelling ropeways and the trip business .So, establishing a normalised safety analysis system, which aims at predicting and preventing accidents, is the main objective of ropeway managers in China at present.

I. Current situation of safety management of Chinese home-made ropeways

Chinese travel ropeways for passenger transport has been built since 1980's,From 1990,the number of ropeways have increased about 20 yearly. Now in China, there are 193 ropeways in working condition, more than eighty percent of these ropeways were designed and manufactured by Chinese factories, and 131 ropeways are mono-cable circulating with fixed grips and chairlifts (or cabinlifts).

Although aerial ropeways for passenger transport is a new profession in China, some of the factories pay more attention to management than maintain, or pay more attention to maintain than , in order to make the management to be scientific, standardisation, normalisation, and continuously, the national government has issued “safety codes for passengers aerial ropeways” and “Regules of Inspection for the safe maintain of the aerial rope way for passenger transport”,most of the rope way corporations have set up safety management system according to the codes and the condition of the corporation.

However, the key problem is the low automation level in Chinese ropeways management. The managers can not evaluate the safety index of the

ropeways for the look of quantity safety analysis system . They may ask which system could be looked on as a safe one.

For a long time, We Chinese ropeways administrators have explored to find some practice ways, which can predict the accident probability and thus can evaluate the system safety in quantity and quality. So, we can alarm the fatalness of the accident to the manager in the running and management of the rope way. And we can propose rule for safety through the result of the parity. In order to prevent and restrict the accident, we must establish a predict and data analysis system for the rope way malfunction, watch the rope way machine electronic equipment. So we can keep a safe ,reliable and economic rope way.

II. Safety management of Chinese home-made ropeways and the use in safety check

It is well known that predicting and preventing safety problems were based on managers' experiences and intuitions in the past in China. It's necessary to establish an automatic safety analysis system analysing each level or the ropeway's machine electric equipment ,such as element → package → function module → sub-system → system. According to our determined safe critical coefficients for each level, we can make a dynamic control the machine electric- equipment.

1 Establishment of the safety analysis system like a domino

Any accident happened because of a series of failure, such a succession procedure called an accident chain, This chain is like a domino, when one domino fall ,it will make a domino chain fall too. To ensure the whole ropeway's safety, it is need to establish the safety analysis system. i.e. make sure any part of the ropeway's safe running, rescerch and calculate the safety levels, determined the safety warning level. Nanjing Purple Mountain travel ropeway is a Chinese home-made mono cable circulating rope way with fixed grips and chirelifts. Its machine equipment is shown in Fig 1.

2 The use of the safety analysis system in the safety check

In lack of systematic safety check, the traditional safety way, always caused mistakes. neglects the potential intrinsic safety problems, and

finally becomes a formalism. So we established safety check system, including compiling the safety check tables, taking apart the whole rope way into sub-system or unit, determining the unsafe fact of each part, and determining the check task and check time.

The effect of the safety check has greatly enhanced by the way of safety check system. The safety check has several parts as followed in safety managing the rope way.

(1) Daily check .It is made by mechanics before rope ways running and when it is running. The item of check include the flexibility and the reliability of each rotating part, oil level box, affiances of brake. the displacement of steel, state of control circuit, accident display, working state display.etc.

(2) Monthly Inspection, inspecting whether the oil leak exists in the hydraulic system's pipe tie-in of driving system at the end of every month; adding oil to exalters and gimbals and inspecting their deterioration level; inspecting the deterioration level of driving (return) sheave linings; inspecting whether the cracks and corrosion exist in the handrails and ladders of assembly platforms; eyeballing the steel wire ropes and welds and measuring their diameters; inspecting the cabinlifts or chairlifts.

(3) The fixed grip robe way is transported under the request of "safety codes for passengers aerial robe ways. At the same time, the diameters of steel wire ropes should be measured.

(4) Middle examination is executed every half of year; Complete examination is executed every two years and includes the inspection of the robe way machine-electrical system which main contents are the scatheless crack detection of steel wire ropes, etc.

(5) The substitutions of steel wire ropes must stand by "Wire rope for aerial rope ways----"Code for examination and discard".

Safety Inspection Table can quantificational characterize the safety analysis system. It is widely used in the safety analysis system for Chinese home-made rope way and easily understood and operated. Every examination record is filled in by professional staff after completely examining, then saved as technical files. So it provides the original data for

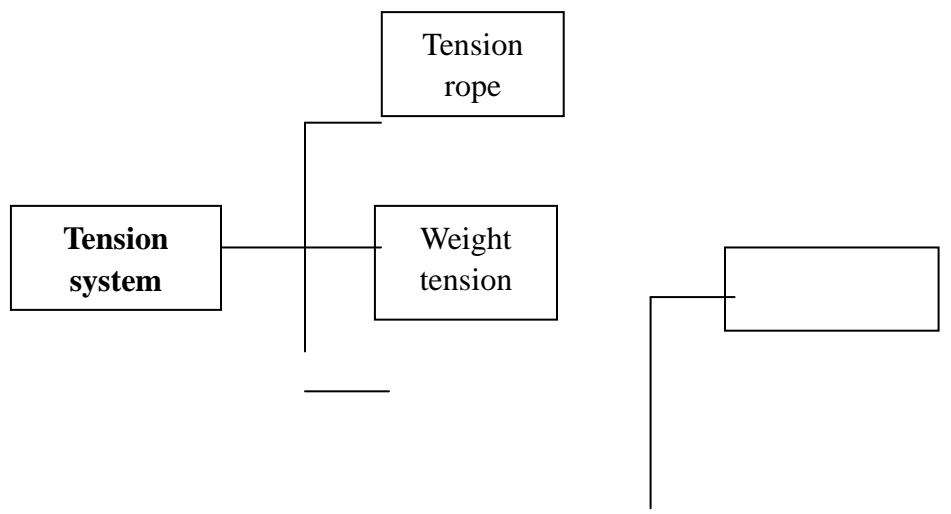
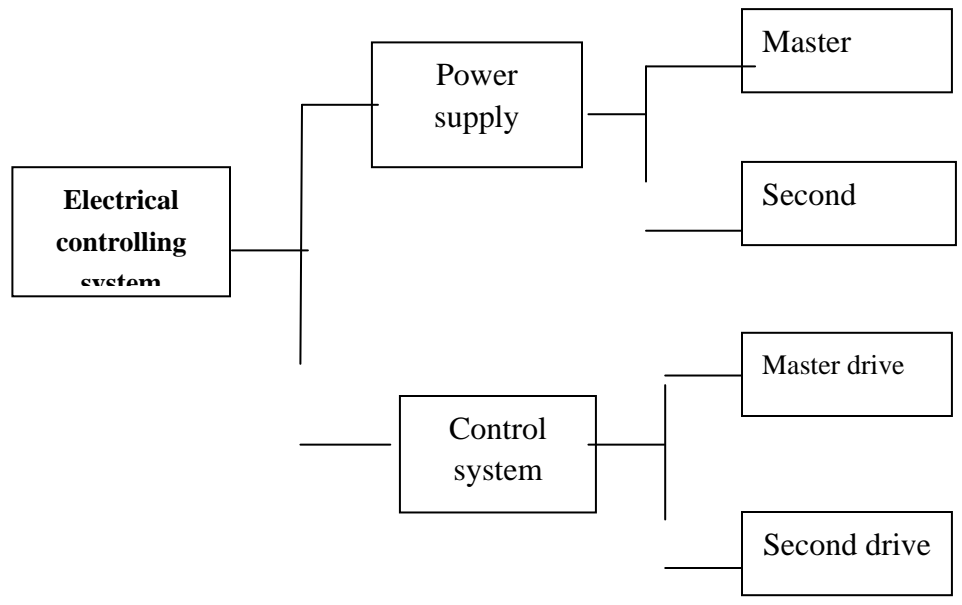
evaluation of the rope way's safety and makes a solid background for safe running and technical innovation.

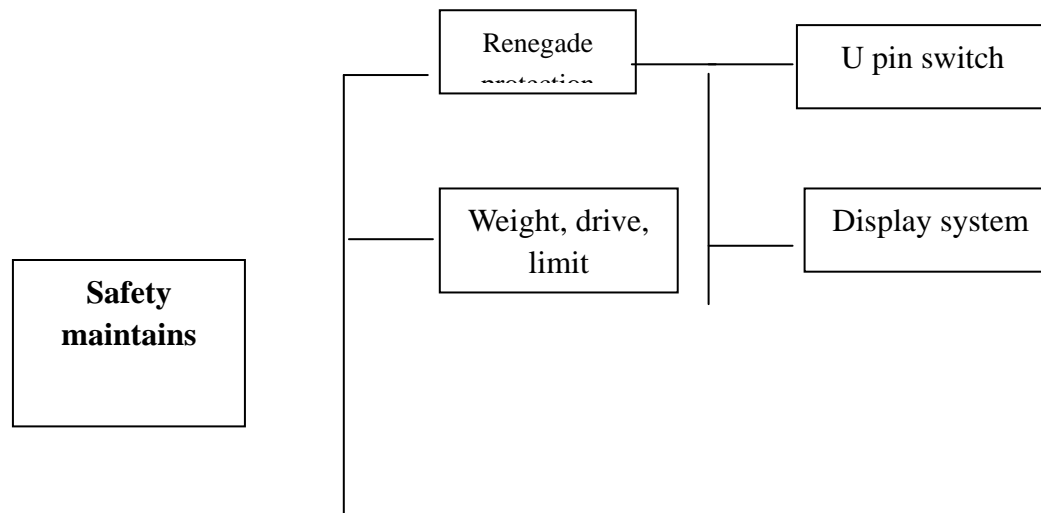
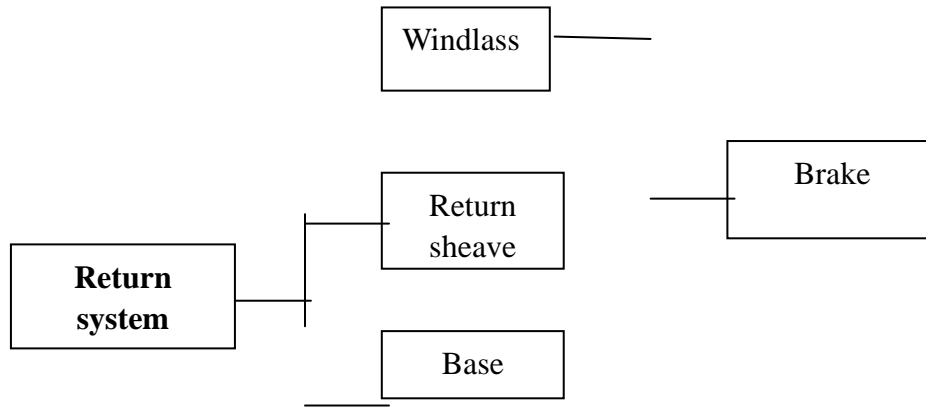
III. The further of the online safety analysis system of machine-electrical equipment in China

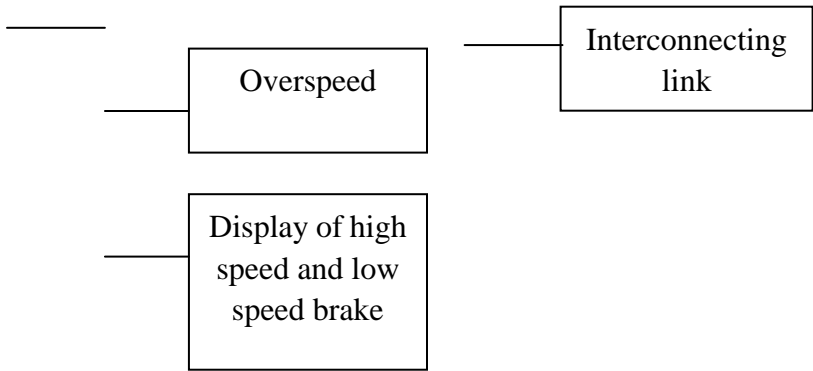
In the 21st century, the rope ways of China will have an excellent opportunity to develop itself with the prosperity of travel industry. However, we are in the rudimental period and in the low level in the rope way safety management. So establishing a dynamic safety analysis system of machine-electrical equipment based on computer network system inside the rope way industry is our important work. That means collecting and analyzing the data from the check points inside the rop way, though computer network system, then transferring it to the industry managers and providing the latest, the most percussive and the most reliable original data for the scientific safety evaluation. With the extending of the computer network communication technique, setting up the online safety analysis system of machine-electrical equipment for there is one of the aims of developing the rope way machine-electrical equipment of China. Described as fig2, the online safety system management of rope way machine-electrical equipment is to set up an online database, supported by the computer network communication technique, to collect, process, manage and inquire the data of all of machine-electrical equipment, to optimize the decision-making management of rope way. Finally, the computer network optimizing system can optimize and save the data from the rope way's check points as the different types, then form database.

In such system based on computer network technology, the data of every element such as machine equipment, electrical equipment and staff, etc will be collected in-situ. The managers also can predict and prevent accidents according these data. Thus, it can realize the aims at predicting and preventing the accidents and the main objective of rope way managers in China.

China is a developing country. The travel rope way are increasing rapidly. In the mean while, the travel rope ways concern the lives of visitors. If we want to ensure that the rope way could travel safety, we must establish a powerful online safety analysis system of machine-electrical equipment. So that we could gain better economic and social efficiency, we'd like to accelerate the developing of the travel rope ways in China.







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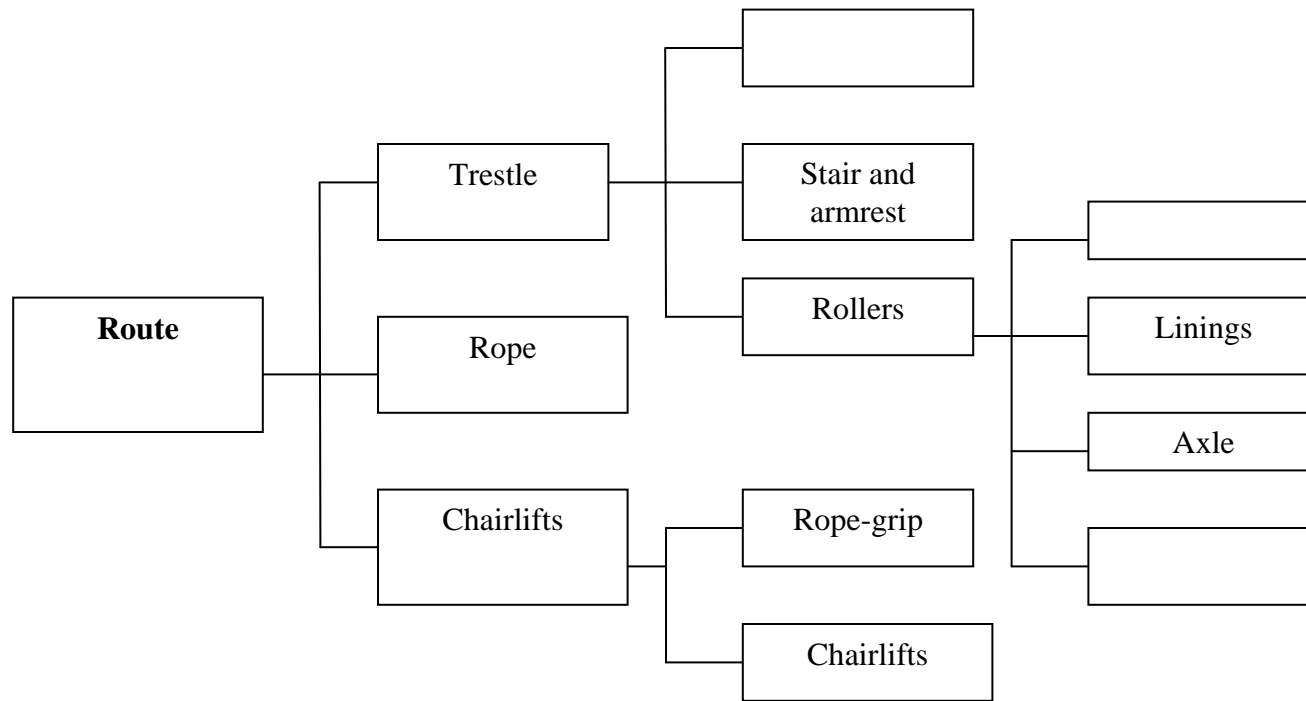
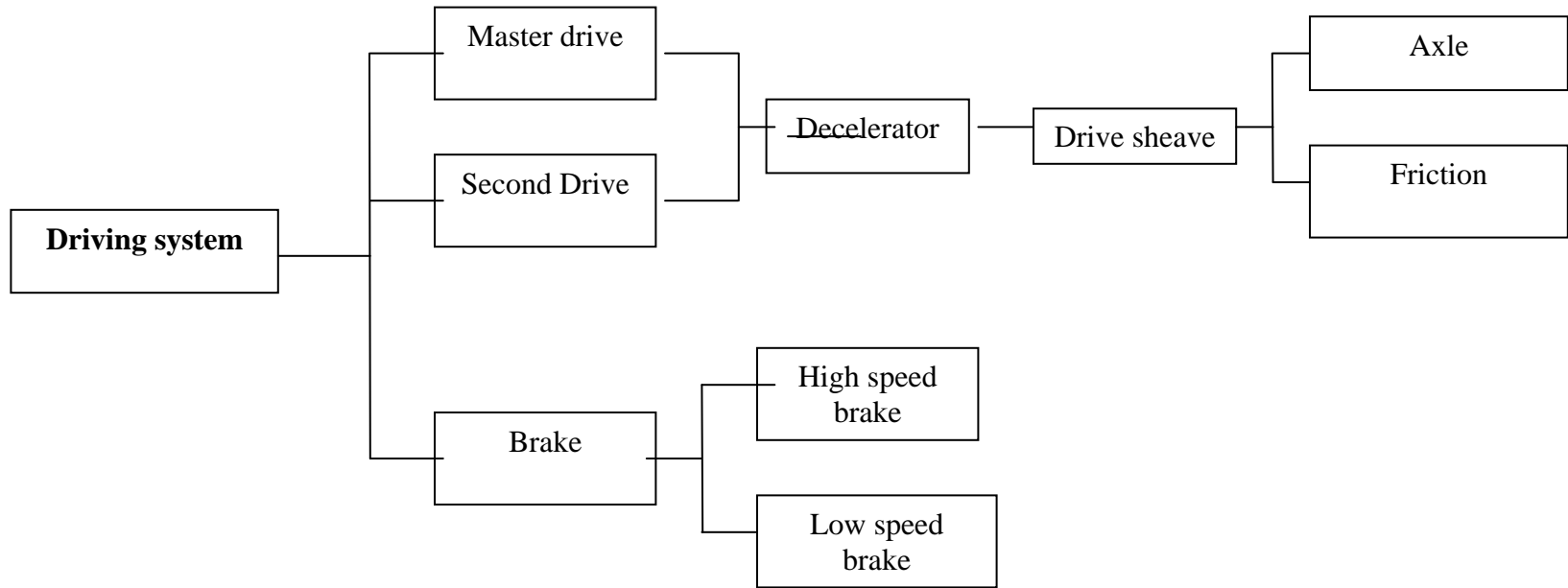


Fig 1 Ropeway machine-electrical equipment



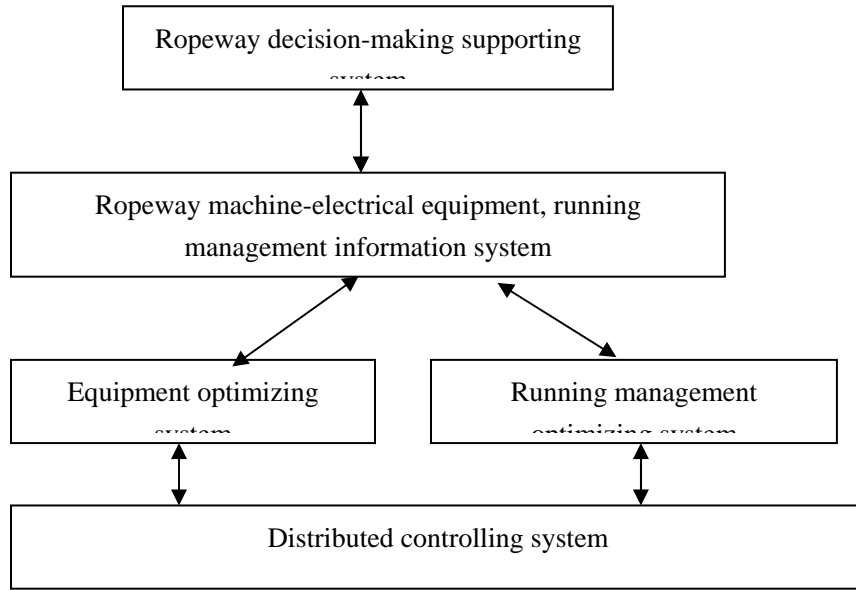


Fig 2 the synthesizing automatic system of ropeway site