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Modification of conventional doors of Indian Railways for Crowd Management

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ABSTRACT: This journal addresses the particular issue of managing crowd in Indian Trains, due to the non-existence of separate in and out door design, that causes unnecessary chaos and collision between the entering and exiting passengers in the coaches. A 90° turn-able horizontal stiles system can be used, in addition to the conventional doors, to make the people to move into the One-way culture of using entry doors for entry & exit doors for exit, as they are made unable to enter in exit doors and exit in entry doors.

KEYWORDS: door, one way, stiles, turn-able.

I. INTRODUCTION

Congestion issue during entering and exiting trains is mainly due to the entering passengers trying to get in the way of exiting passengers and exiting passengers, trying to get in the way of entering passengers. This becomes a very big problem, when Indian railways is planning to reduce journey time. This problem can be eliminated by using a system that allows only entering passengers via door which is exclusively for entering and making it hard or impossible for the exiting passengers to exit by entry-door and vice versa. It is possible to reduce the train waiting time, by proper management of entering and exiting passengers.

II. RELATED WORK

Turnstiles were originally used, like other forms of stile, to allow human beings to pass while keeping sheep or other livestock penned in. The use of turnstiles in most modern applications has been credited to Clarence Saunders, who used them in his first Piggly Wiggly store. In 1974 in Italy the company Alfi distinguished itself for conceiving the first electronic access control system with turnstile for ski lifts and tows in San Vigilio di Marebbe and the following year it supplied the new-born SuperskiDolomiti ski centre with the equipment and materials required for ticket issuing and checking.

The user inserts a ticket or pass into the slot, from which a barcode is read; if access is to be granted, a sensor determines the speed with which the user passes through and sets the electric motor to turn the turnstile at the corresponding speed. Sometimes also referred to as "half-height" turnstiles, this fixed arm style has traditionally been the most popular type of turnstile. Some styles are designed to allow entry only after a payment (actual coins and tokens) are inserted [3], while others allow access after a valid barcode is electronically read. A disadvantage to this type is people can "jump the turnstile".

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III. DESIGN OF ONE WAYSTILES

Kinematics of mechanism [4] is worked out based on standard data of door, followed by solidworks design as in Fig.1. One-way stile system as shown in figure 1 consists of a 90° turn-able horizontal stile (Rose), hinged to fork and base part (Green & blue respectively) with the help of pin. A torsion spring is placed in socket which is in the fork. A stopper (red in figure 1) is provided between the gaps of the fork. The fork and base part is fixed to the doors of coaches.

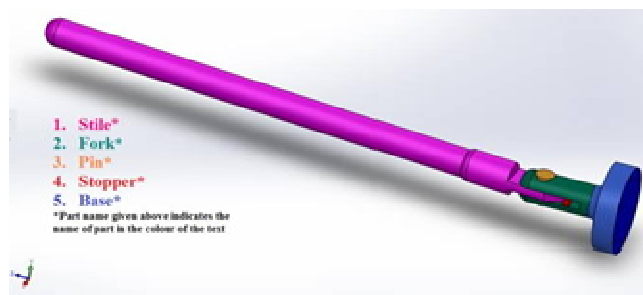


Fig. 1. One-way stile system (Solidworks Design)

IV. SIMULATION AND RESULTS

4.1. Analysis of stile

Stile is a cylindrical member of outer diameter 19mm and thickness 0.8mm. Real time forces are calculated [2,5] applied over the stiles using ANSYS [6]. Maximum stress acting on the stile is approximated to 280 MPa under real time constraints. The analysis result of stile using Von-Mises theory is shown in fig. 2. Based on analysis, material of stile is selected as AISI 1018 Mild/Low Carbon Steel whose Tensile Strength (Yield) is 370 MPa with Shear Modulus (Typical for steel) of 80 GPa and Modulus of Elasticity (Typical for steel) of 205 GPa.

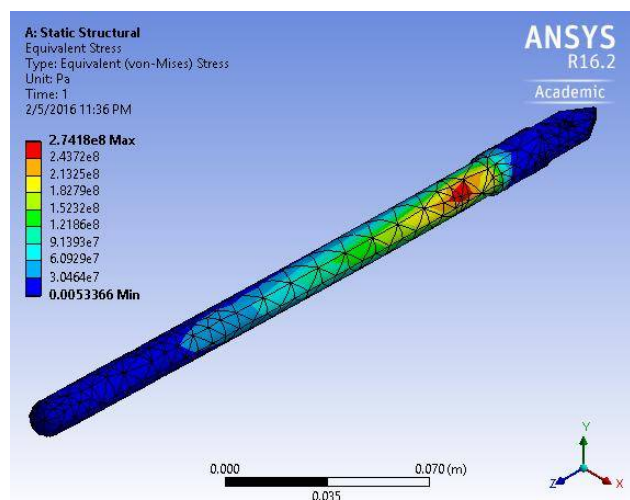


Fig. 2. Analysis of stile

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4.2. Analysis of Fork & Arm and other parts

Maximum stress acting on fork & base part is approximated to 280 MPa under real time constraints. The analysis result using Von-Mises theory is shown in figure 3. Maximum stress acts around the stopper & lowest stress acts in whole of base part and part of fork, which are evident from the figure 3. Based on analysis, material of fork & base part is selected as AISI 1018 Mild/Low Carbon Steel which is same as that of stile.

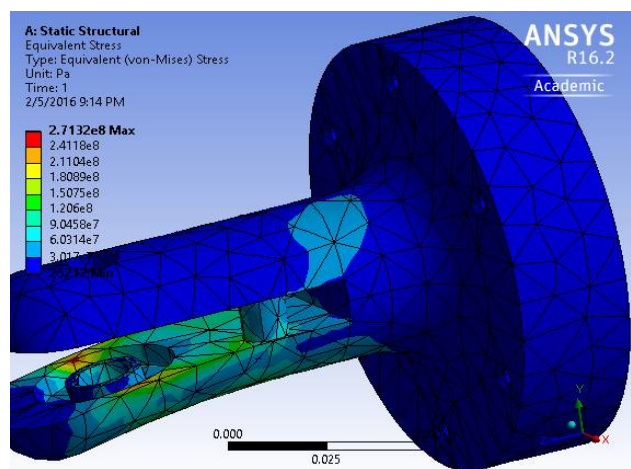


Fig. 3. Analysis of fork and arm part

Using ANSYS R16.2. pin is also analysed. The properties of torsion spring used in fork are Diameter 1.0 mm, Mean diameter 12.5 mm, Spring index 12.5 and Spring rate 510.723 N-mm/360 Degrees, which are found using proper design procedures [1].

V. INSTALLATION AND WORKING

The entire system has to be fixed to the chamfer provided in the train coach door as shown fig.4. 3 stiles are installed in order to ensure that passenger cannot misuse the one-way stile by holding 2 stiles in hand and using the door as though no stile is in the way. This installation is very simple as it doesn't require any changes to the existing doors.

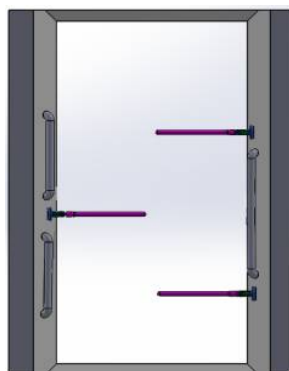


Fig. 4. Installation in conventional coach doors

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Stile acts as barrier. Fork consists of a stopper which prevents outward movement from initial position in the entry stiles and inward movement in the exit stiles. Pin acts as a pivot point for the stile. When the passenger tries to enter using entry stile, he will push the stiles forward and moves inside. Immediately, stile comes back to its original position. When the same passenger tries to exit using entry door, stopper prevents movement of the stile, so that he cannot use entry stile to exit.

VI. CONCLUSION

The issues of congestion due to population can be well addressed in short duration, by proper engineering designs. Better crowd management of the passengers in Indian Railways can be achieved with the help of one-way stiles. But One-way stile will address such congestion issue by changing the passengers' psychology, to follow an ordered culture of entry through only entry doors and exit through only exit doors. In addition, it will prevent collision and unwanted petty quarrelling among the passengers.

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