

**DESIGN AND VALIDATION OF A CRASH RATED  
BOLLARD AS PER SD STD 02-01 REV. A (2003)  
STANDARD USING FINITE ELEMENT (FE) ANALYSIS**

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**KEYWORDS**

Vehicle security barrier, bollard, crash

**ABSTRACT**

Use of vehicle barriers for traffic regulation is of utmost importance in a densely populated country like India. These barriers can be used effectively to divert vehicles during public events and emergency situations. Due to their periodic requirement at different locations, it is essential that the barriers provide visibility and security while remaining comparatively cheaper at the same time. Out of the different types of available barriers like solid walls, pillars, beams, gates, etc., a bollard (vertical pole protruding from the ground to a very less but visible height) is the most effective in terms of space occupied and absorption of impact energy. Multiple bollards used in series are effective towards withstanding large vehicle impacts, while allowing passage to pedestrians and bicycle riders with ease.

The prevalent methodology of evaluating energy absorption capacity of bollard as per SD. STD. 02-01 Rev. A (2003) standard includes physical impact of the designed bollard by designated vehicle type (M type of vehicles) for K-4, K-8 and K-12 types of crash ratings. A finite element (FE) model of the designed bollard was analysed under similar impact conditions using crash analysis software (LS-Dyna v. 971). The FE results were validated with the results of the physical test conducted subsequently.

Parametric optimization of the K-12 rated FE bollard was conducted and a new bollard design for K-8 rating was thus prepared and analysed for vehicular impact.

The use of Computer Aided Engineering (CAE) tools and FE analysis during design stage itself aimed at reducing the cost and time required to build and successfully test the bollard for crash rating.