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GENERAL SAFETY

Truck Mounted Ladder Racks

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ABSTRACT

While climbing a properly set up aluminum extension ladder, a workman fell with the ladder after a crack completely penetrated one of the side rails. The crack initiated at a site which corresponded exactly with the location where the side rail normally rests on a steel ladder rack during transport. There are a number of recommended countermeasures in the ANSI ladder standards for preventing ladder damage from road shock and vehicle vibration including one which suggests securing the ladder at each support point. This bulletin demonstrates that the latter recommendation alone will prevent fretting damage and its associated loss of structural integrity.

INTRODUCTION

Truck mounted ladder racks are the most popular method for transporting ladders to work sites. The ladders are typically secured to the racks using ties or bungees to prevent falling during transit with the attendant property loss and road hazard. Another hazard, which is more insidious, arises from the roading environment which causes ladders to bounce against the ladder racks. This situation is described in the American National Standard A14.2-1990 to wit:

> ***8.4.4 Transporting.*** *Ladders transported on road, street, and highway motor vehicles shall be properly supported. Overhang of the ladders beyond supporting points should be limited. Supporting points should be of a material such as wood or rubber-covered iron pipe, to minimize chafing and the effects of road shock. Securing the ladder to each support point will greatly reduce damage due to road shock.*

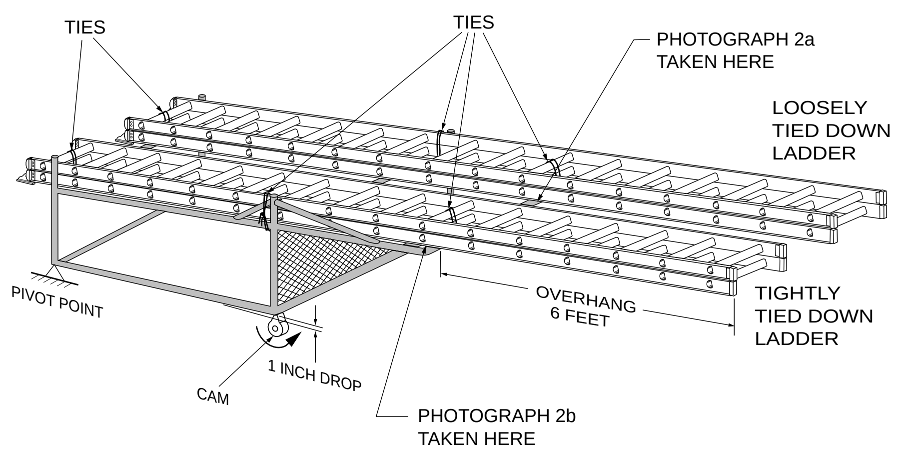

Fig. 1 Test Set-Up

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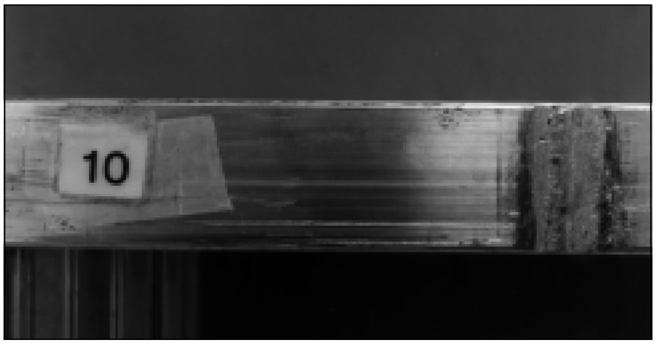

Fig. 2a Loosely Tied Ladder Flange Damage

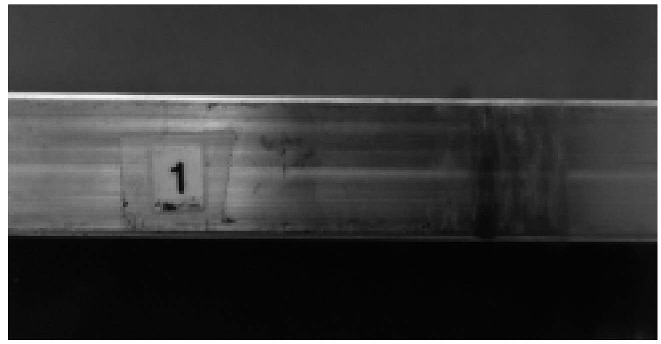

Fig. 2b Securely Tied Ladder Flange Damage

> ***8.4.4.1 Truck Racks.*** *Ladders shall be secured to the truck rack in a manner that will avoid chafing from relative horizontal and vertical motion. The ladder feet, when present, should be secured from pivoting about the ladder while the vehicle is in motion. The ladder truck rack shall be designed to positively secure the ladder into a fixed position, and the rack should be designed to fit the particular ladder being fixed to the truck. If these requirements are not satisfied, excessive wear of the ladder will occur which will cause premature deterioration of the ladder and reduce its service life. Improperly designed and used truck racks may damage side rails, steps or rungs, feet, and other ladder parts, owing to vehicle vibration and road shock.*

The standard defines the hazard and either explicitly or implicitly proposes the following countermeasures:

1. Soft supports such as wood or rubber-covered iron pipe.
2. Limited overhang.
3. Securing the ladder at each support point.
4. Softer spring vehicle suspensions.
5. Custom design racks for particular ladders.

As an "on-product" warning sign, the standard proposes the following language found in Marking No. 10: "Properly secure and support ladder when in transit." The effectiveness of this safeguarding procedure for preventing structural damage is explored in this bulletin.

The consequence of fretting damage is avoided by three additional admonitions contained in Marking No. 10 under the heading <u>Inspection</u>:

- *Inspect upon receipt and before each use.*
- *Never climb a damaged, bent, or broken ladder.*
- *Destroy ladder if broken, worn, or if exposed to fire or chemical corrosion.*

TESTING PROGRAM

A test was conducted with two 32-foot aluminum extension ladders (16 feet in length when retracted) situated with a 6-foot overhang beyond the front tubular steel support of a roof rack shown in Fig. 1. One of the ladders was loosely tied so that the ladder could rise above the roof rack supports. The other ladder was securely tied with rope to each of the three supports on the roof rack. Simulated road shock of one-inch amplitude was imparted to the roof rack for 95,000 cycles. Every cycle resulted in an impact to the same location of the ladder side rails; both ladders were subjected concurrently to the same simulated road shock.

The flange thickness of the more significantly damaged side rail on the loosely tied ladder was reduced from 0.1306 inches to 0.1132 inches; a reduction of 13.2%. The damage site is shown in Fig. 2a. For the securely tied ladder, the side rail with the greater damage was reduced in thickness by only one thousandth of an inch, from 0.1310 inches to 0.1300 inches; a reduction of 0.76%. The associated damage site is illustrated in Fig. 2b.

The damage sites depicted in Fig. 2 may be compared to the right side rail damage shown in Fig. 3 for a nominally identical ladder which fractured and collapsed during field use.

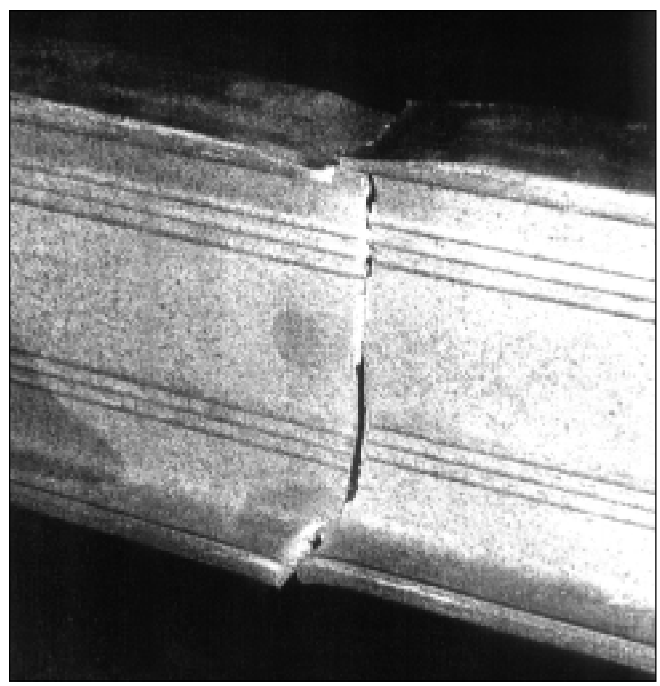

Fig. 3 Fractured Ladder Damage

CONCLUSION

The benefit of securely tying ladders before transporting them on roof racks is far greater than simply making sure that the ladder remains on the transporting vehicle and does not create a hazard for other traffic. Secure tying also prevents premature wear and tear on the structural elements of the ladder which could lead to structural collapse of the ladder during use if the damage remains undetected or ignored.