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[Redacted]

Gentlemen,

This letter describes my part of the investigation in the above case. This investigation undertaken with Dr. [redacted], who was to consider the structural and design aspects of the ladder, while I was to consider metallurgical factors.

I examined the failed ladder in a Huntington, West Virginia law office in the company of Dr. [redacted] and your [redacted]. No destructive tests were allowed, nor was the ladder to be removed from the law office. As such tests to determine strength, ductility, composition, and microstructure were impossible. The examination consisted of study with the naked eye and a ten-power hand lens.

The ladder was of the conventional aluminum extension type. The metal appeared sound and well finished, with no noticeable defects in material or workmanship.

One flange of one side rail of the lower section had buckled slightly. The ladder had reportedly been straightened after the collapse, so as to allow the two sections to slide together. The straightening would certainly remove much of the buckling.

The buckled area was studied carefully with the aid of a hand lens. No evidence of defects in material or workmanship was found.

On 23 March 1980, at his Marblehead, Massachusetts home, Dr. [Redacted] and I conducted a series of tests on two ladders of the same kind as the failed one, to determine under what conditions the ladders would fail. We were particularly concerned with conditions corresponding to men located near the middle and top of the ladder. Loading was effected by hoisting water-loaded trash cans from the top rung of the bottom section and the next to the top rung of the top section. Each can weighed 225 lbs. The ladder was leaned against the side of the house, with the feet resting firmly on the lawn. The following tests were performed; the ladders are referred to as "A" and "B" for identification:

Test	Description
A-1	Ladder A extended to 17', placed at proper 1:4 angle, with base 4.5 feet from house and loads at center of rungs. Ladder shaken by hand while loaded. Result: Modest deflection, ladder seems stable.
A-2	Move base of ladder to 6.5 feet from wall, locate loads at extreme left of rungs to give maximum off center loading, shake ladder. Result: More deflection, less rigid, still no sign of failure.
A-3	As A-2, except ladder base now 8.5 feet back from wall. Result: Big deflection of left rail (recorded photographically) but still no failure. The deflection could have been frightening to a human on the ladder. The ladder resumed its original configuration when overloaded.
A-4	From vertical position, drop ladder on side three times on asphalt driveway. Result: No buckling of flanges, though the top of the down rail bent slightly.

The next series of tests were run on Ladder B with the left hook unattached. In this way, the top left rail could not transmit its axial load (from the top load) to the over left rung.

Test	Description
B-1	Ladder B, placed at proper angle, left hook not fastened, loaded at middle only, shaken. Result: Neither failure nor excessive deflection.
B-2	As B-1, but loaded at top and middle. Result: Pronounced bow to right, but no failure.
B-3	As B-2, but base of ladder moved to 6.5 feet from wall. Result: Failure of upper flange of lower right rail near the bottom of the top section (recorded photographically, Fig. 2).

Dr. [Redacted]'s report will go into the design implications of the test results. It is clear, though, that the ladder was designed with a large margin of safety, as it failed only after being simultaneously:

1. Overloaded two-fold;
2. Used at too shallow an angle;
3. Used with only one hook attached.

The tests are quite dramatic in illustrating the inherent safety of the ladder, and could easily be repeated before a court, should the case go to trial. An invoice is enclosed.

Respectfully submitted,

Kenneth C. Russell
Consultant



Figure 1: Ladder testing.



Figure 2: Failed aluminum ladder.