

# Narrative for ODOT Concrete Barrier Crash-Testing

Three separate crash-tests were scheduled in 2001. Since subsequent tests were contingent on the success (or failure) of the first and second tests we did not know until after the test results were analyzed what was to be tested next.

The crash-testing facility that conducted the tests was KARCO Engineering of Adelanto, California, near Barstow, in the Mojave Desert.

## Test 1

The first scheduled test is the standard test for all barriers, known as NCHRP Report 350 Test 3-11. The test subject was the pre-cast 32-inch high pin-and-loop, unanchored, utilizing 6 loops per connection. This is ODOT's standard barrier, both for temporary and permanent use. The test was conducted on April 17, 2001. Test 3-11 runs a 4400 pound ¾-ton pickup into the side of the barrier at a speed of 62 mph and an angle of 25 degrees.

### Crash Test 1 results - Standard F-shape barrier and 4400 pound truck

Parameter	Result	NCHRP Requirement
Vehicle containment & redirection	Pass	Vehicle redirection in a controlled manner; no underide or override allowed.
Debris from the impact	Pass	No debris from the impact should present a hazard to occupant compartment or others.
Occupant compartment	Pass	No hazardous deformation or intrusion of the occupant compartment
Vehicle attitude	Pass	Vehicle should remain upright; moderate roll, pitch and yaw acceptable
Occupant impact velocity longitudinal direction	19 ft./sec.	Allowable, not to exceed 40 ft./sec.
Occupant ridedown acceleration longitudinal direction	12.52 G	Allowable, not to exceed 20 G
Vehicle exit trajectory	11 degrees	Preferred not to exceed 60% x 25 = 15 degrees
Maximum barrier deflection	30 inches	No NCHRP requirement; ODOT requirement:36 in.

No drop-in pins failed or were bent from the impact.

## Test 2

Since the first test exceeded our expectations and we still had two tests to conduct, we abandoned further testing with the 32-inch and switched over to our recently- introduced 42-inch Tall F-Shape to see how it would compare with the 32-inch barrier. Test 3-11 again was the chosen test. The test subject at that time was 10 feet long rather than the current length of 12.5 feet. The connection system consists of four intersecting "C" channels bolted together. There was no anchorage to the pavement. The test was conducted on June 19, 2001.

**Crash Test 2 results - Tall F-shape barrier and 4400 pound truck**

<b>Parameter</b>	<b>Result</b>	<b>NCHRP Requirement</b>
Vehicle containment & redirection	Pass	Vehicle redirection in a controlled manner; no underride or override allowed.
Debris from the impact	Pass	No debris from the impact should present a hazard to occupant compartment or others.
Occupant compartment	Pass	No hazardous deformation or intrusion of the occupant compartment
Vehicle attitude	Pass	Vehicle should remain upright; moderate roll, pitch and yaw acceptable
Occupant impact velocity longitudinal direction	20.4 ft./sec.	Allowable, not to exceed 40 ft./sec.
Occupant ridedown acceleration longitudinal direction	19.36 G	Allowable, not to exceed 20 G
Vehicle exit trajectory	12 degrees	Preferred not to exceed 60% x 25 = 15 degrees
Maximum barrier deflection	32 inches	No NCHRP requirement; ODOT requirement: 36 in

No bolts failed or were bent as a result of the impact. It is assumed that the extra deflection was caused by the shorter length of barrier segments tested.

**Test 3**

Since the Tall F-Shape was developed to contain trucks it was decided that we should at least see if the barrier could stand up to a Test Level 4 impact. Test 4-12 runs a Single Unit truck weighing 18,000 pounds into the barrier at a speed of 50 mph and an angle of 15 degrees. Again, the test subject was an unanchored 42-inch Tall F-Shape. The test was conducted on September 18, 2001.

**Crash Test 3 results - Tall F-shape barrier and 18,000 pound truck**

<b>Parameter</b>	<b>Result</b>	<b>NCHRP Requirement</b>
Vehicle containment & redirection	Pass	Vehicle redirection in a controlled manner; no underride or override allowed.
Debris from the impact	Pass	No debris from the impact should present a hazard to occupant compartment or others.
Occupant compartment	Pass	No hazardous deformation or intrusion of the occupant compartment
Vehicle attitude	Pass	Preferable that the vehicle remain upright
Occupant impact velocity longitudinal direction	6.14 ft./sec.	No NCHRP requirement
Occupant ridedown acceleration longitudinal direction	5.29 G	No NCHRP requirement
Vehicle exit trajectory	7.3 degrees	Preferred not to exceed 60% x 15 = 9 degrees
Maximum barrier deflection	32.5 in.	No NCHRP requirement; ODOT requirement: 36 in

No bolts failed or were bent as a result of the impact.