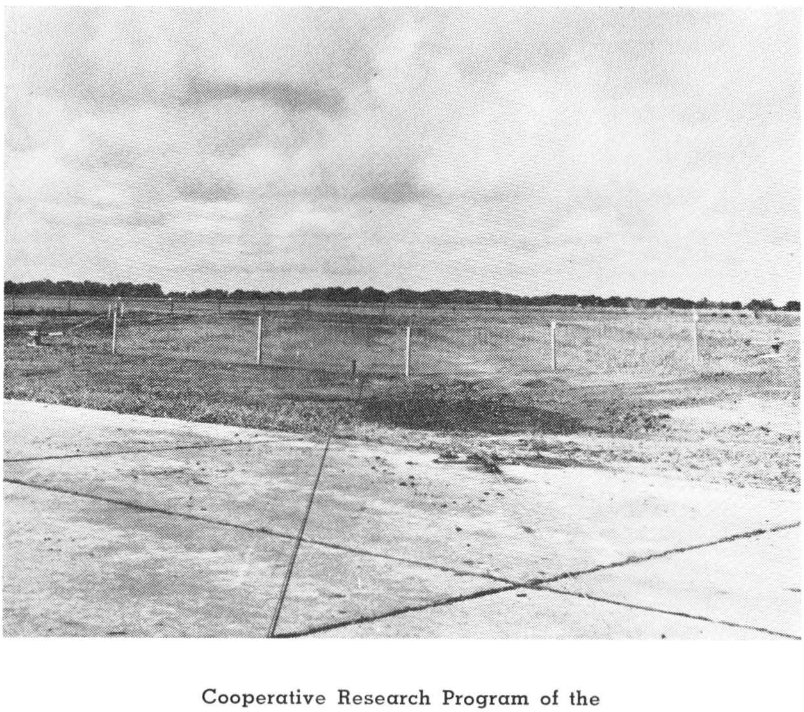
SUMMARY REPORT 146-10(S)

CHAIN LINK FENCE VEHICLE ARRESTING SYSTEM

SUMMARY REPORT
of
Research Report Number 146-10
Study 2-8-68-146



Cooperative Research Program of the
Texas Transportation Institute and the Texas Highway Department
In Cooperation with the
U. S. Department of Transportation, Federal Highway Administration

July, 1973

TEXAS TRANSPORTATION INSTITUTE
Texas A&M University
College Station, Texas

CHAIN LINK FENCE VEHICLE ARRESTING SYSTEM

by

E. L. Marquis, G. G. Hayes, and T. J. Hirsch

There are several features or areas along our roadways or highways which can be hazardous to vehicles when leaving the travelway at high speed. In many cases, conventional guardrails or crash cushions are not an effective or economical means of preventing vehicles from entering these hazardous areas. Some obvious areas of this type are:

1. Median areas or holes between twin bridges on divided highways.

2. "Dead Ends" or termination of roads or highways.

3. Barriers to close off entrance and exit ramps on freeways.

The chain link fence vehicle arresting system reported on here was designed specifically to prevent motorists from entering the median area or hole between twin bridges on divided highways. At the present time, guardrail or no protective device is used in these areas. Guardrail, if used, will generally be inadequate to prevent a high speed vehicle from entering this hazardous area because the vehicle will be impacting it almost head-on. The device reported on here is composed of a chain link fence mounted on standard steel delineator posts. Each end of the fence is attached to a "metal bender" energy absorber mounted on a standard wooden guardrail post. Similar devices of this type have been used at automobile drag race tracks under the trade name of "Dragnet." The Texas Highway Department has a barrier at the Bolivar Ferry Landing near Galveston which uses the metal benders as an energy absorber.

Several tests have been conducted on similar installations in which the net between the metal benders was straight and level. District 11 of the Texas Highway Department had a potential installation in which the net connecting the two metal benders would traverse a median ditch with 12:1 side slopes. Officials of this district were concerned about the interaction of an errant vehicle and a dragnet system spanning a ditch section of this configuration.

A test site was developed at the TTI Proving Grounds, and the dragnet system was installed. A head-on test was conducted, and the metal bender tapes failed to perform as intended. The manufacturer had modified the design of the system to simplify and improve the installation of the metal bender units. A hole was placed in the center of the metal bender of sufficient size to fit over a standard 7 in. guardrail post. The closure of the case provided an axle for the coil of tape to spin around.

TABLE I. STOPPING DISTANCES AND DECELERATIONS FOR TAPE TENSIONS OF 4000 LB

Vehicle Weight lb	Velocity mph	Kinetic Energy 1-k	L=30 ft		L=40 ft		L=50 ft		L=60 ft		L=70 ft		L=80 ft	
			X_{max}	Gavg	X_{max}	Gavg	X_{max}	Gavg	X_{max}	Gavg	X_{max}	Gavg	X_{max}	Gavg
2000	30	60.1	16.8	1.8	18.9	1.6	20.2	1.5	22.5	1.3	24.1	1.2	25.6	1.2
4500	30	135.3	28.2	1.1	31.0	0.9	33.6	0.8	36.1	0.8	38.3	0.7	40.5	0.7
2000	40	106.9	24.1	2.2	26.7	2.0	29.1	1.8	31.3	1.7	33.4	1.6	35.3	1.5
4500	40	240.5	42.5	1.3	45.9	1.2	49.1	1.1	52.0	1.0	54.9	0.9	57.5	0.9
2000	50	167.0	32.6	2.5	35.6	2.3	38.5	2.2	41.1	2.0	43.6	1.9	45.9	1.8
4500	50	375.8	60.1	1.4	63.9	1.3	67.5	1.2	70.9	1.2	74.1	1.1	77.2	1.1
2000	60	240.1	42.4	2.8	45.9	2.6	49.0	2.5	52.0	2.3	54.8	2.2	57.5	2.1
4500	60	541.1	81.3	1.5	85.3	1.4	89.2	1.3	92.9	1.3	96.5	1.2	99.9	1.2
2000	70	327.3	53.9	3.0	57.5	2.8	61.0	2.7	64.3	2.5	67.4	2.4	70.3	2.3
4500	70	736.6	106.0	1.5	110.3	1.5	114.4	1.4	118.3	1.4	122.2	1.3	125.9	1.3
2000	80	426.9	66.7	3.2	70.6	3.0	74.3	2.9	77.8	2.7	81.1	2.6	84.4	2.5
4500	80	962.0	134.4	1.6	138.8	1.5	143.1	1.5	147.2	1.5	151.3	1.4	155.2	1.4

No bushing or bearing had been provided between this axle and the coil of metal tape. During the test, the tape tightened around the axle and locked up, resulting in tape breakage. Brass bushings were provided for the metal benders. The re-testing with brass bushings, verified that the median configuration could be successfully protected by a dragnet system. As a result of the first test, it was found that the fence support post could be made "breakaway" to improve the fence-vehicle entrapment performance.

The addition of the hole and the brass bushings improved the installation and maintenance features of the metal bender. This feature when coupled with breakaway posts supporting the fence make the Chain-Link-Fence Vehicle arresting system an excellent safety device for certain types of installation such as between parallel structures.

Design of System

Simple formulas to be used for design have been developed in a previous report and included in the published version of this report. For a head-on impact in the center of the system these are

$$R_{max} = \frac{WV^2}{4Tg}$$

$$X_{max} = \sqrt{R^2_{max} + R_{max}L}$$

$$Gavg = \frac{V^2}{2\ g\ X_{max}}$$

where

L = Length of net, ft.

T = metal bender tape tension force, lb.

R_{max} = run out of metal bender tape (assuming all energy is absorbed by tape), ft.

X_{max} = stopping distance, ft.

W = weight of vehicle, lb.

V = initial velocity of vehicle, ft/sec.

g = acceleration due to gravity, 32.2 ft/sec^2.

Gavg = average acceleration force in g's

Table 1 has been developed as a design aid for a system being impacted at the center and at right angles for various design speeds and lengths of openings.

The published version of this report may be obtained by addressing your request as follows:

R. L. Lewis, Chairman
Research and Development Committee
Texas Highway Department—File D-8
11th and Brazos
Austin, Texas 78701
(Phone 512/475-2971)