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JD Fence™ for Small Mountain Stream

1. Introduction

Countermeasures for sediment disasters at zero-order streams and other small mountains streams where the catchment area is small and a downstream watercourse cannot be provided have become an urgent issue in recent years. In many cases, residential land has been developed to the valley mouth, and total destruction of houses and other severe damage will occur once a debris flow begins. Moreover, if multiple debris flows occur simultaneously, as happened in the Hiroshima sediment disaster of 2014, the damage will become catastrophic.

In Japan, about 89 000 dangerous streams due debris flows affecting 5 or more houses at one location have been designated nationwide (announced in FY 2002)[1], but little progress has been made in countermeasures, as one or more sabo dam has been constructed on only about 22% of those dangerous streams[2].

JD Fence™ is a specialized product which was developed as a countermeasure for sediment disasters involving zero-order streams and other small mountain streams, and reduces construction costs and shortens construction time in comparison with conventional impermeable dams.

2. Features and Applicable Range of JD Fence™

2.1 Features

(1) JD Fence is debris flow and driftwood countermeasure constructions which are installed on zero-order streams and other small mountain streams where a watercourse cannot be provided downstream.
(2) It is suitable for areas where residential land has been developed up to the mouth of a valley, and for locations protecting community roads and railways.
(3) JD Fence enables sure capture of driftwood because it is a permeable structure.

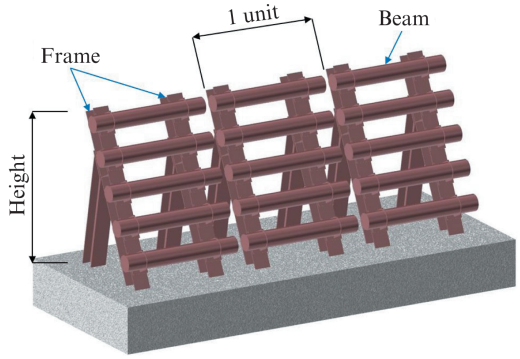

Fig. 1 Diagrammatical view

2.2 Applicable Range

(1) Cases where running water normally does not exist and the watercourse is indistinct.
(2) Cases where the discharged sediment volume is roughly 1 000 m^3 or less.
(3) Cases where sediments with the maximum grain size are 20 cm or more and driftwood flows out together with sediments.

3. Structure

JD Fence has a structure in which H-shaped steel is used as the column material, and a dense arrangement of steel pipes is used in the horizontal members with which gravel and driftwood collide during a debris flow. **Figure 1** shows a schematic diagram.

The cross section has a triangular shape, which is a rational shape for debris flow fluid dynamic force and sediment pressure. The collision energy of the gravel and driftwood in a debris flow is absorbed by cave-in deformation of the steel pipes and deflection deformation of the beam.

The standard height range is 2 m to 5 m.

4. Performance Verification (Hydraulic Model Experiment)

Because JD Fence has a construction close to that of the closed type, in which the horizontal beams are arranged densely, its sediment and driftwood capture performance compared with an impermeable dam was confirmed under the same conditions.

† Originally published in *JFE GIHO* No. 43 (Feb. 2019), p. 103−104

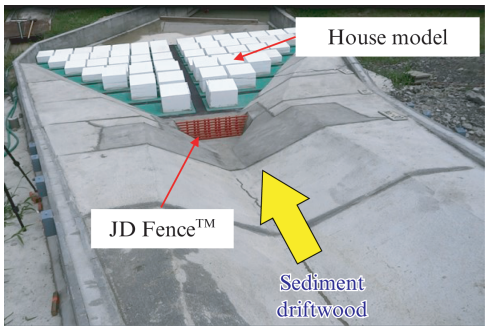

Photo 1 Experimental scene

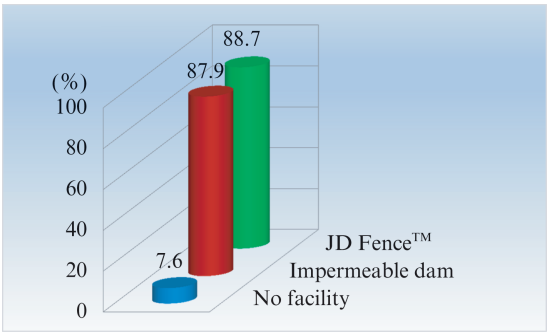

Fig. 2 Sediment capture rate

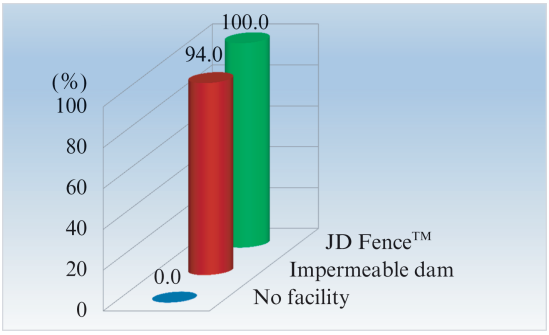

Fig. 3 Boulder capture rate

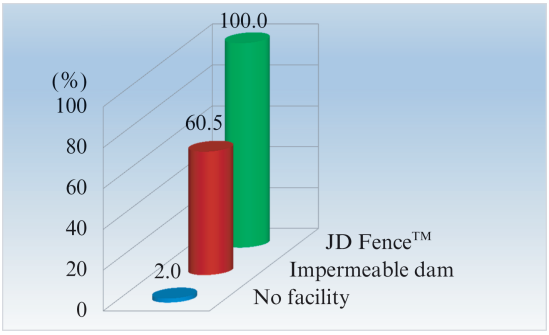

Fig. 4 Driftwood capture rate

4.1 Outline of Experiment

In the experiment, a debris flow water channel, river channel, alluvial fan and residential area were modeled, and the experiment was performed at a scale of 1/30.

Photo 2 Construction case (Hyogo Prefecture)

Photo 3 Construction case (Fukushima Prefecture)

The condition of the hydraulic model experiment is shown in **Photo 1**.

4.2 Experimental Results

4.2.1 Sediment capture rate

The sediment capture rates were 87.9% for the impermeable dam and 88.7% for JD Fence. Thus, the same or a superior effect was conformed (**Fig. 2**).

4.2.2 Boulder capture rate

At the impermeable dam, boulders bounced upward on impact with the dam and easily flowed out to the downstream area. The boulder capture rates were 94% for the impermeable dam and 100% (complete capture) for JD Fence (**Fig. 3**).

4.2.3 Driftwood capture rate

Because driftwood flows down near the water surface, it easily flows out through the spillway of an impermeable dam. The driftwood capture rates were 60.5% for the impermeable dam and 100% (complete capture) for JD Fence (**Fig. 4**).

5. Construction Record

The construction record as of August 2018 was 5 projects. Construction cases are shown in **Photo 2** and **Photo 3**.

6. Conclusion

Construction technology review and certification (sabo technology)[3] was received in October 2018.

In the future, we hope to further heighten the product appeal of JD Fence by improving workability, and to contribute to even greater reductions in sediment disasters.

References

1) Ministry of Land, Infrastructure, Transport and Tourism website. Number of dangerous spots for sediment-related disasters by prefecture.
https://www.mlit.go.jp/common/001286018.pdf
2) Ministry of Land, Infrastructure, Transport and Tourism website. Construction status of facilities at dangerous spots for sediment-related disasters.
https://www.mlit.go.jp/river/sabo/taisaku_syojoho/kikenkasyo_seibijokyo.pdf
3) SABO & LANDSLIDE TECHNICAL CENTER. Construction technology review and certification (sabo technology) report. JD Fence for Small Mountain Stream (Debris flow fence).

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