CONSTRUCTION INDUSTRY COUNCIL
建造業議會

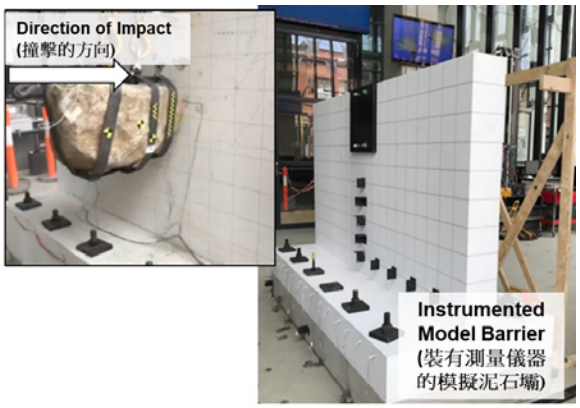
CIC CONSTRUCTION INNOVATION AWARD
建造業議會創新獎

A New Generation of Rigid Landslide Debris-resisting Barrier System

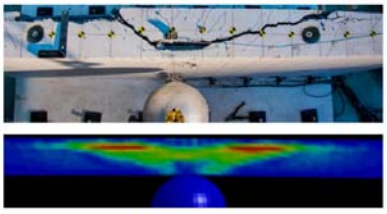
Geotechnical Engineering Office,
Civil Engineering and Development Department, The Government of HKSAR

In Hong Kong, rigid debris-resisting barriers are commonly used to mitigate natural terrain landslide hazards. There are, however, two major challenges associated: (1) intensive construction works in remote hillsides; and (2) risk of extreme landslide events due to climate change. To tackle these challenges, a new generation of rigid debris-resisting barriers is developed based on the following two facets of holistic technical development work.

Testing of Debris Impact
(泥石流撞擊試驗)



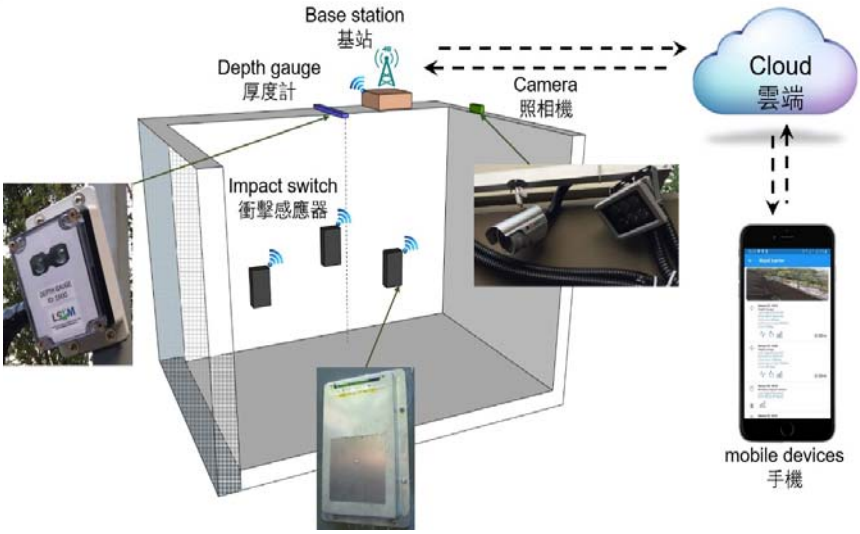
Testing of Boulder Impact
(大石撞擊試驗)



Modelling of Localised Damage
(局部破壞模擬)

Facet 1: To optimise the structural requirements of rigid barriers, a novel design philosophy has been proposed. It mainly involves an innovative displacement-based assessment of geotechnical stability, and improved methodology for the evaluation of flexural response and localised damage of rigid barriers. These methods have been validated. The revamped design guidelines also incorporate an optimised debris impact load model and quantify the use of cushioning materials to protect rigid barriers. These areas of improvement could yield a less-structural demanding barrier, thereby reducing construction cost and time, and minimising environmental impacts.

Facet 2: To enable immediate landslide detection for expediting emergency responses, a Smart Barrier System equipped with Internet-of-Things (IoT) instrumentations is developed. The instruments are linked to a cloud-based IT platform which swiftly facilitates emergency responders to conduct real-time surveillance and monitoring using mobile devices. Site trials have been conducted to examine the system durability and reliability. In future, this system can be inter-connected with other emergency IT systems to form an emergency IoT ecosystem that enables the achievement of enhanced community resilience against the impact of climate change.



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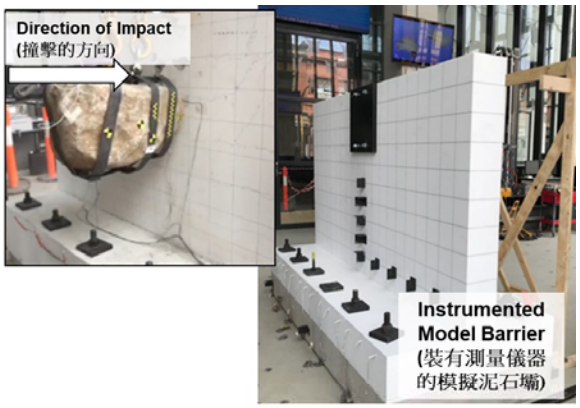
新一代泥石壩系統

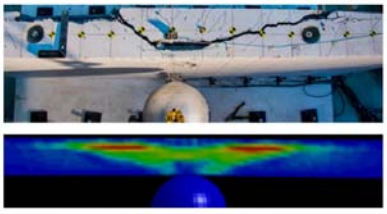
香港特別行政區政府土木工程拓展署土力工程處

泥石壩是香港常用於緩減天然山坡山泥傾瀉風險的措施。然而，泥石壩的應用正面對兩項主要挑戰：（一）需要在偏遠山坡上進行較大型的建造工程；（二）因氣候變化而發生極端山泥傾瀉的風險。「新一代泥石壩系統」的開發正是為了應對這些挑戰，當中包括以下兩項技術發展工作。

Testing of Debris Impact
(泥石流撞擊試驗)



Testing of Boulder Impact
(大石撞擊試驗)



Modelling of Localised Damage
(局部破壞模擬)

項目一：運用創新的概念來優化泥石壩的結構設計。當中主要涉及用作評估泥石壩整體穩定性的新穎位移法，以及用作預測結構彎曲反應和局部破壞的改良方法。這些方法均已進行驗證。除此之外，修訂後的泥石壩設計指引亦會優化泥石流撞擊荷載和緩衝物料這兩方面的設計。由此建造的泥石壩結構將更為精簡，從而減少工程成本和時間，並減低對環境的影響。

項目二：利用物聯網傳感技術發展「智能泥石壩系統」。這套系統能對山泥傾瀉的發生進行實時感應，從而讓有關人員可以加快採取緊急應變措施。所有儀器均連接到雲端網上平台，並可以使用流動設備進行實時監控。試驗該系統耐用性和可靠性的實地測試已經完成。「智能泥石壩系統」可以在將來與其他網上緊急應變系統互連，從而增強香港抵禦氣候變化影響的能力。