# 研究及技術
# Research and Technology








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# 更耐用的瀝青鋪路物料
# More Durable Bituminous Surfacing Material

## 10 毫米高改性瀝青瑪蹄脂碎石混合料
## 10 mm Highly Modified Stone Mastic Asphalt (HMSMA10)

傳統瀝青路面物料在高溫和高交通荷載下容易呈現不穩定狀況，導致路面出現車轍等損壞。我們與香港理工大學合作，研發了 10 毫米高改性瀝青瑪蹄脂碎石混合料（HMSMA10）。這種先進的路面物料具備以下特點：

Conventional bituminous surfacing is prone to instability under high temperatures and heavy traffic loads, leading to pavement defects such as rutting. In collaboration with the Hong Kong Polytechnic University (PolyU), we have developed 10 mm Highly Modified Stone Mastic Asphalt (HMSMA10) – an advanced surfacing material featuring:

- 高改性瀝青油，提升耐高溫性能和耐用性
  Modified bitumen binder with enhanced high-temperature resistance and durability
- 提升抗變形能力（減少車轍）
  Enhanced deformation resistance (reducing rutting)
- 改善抗老化性能
  Improved anti-aging properties
- 優異的耐疲勞能力
  Excellent fatigue resistance

大量的實驗室測試和實地試驗結果證明， HMSMA10 具備：
Extensive laboratory testing and field trials confirm that HMSMA10 offers:

✓ 比傳統物料具更優勝抗車轍能力
Greater rutting resistance than conventional materials

✓ 更長的使用壽命
Longer service life

✓ 顯著減少維修需求
Significant reduction in maintenance requirements

通過採用 HMSMA10，可顯著減緩路面損壞速度，有效提升路面耐用性，減低維修頻率和相關的環境影響。自二零二五年四月一日起，我們已全面採用 HMSMA10 於合適位置作鋪路之用，以進一步提升本港整體路面質素。

By adopting HMSMA10, the deterioration rate of road surfaces can be significantly slowed, effectively enhancing pavement durability while reducing maintenance frequency and associated environmental impacts. To further improve Hong Kong's road quality, we have fully implemented HMSMA10 in suitable locations since 1 April 2025.

深圳灣公路大橋鋪設的 HMSMA10
HMSMA10 on Shenzhen Bay Bridge

# 低噪音鋪路物料
# Low Noise Road Surfacing Material

## 6 毫米高改性瀝青瑪蹄脂碎石混合料
## 6 mm Highly Modified Stone Mastic Asphalt (HMSMA6)

傳統的道路表面在與輪胎接觸時會產生顯著的噪音，尤其在稠密的市區環境。為應對這項挑戰，我們與香港理工大學合作研發創新的解決方案。6 毫米高改性瀝青瑪蹄脂碎石混合料（HMSMA6）為低噪音鋪路物料技術帶來突破，具下列優勢：

Traditional road surfaces generate significant noise from road-tire contact, particularly in dense urban environments. To address this challenge, we partnered PolyU to develop an innovative solution. 6 mm Highly Modified Stone Mastic Asphalt (HMSMA6) represents a breakthrough in low-noise road surfacing (LNRS) technology, offering:

- 有效降噪：可降低輪胎路面噪音約 2.5 分貝(A)，相當於減少近半交通量所感知的噪音水準
  Effective noise reduction: Cuts road-tire noise by approximately 2.5 dB(A) - equivalent to a reduction of nearly half of the perceived noise experienced by traffic volume.
- 提升耐用性：抗車轍能力比傳統物料更優勝
  Enhanced durability: Superior rutting resistance compared to conventional materials
- 持續性表現：更長的使用壽命減少維修需求和對環境的影響
  Sustainable performance: Longer service life reduces maintenance needs and environmental impact

大量的實驗室測試和實地試驗展示了 HMSMA6 的優點如下：
Extensive laboratory testing and field trials demonstrate HMSMA6's advantages:

✓ 在減少噪音方面較標準道路表面優勝
Improvement in noise reduction over standard surfaces

✓ 抗變形能力更強
Greater resistance to deformation

✓ 延長的保養周期減少了在整個生命周期的成本
Extended maintenance intervals reducing life cycle costs

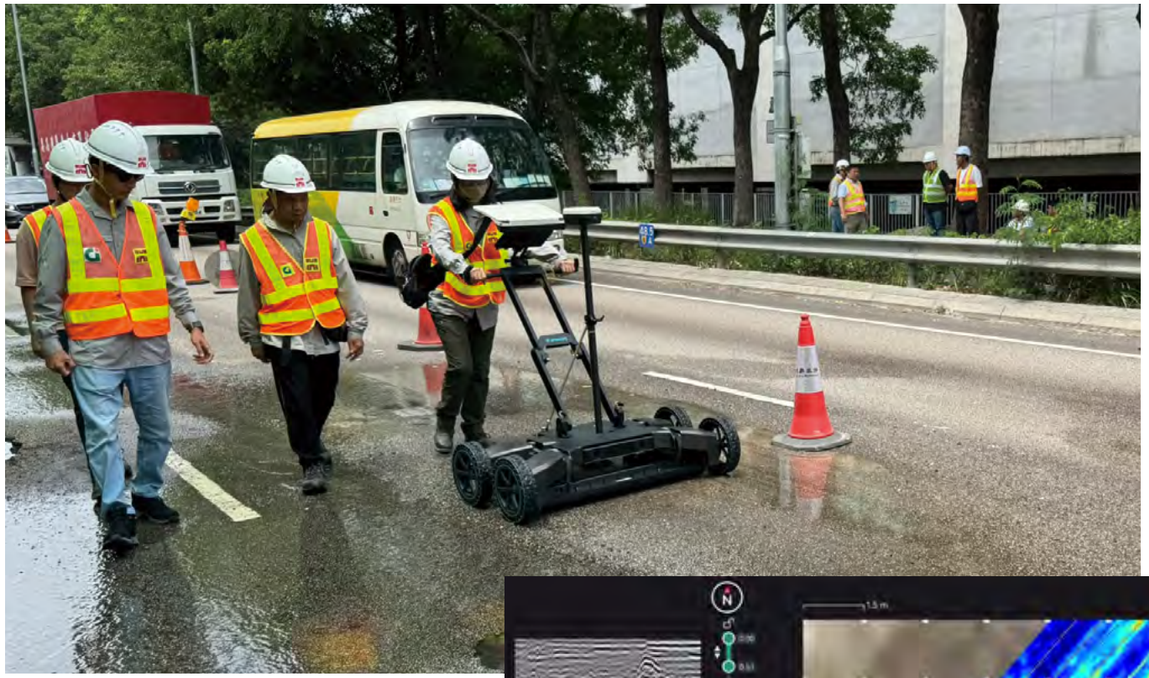
HMSMA6 自二零二五年四月一日起獲採用為用於區內道路的新一代低噪音鋪路物料，為更寧靜和更可持續的都市環境作出貢獻。

Since 1 April 2025, HMSMA6 has been adopted as the new-generation LNRS material for local roads, contributing to a quieter and more sustainable urban environment.

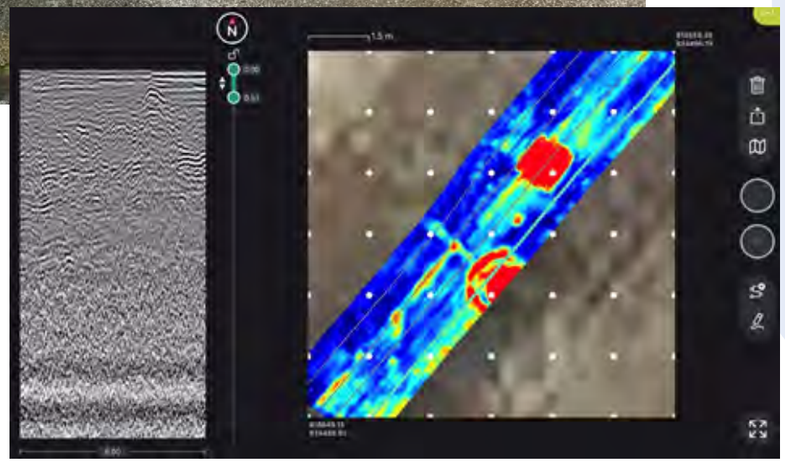


鋪設在荃灣蕙荃路的 HMSMA6
HMSMA6 on Wai Tsuen Road, Tsuen Wan

# 探地雷達系統的應用
# Application of Ground Penetrating Radar System



使用探地雷達測量行車道
GPR surveying a carriageway



從探地雷達掃描數據中發現地底異常
Subsurface anomaly detection in GPR scan data

## 探地雷達的應用
## Application of Ground Penetrating Radar

我們致力於整合創新技術，在提升營運效率的同時，盡可能降低對環境的影響。作為此項倡議的一部分，我們已採用探地雷達系統—一種非破壞性的地下探測方法。相較於傳統的開挖或鑽探作業，探地雷達系統能在無需擾動性物理介入的情況下，評估地下狀況。

We are committed to integrating innovative technologies that enhance operational efficiency while minimizing environmental impact. As part of this initiative, we have adopted the Ground Penetrating Radar (GPR) system, a non-destructive subsurface investigation method. Unlike traditional excavation or drilling, GPR allows us to assess underground conditions without disruptive physical intervention.

## 探地雷達的運作原理
## How GPR Works

探地雷達向地底發射高頻率的雷達脈衝，並分析反射的信號，以產生詳細的地底圖像。它在多種應用中非常有效，例如定位地下公用設施及識別道路表面下的空洞。這種主動且非侵入性的方法，與經常需要對環境進行大範圍物理破壞的傳統方法大不相同。

GPR emits high-frequency radar pulses into the ground and analyzes the reflected signals to generate detailed subsurface images. It is highly effective for applications such as locating underground utilities and identifying voids beneath road surfaces. This proactive and non-invasive approach differs greatly from conventional methods that often require extensive physical disruption to the environment.

# 探地雷達系統的應用
# Application of Ground Penetrating Radar System

## 環境效益
## Environmental Benefits

探地雷達的應用從根本上改變了進行地底勘察和後續維修的方式，從而帶來顯著的環境效益。

The use of GPR delivers significant environmental advantages by fundamentally changing how subsurface investigations and subsequent repairs are conducted.

### 1

### 減少環境破壞
### Reduced Environmental Disruption

探地雷達能大幅降低對環境造成的破壞程度。作為非破壞性的測試方法，使用探地雷達時無需進行大量挖掘，從而將挖開地面和操作重型機械時所衍生的噪音、氣味和空氣污染減至最少。因此，探地雷達在市區和敏感地區尤其有價值，因為將這些地區受到的干擾減至最少至關重要。

GPR significantly lowers the level of environmental disruption. As a non-destructive testing method, GPR eliminates the need for extensive excavation, thereby minimizing noise, odor, and air pollution that arise from breaking ground and operating heavy machinery. This makes it particularly valuable in urban areas and sensitive areas where minimizing disturbance is crucial.

### 2

### 資源效率和減廢
### Resource Efficiency and Waste Reduction

通過應用探地雷達，我們亦可更有效地運用人力和資源。探地雷達可精確識別地底的問題區域，讓我們可採取針對性方式進行維修。這種精確性大幅減少補救工作所需的原材料（例如瀝青和混凝土）的數量。因此，與生產和運輸這些材料相關的碳足跡也得以減少。

GPR also optimizes the use of manpower and resources. The system allows for the precise identification of underground problem areas, enabling a targeted approach to repairs. This precision significantly reduces the quantity of raw materials, such as asphalt and concrete, needed for remediation work. Consequently, the carbon footprint associated with the production and transportation of these materials is also reduced.

### 3

### 結合數碼方式持續運作
### Digital Integration for Sustainable Operations

探地雷達的應用有助於推動基礎建設管理的數碼轉型。所有的測量數據會以數碼方式記錄，能夠順暢地整合至網頁版地理資訊系統，讓我們可即時分析和作出決定。這種從紙本測量計劃到全數位工作流程的轉變，減少了紙張浪費，並促進更具可持續性和有效率的運作。

GPR supports digital transformation in infrastructure management. All survey data are digitally recorded and can be seamlessly integrated into web-based Geographic Information Systems (GIS), enabling real-time analysis and decision-making. This shift from paper-based survey plans to a fully digital workflow reduces paper waste and promotes more sustainable and efficient operations.