

# *Pipe Rehabilitation by Trenchless Lining Methods*

## 非開挖式修復法 管綫維修好方法



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## Why is trenchless lining applied for pipe Rehabilitation?

Underground pipe systems in a modern city are essential and complicated. In Hong Kong, portable and salt water are supplied through mains of more than 7200km while sewer is drained via a network of over 1525km to maintain our daily living. However, many of the underground systems are built years ago and approaching the end of their service life. To keep their efficiency and reliability, rehabilitation of the pipelines is necessary. Nevertheless, Hong Kong is a crowded and busy city, traditional pipe rehabilitation by excavation will affect the traffic and daily lives of people and is more costly. Therefore, Hong Kong has adopted trenchless technologies for pipe rehabilitation since the 1990s, including various trenchless linings.

### 為何管道修復採用非開挖式內襯法？

一個現代城市的地下管道網絡是必要和複雜的設施。供應香港的食水和咸水的網絡超過7200公里，排放污水的網絡則超過1525公里。這些系統維持了我們日常生活的便利，但多於早年建成，經年累月的損耗積累了大量缺陷，令系統的效率和可靠度大大降低，因此需要及時的修復。香港是一個擁擠繁忙的城市，以往傳統的開挖式管道修復每每嚴重影響交通運作和市民日常生活，而且成本比無開挖式修復方法更高。因此香港早於九十年代已引入無開挖式管道修復法，包括多種無開挖式內襯修復法。



## Different lining methods

There are many different lining methods, each with its own characteristic. Most common lining methods include cured-in-place-pipe (CIPP) lining, sliplining, close-fit-pipe lining and modified sliplining. These methods further comprise several sub-divisions. Applying which method depends on many factors. The basic consideration is whether the host pipeline is a pressure pipeline. Other factors include the shape of host pipe, the fluid flowing in host pipe, whether host pipe have bends, connected to laterals or not, ect.

### 不同的非開挖式內襯修復法

無開挖式內襯修復法的種類很多，而每一種都有它自己特別的地方。最常見的內襯修復法包括原位內擄喉管法，內套喉管法，內喉緊貼法及修訂內套喉管法。這些方法還可以再細分作幾種方法。採用哪一種方法修復管道需要考慮多方面的因素。最重要的考慮是到底原管道出現的問題是結構性的，半結構性的或非結構性的。另一重要的考慮是原管道是一條壓力管或是重力管。其他要考慮的因素包括原管道的形狀，有沒有彎位，有沒有分支等。



## Preparation works for trenchless linings

Through different lining methods applies different technologies, there are similar preparation works for successful installation:

1. A reconnaissance survey is essential to check the host pipe's condition and if the chosen lining method is appropriate, also decide the manholes or the location of excavation pits for installation and plan for temporary traffic arrangement (TTA).
2. A thorough cleaning for the host pipe by pipe jetting or other suitable methods prior to installation is necessary. The target of cleaning is to remove all internal rust, greases, tuberculation, deposits, debris, remains of the original internal coating and foreign intrusion like roots.
3. After the cleaning, a pre-installation CCTV inspection should be conducted and video should be taken. The degree of cleanness, any existing defects and the locations of laterals (if any) should be noted during the CCTV inspection.
4. Depending on the lining method chosen, the existing flow may have to be partially or fully bypassed.

## 無開挖式內襯管道修復方法的準備工作

雖然不同的內襯管道修復方法應用的技術不同，但它們的安裝前的準備工作卻大同小異：

1. 在未安裝前工地必須先經實地考察以檢查原管道的情況，決定所選擇的修復方法是否適合，選取合適的沙井或壕坑開挖地點作臨時交通管制措施的安排。
2. 在安裝進行前，原管道須以高壓噴洗法或其他可行的方法清洗所有的油脂污垢，鐵鏽舊漆及其他的沉積物和障礙物。
3. 在清洗原管道後，應對管道進行閉路電視檢測和錄影以檢查並記錄清潔的程度，以及缺陷和分支的地點(如有的話)。
4. 視乎所採用的內襯修復法，原管道內的流體可能需要部份或完全改道。



## Quality controls and installation notes for lining

Since the installation processes for various linings are different, the following introduce the general points to note during an installation:

1. Since installation work is usually carried out in manholes or excavated pits, the safety regulations for working in a confined space should be strictly followed.
2. The lining should be installed by well-trained, experienced and qualified personnel as the installation skills of the workers, such as butt fusion techniques in sliplining, can greatly affect the end quality of the new pipe.
3. The lining should be stored at a temperature as recommended by the manufacturer.
4. The internal temperatures and pressures of the lining should be monitored and recorded by remote sensors during the installation process to realize the installation progress.
5. The installation progress, such as winching speed of sliplining, inversion speed of CIPP, winding speed of spiral wound lining, etc. should be monitored and controlled.
6. There should be a relaxation period for lining after the lining has been installed into the host pipe.

### 內襯修復法的品質監控與修復過程的要點

由於不同的內襯修復法有不同的安裝程序，以下主要簡介一些安裝時普遍需注意的地方：

1. 由於安裝往往於沙井或開挖的坑洞進行，密閉空間的工作安全守則要嚴格遵守。
2. 內襯應由有足夠訓練和經驗和合資格的人員安裝，因為相關人員的安裝技術，如內套喉管法中的對接熔合技巧，對修復完的新管道的品質和耐用性有關鍵的影響。
3. 安裝內襯時其內部的溫度和壓力應該用遙距感應器進行監察及記錄以了解安裝的進程
4. 安裝的進度，如內套喉管法的絞車拉入速度，原位內搪喉管法的反搪安裝速度，旋轉施工法的卷繞速度等，應該緊密監察和控制。
5. 在完成內襯安裝後，剛形成的新管道應該有一段舒張期。



## Post-lining procedures and tests

The post-lining procedures and tests for different linings are the same or similar:

1. For lining that has been heated up during installation, it should undergo a cool-down process.
2. The ends of the newly formed pipe should be cut and trimmed.
3. Cleaning by pipe jetting or other methods should be conducted to remove any remains left in the pipe.
4. The laterals should be reconnected before service is reverted.
5. CCTV inspection should be conducted to check the acceptability of the rehabilitation works and the recorded video should be submitted.
6. Hydraulic performance test and pipe wall thickness test are conducted.
7. The report including CCTV inspection video, test results, etc. should be submitted to the Client.

## 內襯安裝後的工序和測試

不同內襯修復法的內襯安裝後的工序和測試是一樣或相似的：

1. 如果內襯在安裝的過程中被加熱，就要在安裝後有一段冷卻期。
2. 新管道兩頭末端多餘的內襯要修剪整齊。
3. 新管道應以高壓噴洗法或其他方法進行清洗。
4. 所有分支的管道應重新與原管道連接以投入服務。
5. 以閉路電視檢查視察修復的工作是否完善及可接受。閉路電視的錄影記錄應呈送給客戶。
6. 新管道在正式投入服務前需經一番性能測試和管壁厚道測試。
7. 包含閉路電視錄影的記錄以及各種測試的結果的報告應呈交客戶。

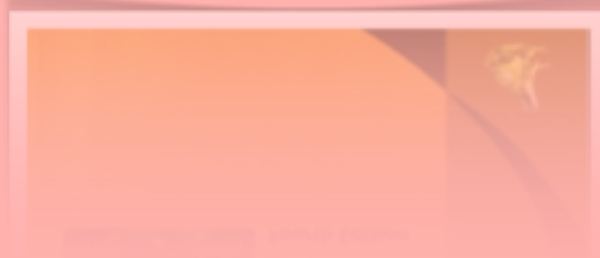
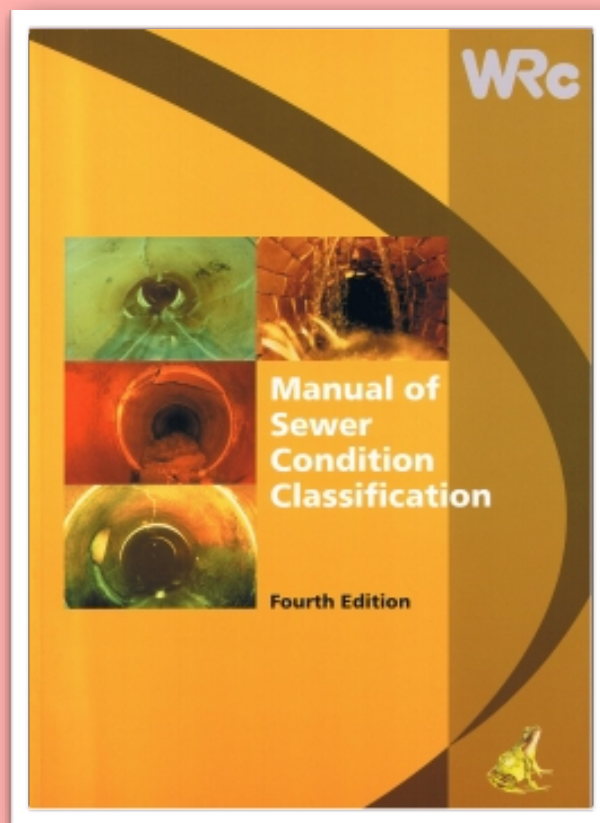


## **Further Information**

For further information about trenchless lining, readers may refer to the guidebook of this pamphlet or other references such as the “Sewerage Rehabilitation Manual” published by Water Research Council, UK. There are also different standards and specifics for different lining methods such as ASTM International and CEN. Readers can also go to the website of HKIUS <http://www.hkius.org.hk> to obtain more related information.

## **更多資訊**

更多非開挖管道修復的資訊可從小冊子的相關指引獲得，或參考其他參考資料，如英國水科學研究中心(WRC)出版的<污水系統修復手冊>。此外現時也有不少非開挖管道修復法的相關標準和規範可以參考如ASTM國際標準和歐洲標準委員會的標準。讀者也可以在香港管綫專業學會的網頁 <http://www.hkius.org.hk>獲得更多的資訊。



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