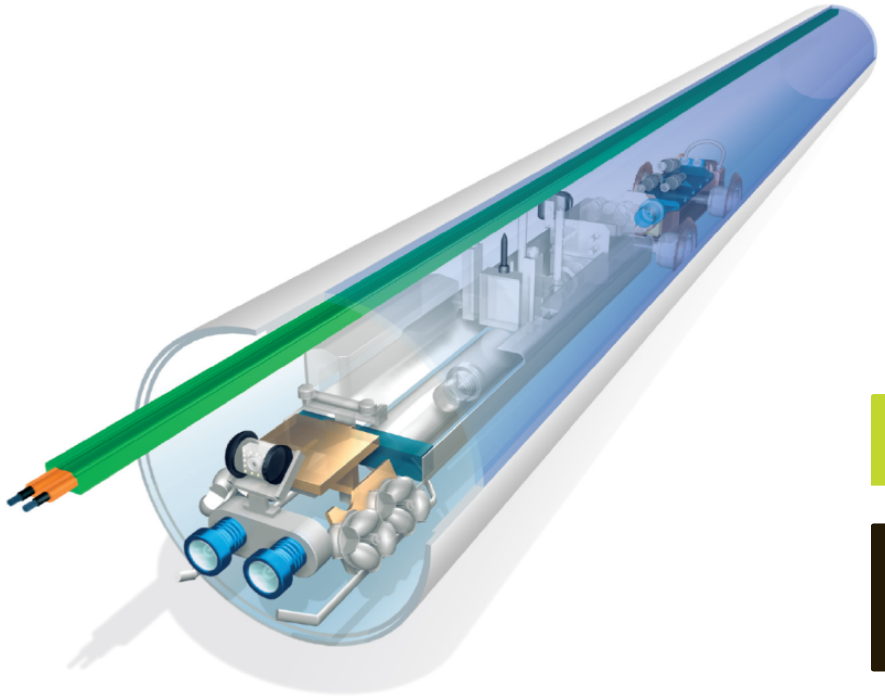
CableRunner INTERNATIONAL

THE FIBER OPTIC INFRASTRUCTURE COMPANY



Project reference
HOFOR A/S,
Copenhagen

HOFOR

THE STORY OF THE CABLERUNNER TECHNOLOGY

- The **CableRunner Technology** was invented by the **Sewer Department of the City of Vienna** in 1996 and was applied first in Vienna's own sewer and storm water systems.
- CableRunner commenced its **international business activities** by establishing subsidiaries in **USA, Spain, Germany, China and Russia**. Since then, the technology was continuously improved and more than **2.000 km of in-sewer fiber optic networks** in different countries worldwide have been **successfully deployed**.

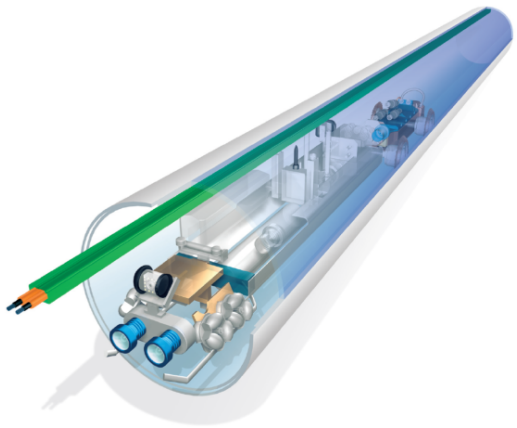
- CableRunner has always been closely connected to Vienna. At first, **Vienna's Sewer Department connected its own facilities** with the CableRunner technology. With the foundation of CableRunner, an entity was created that served local businesses as a **constructor for P2P-networks**. Later, CableRunner was asked to **build Vienna's fiber optic backbone**. Finally, CableRunner is **upgrading to FTTH in Vienna** right now.

- This shows the **wide spectrum of applications** of the CableRunner technology – from **P2P networks to FTTH**. Moreover, thanks to the great flexibility, **networks can easily be expanded afterwards according to the demand.** The following pages show how Vienna's fiber optic network evolved by using the CableRunner technology.

The CableRunner Installation Unit

CableRunner International's worldwide activities

A GREEN TECHNOLOGY FOR FIBER OPTIC NETWORKS



The CableRunner robot as a draft…

…and in reality

- CableRunner has developed **installation techniques** to **utilize existing city underground infrastructures** – such as sewer and storm drainage systems, canals etc. – for fiber optic cable deployments. The CableRunner technology can be applied in **every type of sewer:** Where it is possible, workers enter the sewers to perform installations. For sewers that are too small for workers to enter, CableRunner has developed robot installation techniques.

- CableRunner's underground fiber optic deployment technology **benefits installers in a number of ways**:
  - Shorter construction periods,
  - reduced installation costs,
  - no traffic disruption,
  - no or minimal excavation,
  - no heavy equipment,
  - no inconvenience to businesses or to the public,
  - maximum protection by eliminating "hot cuts" or unintentional access to lit fiber,
  - and the utilization of an environmental friendly technology.

- CableRunner is **dedicated to product innovation** and offers **unique solutions** for deploying fiber optic cables in **man-accessible and non-accessible sewers** in congested metropolitan areas. The company has **partnerships with leading international telecom companies** to develop customized solutions. CableRunner products and services have been used safely and successfully worldwide.

THE CITY OF COPENHAGEN

- Copenhagen, Capital of Denmark, is the **economic, governmental and cultural center** of Denmark. Home to the Copenhagen stock exchange, the city represents one of the financial centers of Northern Europe

- **Population:** 0.6 million, 290,000 households, 30,000 companies, population density: 6,800/km², area: 90 km²

- **Existing sewer infrastructure:** approximately 4.000 km of sewer pipes

- Copenhagen has started a number of **initiatives in the area of clean technologies** that support the city's goal to be carbon-neutral by 2025

- Thanks to its eco-friendly initiatives, Copenhagen has received the title "**European Green Capital 2014**" and ranked as **top green city for the second time in the 2014 Global green Economy Index**

Source: www.visitkopenhagen.com, photographers: Jacob Schjørring & Simon Lau

Source: www.wikipedia.com used under Creative Commons BY-SA 2.0

QUICK FACTS ABOUT HOFOR A/S

- HOFOR A/S, owned by 8 Danish municipalities, is **Denmark's largest utility company**, serving **more than one million customers** in the Greater Copenhagen area

- With **some 1.050 employees**, HOFOR A/S produces an annual **turnover of more than 4 billion Danish kroner (about 540 million Euros)**

- HOFOR A/S has a strong **focus on sustainable supply** and renewable energy and **supports developments in society** by combining the resources of the 8 municipalities that own the company

- HOFOR A/S is **member of the UN global compact**, a program initiated to **support sustainable and socially responsible policies**

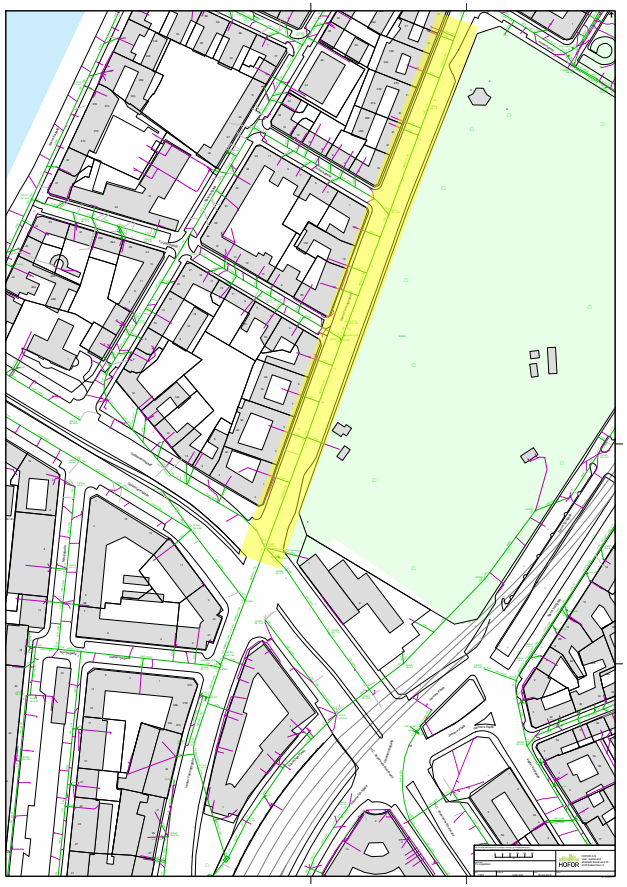
- In 2015, HOFOR A/S has decided to test the **installation of fibers in sewers. CableRunner International was assigned to construct 1.1 km of in-sewer fiber optic installations**

HOFOR

The 8 municipalities owning HOFOR A/S

OVERVIEW OF THE PROJECT

- CableRunner International GmbH was tasked to **construct a fiber optic connection** with a length of approximately **1.1 km through the sewers of Copenhagen**
- The project is **located in the historic center of Copenhagen**, along "Vester Farimagsgade"
- The implementation was based on **project design from HOFOR A/S** with the support of supplemental maps, pictures as well as recent inspection videos
- The **installation process was carried out by experienced workers from CableRunner International** which were sent to Copenhagen for this project
- Thanks to the thoroughly prepared construction site, the whole **construction could be finished within only four days**, between 21st and 24th of September, 2015



Exemplary sector of the project area (yellow: pilot)

INSTALLATION PROCESS

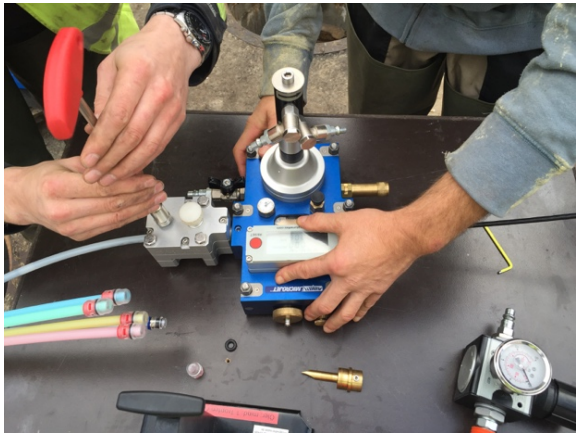
Start of construction at 21st of September, 2015. All local prerequisites have been organized carefully by HOFOR A/S

The connection to the splice shaft Is realized via the nearest manhole

First instalment of fiber optic cables in a Danish sewer, example picture: brick sewer, DN 1334

A modular cable system tube is brought into the sewer via the manhole

After mounting the cables in the sewer, the installation is secured with a protective cover



Last step on 24th of September, 2015: Fiber blowing

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Offices

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CableRunner CHINA

CableRunner also contributes to setting industry standards through ASTM International, one of the largest voluntary standards development organizations in the world.

ASTM Standards for In-Sewer Fiber Development
ASTM Committee F36 on Technology and Underground Utilities developed Standards on Installation and Operation of Fiber Optic Cables in Existing Sewers.
F 2233: Standard Guide for Safety, Access Rights, Construction, Liability, and Risk Management for Optical Fiber Networks in Existing Sewers.
F 2303: Standard Practise for Selection of Gravity Sewers Suitable for Installation of Optical Fiber Cable and Conduits.
F 2462: Standard Practise for Operation and Maintenance of Sewers with Optical Fiber Systems