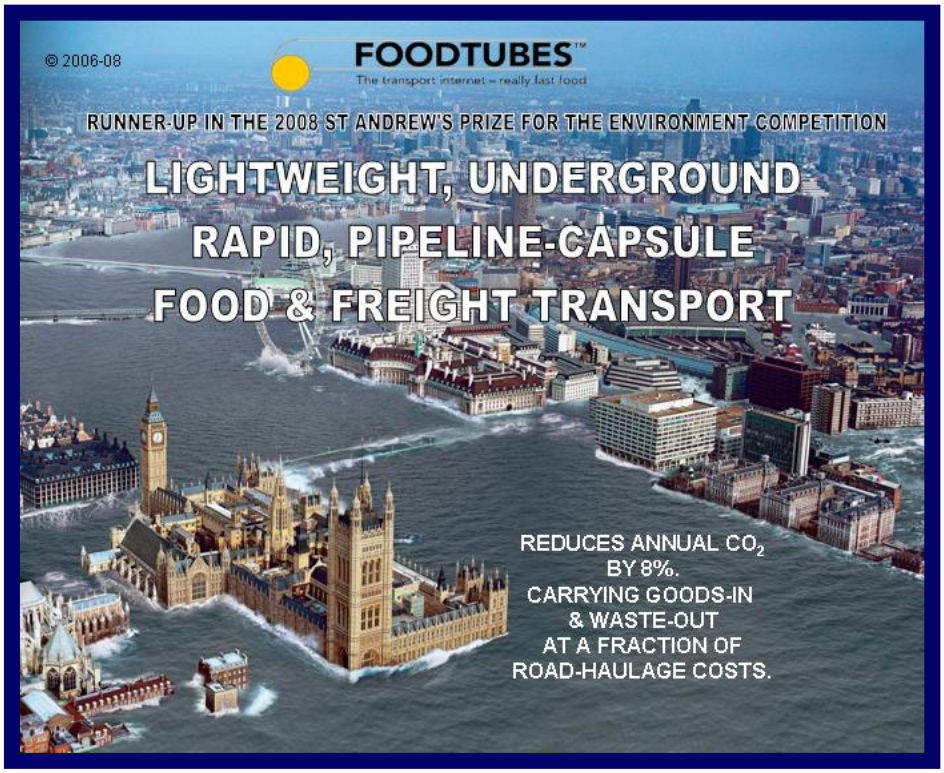
FOODTUBES™

The transport internet – really fast food

FOODTUBES WILL CREATE A GLOBAL ENGINEERING INDUSTRY
AND SAVE MILLIONS OF TONNES OF CARBON DIOXIDE



"The obvious and fundamental difficulty is getting the pipeline infrastructure in place. The costs and disruption - and timescale - involved in constructing what would eventually need to be hundreds of miles of pipeline, would be considerable, especially in urban areas, and this in my view represents a major barrier for the FOODTUBES system." *SEEDA - South East England Development Agency. 2 Nov 09.*

MODERN ENGINEERS DISAGREE.

"WE NO LONGER DIG UP ALL THE STREETS. THERE IS 3,000 YEARS OF EXPERIENCE OF UNDERGROUND PIPELINES."

THERE IS PLENTY OF ROOM UNDER OUR CITIES AND TOWNS FOR FOODTUBES PIPELINES – AND THERE ARE THOUSANDS OF SKILLED ENGINEERS WHO WILL INSTALL THE FOODTUBES PIPELINES WITH LITTLE DISRUPTION TO COMMUNITIES.

LOOK AND LEARN - MODERN, TRENCHLESS, NO-DIG METHODS ENABLE PIPES TO BE LAID ECONOMICALLY, QUICKLY AND QUIETLY.

GOODS-IN & WASTE-OUT.

FOODTUBES™

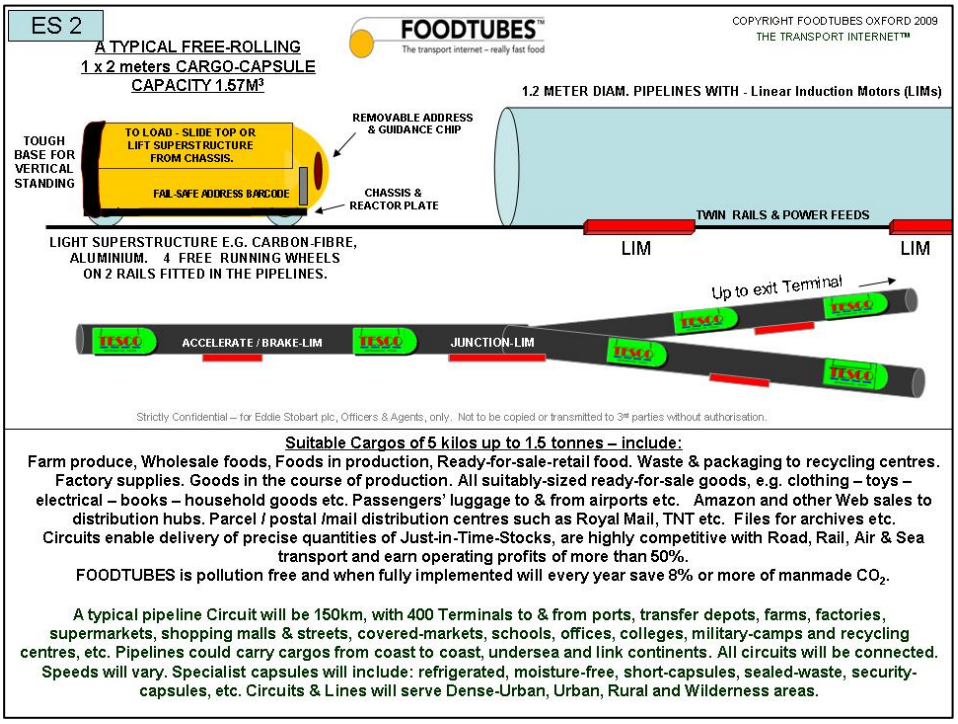
The Transport Internet™ - Really Fast Food.

Runner-up in the St Andrews Prize for the Environment, 2008.

FOODTUBES will transport food and household goods, from primary production up to retailing, in lightweight, 1 meter x 2 meter, cargo-capsules, via underground pipelines. Currently, the fuel or energy for HGVs, vans and rail transport is used 92% to move the vehicles and only 8% to move the goods. Why pipelines? Because, for example, we daily transport water, which is 180 times the weight of our food, invisibly and with little pollution - through pipelines. Similarly, very large quantities of oil and gas are safely and cheaply transported internationally. Most household goods could also be sent by pipeline. 25% of freight vehicles carry food; taking these off the roads and rails will, in the UK, save the food industry 4.2 billion litres of diesel (11.2 M tonnes CO2) and the traffic decongestion impact saves 13.6 billion litres (35.7 M tonnes CO2). At, say, £1 per diesel litre, the cash saving is clear and in total it will save 8% of the annual man-made CO2. The cost per cargo load is about 1/5th of current freight prices, even with a +50% profit margin for FOODTUBES. From a UK base, FOODTUBES intends to create a major civil-engineering, specialised export industry, creating thousands of high-tech and low-tech, sustainable jobs. FOODTUBES saves the Earth - and makes a profit.

The Foodtubes **Commercial Model** (EXCEL) is available at

http://www.noelhodson.com/index_files/ftubesfinancials_28Sep07_v15.xls



Suitable Cargos of 5 kilos up to 1.5 tonnes – include:

Farm produce, Wholesale foods, Foods in production, Ready-for-sale-retail food. Waste & packaging to recycling centres. Factory supplies. Goods in the course of production. All suitably-sized ready-for-sale goods, e.g. clothing – toys – electrical – books – household goods etc. Passengers' luggage to & from airports etc. Amazon and other Web sales to distribution hubs. Parcel / postal /mail distribution centres such as Royal Mail, TNT etc. Files for archives etc. Circuits enable delivery of precise quantities of Just-in-Time-Stocks, are highly competitive with Road, Rail, Air & Sea transport and earn operating profits of more than 50%.

FOODTUBES is pollution free and when fully implemented will every year save 8% or more of manmade CO_2.

A typical pipeline Circuit will be 150km, with 400 Terminals to & from ports, transfer depots, farms, factories, supermarkets, shopping malls & streets, covered-markets, schools, offices, colleges, military-camps and recycling centres, etc. Pipelines could carry cargos from coast to coast, undersea and link continents. All circuits will be connected. Speeds will vary. Specialist capsules will include: refrigerated, moisture-free, short-capsules, sealed-waste, security-capsules, etc. Circuits & Lines will serve Dense-Urban, Urban, Rural and Wilderness areas.

Figure 1 – FOODTUBES Cargos

THE UNSEEN WORLD UNDER OUR FEET.

A BRIEFING FOR DESK-WORKERS & NON-ENGINEERS, TO SHOW THAT THANKS TO RECENTLY DEVELOPED MODERN TECHNIQUES **FOODTUBES PIPELINE CIRCUITS** CAN BE RAPIDLY INSTALLED IN CITIES, TOWNS AND RURAL AREAS WITHOUT TEARING UP ALL THE STREETS – TO SAVE MILLIONS OF TONNES OF CARBON DIOXIDE.

FOODTUBES™ – THE TRANSPORT INTERNET™ is developing a major CO_2 saving project, to transport food and goods in a range of ultra-lightweight, engineless, 1 x 2 metre capsules, through polyethylene pipes, laid above and below ground - propelled by Linear Induction Motors (LIMs) set in the pipes, and controlled by computer tracking and guidance software, connecting suppliers to supermarkets and large offices, colleges and other centres; travelling at speeds from 5kph to 100kph. http://www.noelhodson.com/index_files/foodtubes-sponsors.htm

Figure 2 - FOODTUBES pollution free transport

Illustrations

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FOODTUBES - proposed pipelines in perspective

1,980 KM - FOODTUBES-Circuits for the Greater London shops serving 5 million households

80 KM – FOODTUBES-Circuit for the Croydon shops serving 130,000 households.

5 KM – FOODTUBES-Circuit for demonstrations and testing; mostly above ground.

150,000 KM - Gazprom was the largest Russian company and biggest natural gas extractor with market Capitalisation of US$ 300 billion. The company restructured its business processes to implement vertical integration. Gazprom, headquartered at Moscow, employed 396,571 people and was the world's largest gas company with a 25% of the global gas reserves. In May, 2006, Gazprom had market capitalisation of US$ 300 billion and earned revenues of US$ 50,824.4 millions in 2005. Gazprom's assets included gas reserves, world's longest pipeline network with 150,000 km - banking, insurance, media, construction and agriculture. The core activities of the company were gas exploration, production, transportation, processing and marketing. It supplied gas to every region of Russia and exported to more than 25 European countries. The company relied heavily on Western exports and partnerships.

50,000 KM - By the end of 2006, China has built long distance gas and oil pipelines of more than 50,000 km in total, among which gas pipe measures about 30,000 km, crude oil pipeline

about 15,000 km, and oil product pipeline about 5,600 km. These pipelines have formed a trans-regional oil and gas pipeline network on a primary scale.

23,000 MILES - Interest is growing regarding the potential size of a future U.S.-dedicated carbon dioxide (CO_2) pipeline infrastructure if carbon dioxide capture and storage (CCS) technologies are commercially deployed on a large scale within the United States. This paper assesses the potential scale of the CO_2 pipeline system needed under two hypothetical climate policies (WRE450 and WRE550 stabilization scenarios); a comparison is then made to the extant U.S. pipeline infrastructures used to deliver CO_2 for enhanced oil recovery and to move natural gas and liquid hydrocarbons from areas of production and importation to markets. The analysis reveals that between 11,000 and 23,000 additional miles of dedicated CO_2 pipeline might be needed in the United States before 2050 across these two cases. While either case represents a significant increase over the 3900 miles that comprise the existing national CO_2 pipeline infrastructure, it is important to realize that the demand for additional CO_2 pipeline capacity will unfold relatively slowly and in a geographically dispersed manner as new dedicated CCS-enabled power plants and industrial facilities are brought online.

305,000 MILES - The U.S. natural gas pipeline network is a highly integrated transmission and distribution grid that can transport natural gas to and from nearly any location in the lower 48 States. The natural gas pipeline grid comprises:

- More than 210 natural gas pipeline systems.
- 305,000 miles of interstate and intrastate transmission pipelines (see mileage table).
- More than 1,400 compressor stations that maintain pressure on the natural gas pipeline network and assure continuous forward movement of supplies (see map).
- More than 11,000 delivery points, 5,000 receipt points, and 1,400 interconnection points that provide for the transfer of natural gas throughout the United States.
- 24 hubs or market centers that provide additional interconnections (see map).
- 400 underground natural gas storage facilities (see map).
- 49 locations where natural gas can be imported/exported via pipelines (see map).
- 8 LNG (liquefied natural gas) import facilities and 100 LNG peaking facilities

Figure 3 - USA pipelines

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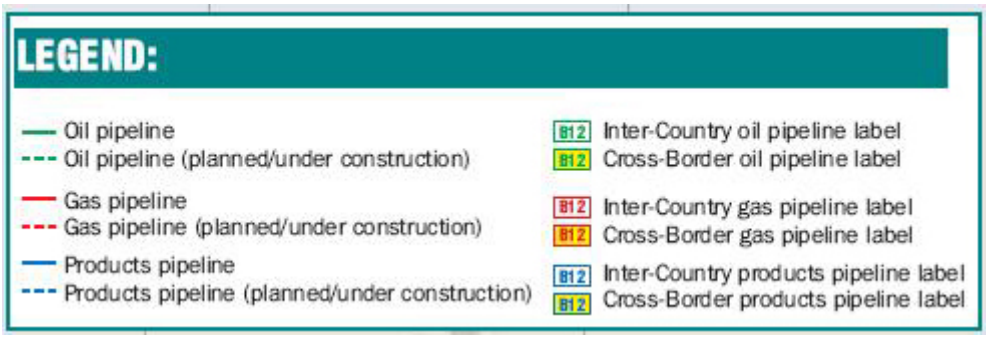

Figure 4 - USA Pipelines legend

1,287 KM - The Trans-Alaska Pipeline System (TAPS), includes the Trans-Alaska Pipeline, 11 pump stations, several hundred miles of feeder pipelines, and the Valdez Marine Terminal. It is commonly called the Alaska Pipeline, Trans-Alaska Pipeline, Alyeska Pipeline or The Pipeline (in Alaska), but those terms technically apply only to the 800.302 miles (1,287.961 km) of 48-inch (122 cm) pipe that convey oil from Prudhoe Bay, to Valdez, Alaska, privately owned by the Alyeska Pipeline Service Company.

3,456 KM - The 3,456-kilometre (2,148-mile) Keystone Pipeline will transport crude oil from Hardisty, Alberta to U.S. Midwest markets at Wood River and Patoka, Illinois and to Cushing, Oklahoma. The Canadian portion of the project involves the conversion of approximately 864 kilometres (537 miles) of existing Canadian Mainline pipeline facilities from natural gas to crude oil transmission service and construction of approximately 373 kilometres (232 miles) of pipeline, pump stations and terminal facilities at Hardisty, Alberta. The U.S. portion of the project includes construction of approximately 2,219 kilometres (1,379 miles) of pipeline and pump stations.

55,000 MILES - USA - The network of crude oil pipelines in the U.S. is extensive. There are approximately 55,000 miles of crude oil trunk lines (usually 8 - 24 inches in diameter) in the U.S. that connect regional markets. The map below shows some of the major crude oil trunk lines in the U.S.

1,295 KM - EU - The Pan-European Oil Pipeline (PEOP) is a newer manifestation of a project formerly known as CPOT – Constanta-Pancevo-Omisalj-Trieste – and is designed to take Caspian and Russian oil from the Black Sea port of Constanta in Romania, through Serbia, Croatia and Slovenia to Trieste in Italy. From there it would join with the TAL (Trans-Alpine Line) and the Italian pipeline network, with any excess oil to be shipped from Genoa in Italy.

The PEOP is expected to be 1295 km long, and to cost USD 2.4 billion. It would carry around 60 million tonnes of oil per year. The PEOP is expected to mainly supply Italy and central Europe, with around nine per cent of the oil to be supplied to Serbia and Croatia. The feasibility study for the project has estimated that the pipeline will commence operations in 2011.

1,200 KM - It is projected that Europe will require more than 100 billion cubic metres of natural gas per annum by 2010. Part of this requirement will be supplied through the 1,200km-long North European Gas Pipeline (since October 2006 the pipeline and operating company have been renamed as Nord Stream), which will transport natural gas from Yuzhno-Russkoye oil and

gas deposits in the Leningrad region of Russia to Germany. Scheduled for completion in 2010, the Nord Stream Gas Pipeline (NSGP) has an estimated cost of over €4bn by a German-Russian JV of JSC Gazprom, BASF AG and E.ON AG.

2,400 KM - Bordeaux has a network of water pipes totalling 2,400 km, 13 water treatment stations and an average of 160,000 m^3 of drinking water distributed every day. Total quality management of the water mains is a task requiring the latest of technologies.

2,100 KM - Sewers have been draining wastewater in Paris since the beginning of the 13th Century, when the city's streets were paved and drains were built on orders from Philippe Auguste, the king of France from 1180 to 1223. Covered sewers were introduced during the reign of Napoléon Bonaparte, and today's network of more than 2,100 km (1,312 miles) of sewer tunnels was begun in 1850. The sandstone tunnels carry drainwater from the streets, sanitary sewers (now in separate pipes), mains for drinking water and the water used for streetcleaning, telecommunications cables, pneumatic tubes between post offices, and (or so one assumes) the occasional rat.

8,730 KM - CONTRACT FACTS Operator: Veolia Eau-Générale des Eaux in France. Contract start: 1923 KEY FIGURES No. of people served: 4 million Production capacity of the three plants: 1.6 million cubic meters/day Network length: 8,730 km

2,400 KM - Paris has over 2,400 km of underground passageways dedicated to the evacuation of Paris' liquid wastes. Most of these date from the late 19th century, a result of the combined plans of the Préfet Baron Haussmann and the civil engineer Eugène Belgrand to improve the then very unsanitary conditions in the Capital. Maintained by a round-the-clock service since their construction, only a small percentage of Paris' sewer *réseau* has needed complete renovation. The entire Paris network of sewers and collectors has been managed since the late 20th century by a computerised network system, known under the acronym "G.A.AS.PAR", that controls all of Paris' water distribution, even the flow of the river Seine through the capital

2009 Pipeline Conference - Shanghai

Advances and Experiences with Pipelines and Trenchless Technology Projects, for Water, Sewer, Gas and Oil Applications.

Trenchless Technology & Pipelines International Conference(ICPTT), scheduled to be held in **Shanghai, China, on October 19 - 21, 2009**. We invite your firm to be an exhibitor in what is expected to be an extraordinary conference. This is an excellent opportunity for you and your company to reach potential clients locally and across the country. Engineers, Contractors, Suppliers, Educators, and Government Managers from China, U.S. and around the world are but a few of the key attendees for this event.

Co-Sponsored By

ASCE Pipeline Division
American Society of Civil Engineers

CTRD China-U.S. Joint Center for Trenchless Research and Development

CSTT China Society for Trenchless Technology

CUIRE CENTER FOR UNDERGROUND INFRASTRUCTURE RESEARCH AND EDUCATION

Supported By

- China Association for Science and Technology
- The Ministry of Land and Resources P.R.C
- Geological Society of China
- China University of Geosciences(Wuhan)
- Pipeline Research Institute of CNPC
- American Society of Civil Engineers
- The University of Texas at Arlington
- Louisiana Tech University
- Research Center of Water & Drainage System of HIT
- Oil & Gas CAE Technology Research Home of UPC
- School of Petroleum Engineering of SWPU

Hosted By

CTRD China-U.S. Joint Center for Trenchless Research and Development

CUIRE CENTER FOR UNDERGROUND INFRASTRUCTURE RESEARCH AND EDUCATION

The FOODTUBES team's purpose is to design and establish the global standards for all FOODTUBES Circuits, which will eventually interlink and must therefore have the same specifications. A single FOODTUBES Circuit is typically 50km to 150km, with about 200 Terminals (exits & entrances) per 50kms. Circuits will be built in Dense-Urban, Urban, Rural and Wilderness areas. The designs will be consolidated in 2 sets of blueprints: (BLUEPRINT 1) Engineering models, drawings and specifications (BLUEPRINT 2) Commercial models for financing Circuits and operating them as businesses.

The first FOODTUBES Circuit will be a 5km demonstration system, mostly above ground, incorporating hills, valleys, junctions, terminals, junction-control-buildings, service shafts and other features.

The most commercially useful, largest CO_2 saving, and most profitable Circuits will be installed in Dense-Urban areas, where people live. The purpose of this file is to familiarise non-engineers with modern pipe-laying techniques and so deal with fears that installing large bore pipes is too difficult and disruptive for city and urban areas.

This is a "YES WE CAN" Case-Book. It introduces readers to the immense underground structures and installations beneath most of our cities and towns. It lists very old and very new pipeline systems; showing that however crowded we may imagine the underworld to be, the Earth is still a big place – and good pipeline engineers have little difficulty in finding routes for more pipes. It shows that hundreds of systems, dating back hundreds of years, were installed by hand – with little or no disruption above ground. It shows that pipes can be installed rapidly – some contracts are completed in weeks – or even days – without any disruption to the public. It shows that most of us have very little idea of what goes on underground and what more can be done, to install cheap, efficient, serviceable and long-life infrastructure.

Engineers have worked unseen, underground, for thousands of years.

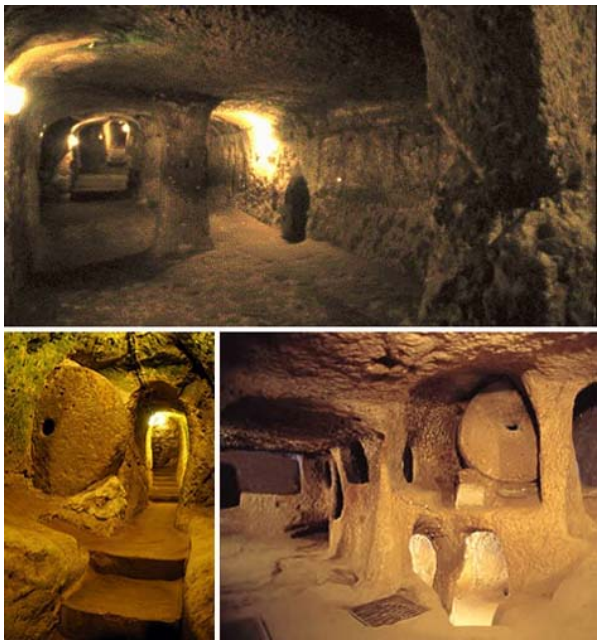

Figure 5 - Capadoccia City Turkey

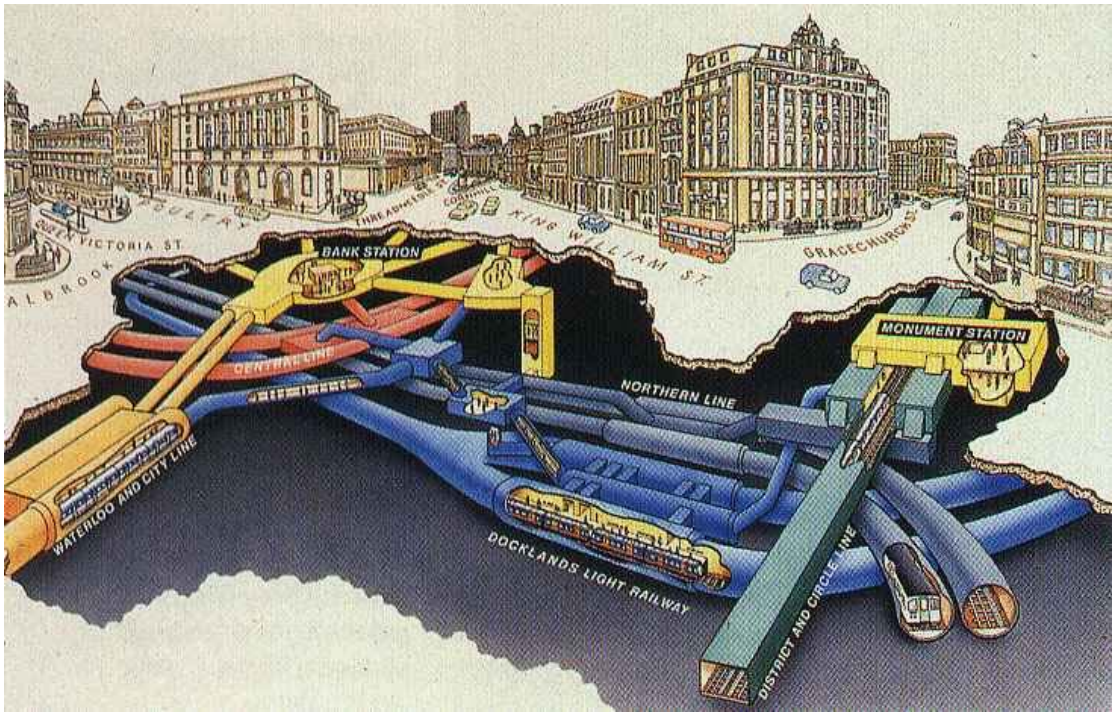

Figure 6 - Underground London

NO DIG METHODS

Every picture is worth a thousand words – we recommend that you watch some of the short, Allen Watson Ltd internet videos about trenchless, no-dig technology – the modern way to install large bore pipes in cities.
http://www.allenwatson.com

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UNDERGROUND SPECIALIST COMPANIES

Allen Watson Limited

From Allen Watson Ltd, Trenchless tunnelling engineers - to FOODTUBES.
20 NOV 09
Noel

In answer to your question your proposals probably are feasible. There would be a limited amount of disruption at each rig set up position and exit position.

Regards
Tom Wells
Allen Watson Limited
Tel: 01403 790772 Fax: 01403 790779
Company Reg. No: 2138400 Web site www.allenwatson.com

Allen Watson Limited - Trenchless Methods

Auger Boring (AB)

Auger boring is a non-steered method used to install pipes from 150mmØ to 1,200mmØ. During installation the pipe fully supports the ground while the cut spoil is conveyed by continuous flight auger back to the work pit. Ideal for boring in a wide range of materials and where minimal settlement is critical.

Directional Drilling (HDD)

Horizontal directional drilling is used for installing pipes from 60mmØ to 1,200mmØ. Typically this is a surfaced launched technique Steered both horizontally and vertically and can also be curved to bypass obstacles. As the bore progresses the ground is replaced and supported with drilling mud. Ideal for bores 25m up to 2000m in a wide range of materials.

Guided Auger Boring (GAB)

Guided auger boring is a steered method used to install gravity pipes from 150mmØ to 900mmØ. Prior to pipe installation, a pilot bore is driven to line/level and all aspects of this method fully support the ground during installation. Ideal for boring in a wide range of materials and where minimal settlement is critical.

Pipe Ramming (PR)

Pipe ramming is a non-steered method using pneumatic equipment for driving steel pipes from 150mmØ to 1,600mmØ without the need of a thrust-wall either from a pit or above ground level. The spoil inside the pipe remains insitu until completion of the bore. Ideal for boring in lose materials, under rivers and through embankments or where minimal settlement is critical.

Impact Moling (IPM)

Impact moling is a non-steered method using pneumatic equipment for the installation of PE pipe or PVC duct 20mmØ to 100mmØ without the need of a thrust-wall. The system relies upon displacing the spoil in its path to form a mini tunnel. Ideal for boring in soft clays/silts (compressible materials) under embankments, roads, railways for lengths up to 20 metres.

Rock Boring (RB)

Rock boring comes in several variants, wet or dry, methods range from pneumatic to rotary, bores can be steered, non-steered, straight or curved subject to specific requirement, for pressure pipelines or gravity drains from 150mmØ up to 900mmØ. Bore distances vary subject to particular method from as little as 10 metres up to 1,000 metres.

Click here to receive Allen Watson Limited case studies

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20 NOV 09
To: Allen Watson Ltd - from FOODTUBES

Dear Sirs,

http://www.allenwatson.com/contact/index.html

Re-Your trenchless pipeline techniques video at:

http://www.allenwatson.com/methods/directional.html?gclid=CLeFuuXLmZ4CFcts4wodmApunA

We are developing a CO2 saving project, to transport food and goods in lightweight 1 x 2 metre capsules, through polyethylene pipes - propelled by Linear Induction Motors set in the pipes, and controlled by computer software, to supermarkets and large offices, colleges etc. at speeds from 5kph to 100kph.

We use Croydon, London, 130,000 homes, as an example of a Dense-Urban area; which would require a FOODTUBES Circuit (clockwise circulation) of about 80 km, with about 400 Terminals (exits) and with goods-transfer depot/s on the M25 motorway.

Several UK Agencies, including the Department for Transport, have this week written (paraphrased - for example):

"The obvious and fundamental difficulty is getting the pipeline infrastructure in place. The costs and disruption - and timescale - involved in constructing what would eventually need to be hundreds of miles of pipeline, would be considerable, especially in urban areas, and this in my view represents a major barrier for the FOODTUBES system."

Your Video representation of trenchless pipe-laying seems to provide a possible solution which I can give to the Agencies. Please send me your CD. With the latest trenchless technologies and - assuming HM Gov puts tackling climate-change, global-warming on a war footing - is it feasible to install an 80km loop in a dense-urban area without tearing up all the streets?

Our first Circuit is likely to be an over-ground 5km demonstration Circuit in a rural /urban area attached to a food Warehouse/ Distribution Centre.

Yours truly

Noel Hodson

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http://www.ukstt.org.uk/trenchless_technology/pipe_cables/

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Underground Moling Services

http://www.undergroundmoling.com/content/hdd.php

If you want an experienced contractor to install long lengths of pipe, cable or ducting with minimal disruption at ground level then UMS' horizontal directional drilling (HDD) capabilities are exactly what you need.

HDD initially uses a guided drill head to generate a pilot bore hole. It is this ability to manoeuvre the drill head to match a pre-planned drill path which makes HDD so safe and effective. When the pilot bore has been completed, the guided drill head is replaced by a reamer which is pulled back through the pilot bore hole increasing the hole diameter to accommodate the new pipe, cable or duct. The wide range of different drill heads means that HDD can be used in virtually all ground conditions including soil, clay and rock.

Traditional 'cut and lay' techniques work well in open countryside, but in heavily trafficked urban and industrial areas they can lead to considerable congestion and environmental disturbance, as well as the evident economic impact. With HDD you can lay pipes, cables and ducting under buildings, rivers, roads, railways, runways, parks, golf courses, SSIs...the list is endless.

HDD leads to far less material being excavated, and a major reduction in reinstatement costs. As they fully understand its potential, engineers are developing ever more applications for HDD.

For example, UMS is working with environmental engineers installing horizontal wells to remove pollutants from contaminated ground, and leachates and gas from landfill sites.

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Herrenknecht AG

Trenchless direct laying of product piping and pipelines.

Figure 7 – Herrenknecht - No-Dig pipe-laying under a river

http://www.herrenknecht.com/process-technology/research-development/direct-pipe.html

Requirement: rapid and uncomplicated pipeline laying

In the past, numerous methods and devices have been developed for the trenchless laying of pipelines in the ground to enable sensitive areas on the surface to be crossed. Geological considerations and time and cost budgets are the crucial factors determining the choice of the most suitable laying technique. Underground pipeline laying poses many problems - for example, how to work in a space-restricted area or circumvent possible obstacles both rapidly and cost-effectively.

Solution: with Direct Pipe your destination is only one step away
The Direct Pipe method combines the advantages of the established laying methods Microtunnelling and Horizontal Directional Drilling (HDD), thereby opening up potential new applications.
One single, continuous working operation is sufficient for the trenchless laying of a pre-fabricated pipeline and the simultaneous creation of the necessary bore hole.
As with Pipe Jacking, earth excavation is by means of a Herrenknecht Microtunnelling machine. The machine is navigable and uses a flushing circuit to transport the excavated material to the surface. Modern and proven controlled

pipe-jacking techniques ensure accurate measurement of the current position along the intended route. The force required to feed the pipeline forward is exerted by a new type of feed device known as the Pipe Thruster. The pressure necessary for the boring process is transferred along the pipeline to the cutterhead.

The German Federal Ministry of Education and Research additionally promoted the development of the method and the implementation of the pilot project in Worms (Suport Code 02WA0814).

Commercial advantages of Direct Pipe:

Single-step method leads to rapid installation of product piping and pipelines
No time needed for coupling pipes (Microtunnelling) or drill rods (HDD)
Pipeline can be installed pre-welded and already tested
Costly shaft construction unnecessary - instead, only simplified surface entry and exit pits are required

Technical advantages of Direct Pipe:

Ideal method for sea outfalls with access from one side only
Pipe Thruster enables both tunnelling machine and pipeline to be withdrawn, for example for cutting tool retooling operations in inaccessible, low-diameter areas
Cone crusher removes obstacles as they occur
Application options:
Pipeline laying from construction pit to construction pit
Pipeline laying from construction pit to shaft
Pipeline laying from construction pit to destination point, for example water course beds
The Direct Pipe method was nominated for the Hermes Award 2008.
Interested?
We will be delighted to help you if you have other questions on the subject of single-step pipeline laying.
directpipe(at)herrenknecht.de

GOTTHARD BASE TUNNEL: MECHANIZED TUNNELLING COMPLETED ON THE NORTH SIDE.

Six months ahead of schedule the Herrenknecht Gripper TBM reaches breakthrough in the western tube from Erstfeld to Amsteg.

WORLD OF TUNNELLING

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SW Directional Drilling Ltd

http://www.swdirectionaldrilling.co.uk/

Welcome to **SW Directional Drilling Ltd**, established in 2005 and with over 25 years experience in specialist plant and engineering, Steve Wilson has introduced a wide range of Trenchless Techniques to the company portfolio. With an ever increasing demand on contractors to care for the environment, and to work to very tight budgets, Trenchless **(No Dig)** Technology is becoming the first option when planning new utility installations.

SW Directional Drilling are one of the Nations leading companies in Trenchless Techniques and pipeline installation. Serving throughout UK we will undertake all work large or small from a 25mm alkathene water pipe installed up a block-paved drive, up to a steel pipe of 1000mm rammed 100mtrs across a motorway, we have the technology and capability to carry out the project safely and on time with the minimum amount of disruption to the client and the local environment.

Trenchless Services Include:

Directional Drilling

Horizontal Directional Drilling or HDD as its better known is a very popular method for installing MDPE pipes and ducts for propagation of Gas, Water, Electric, Telecom and Drainage of pipe sizes 25mm - 1200mm dia. Typically surface launched this system can be very accurately steered horizontally and vertically avoiding know obstacles in all kinds of ground conditions. This system is a very quick method of installing pipes and ducts across motorways, rivers and railways with little or no disruption to the public or environment. A typical motorway crossing of 80mtrs installing 4 x 125mm Electric Ducts would be completed in a day with the commuting road users unaware it ever happened.

Impact Moling

Impact moling is a non steered(directly aimed), pneumatic, torpedo shaped soil displacement hammer which range in sizes from 45mm - 180mm. These are regularly used by utility companies to install domestic water, gas and electric connections over relatively short distances. This method requires very little set-up time after small launch and receive pits are excavated. SW's range in this method are 15mm - 200mm dia with distances up to 40 mtrs.

Pipe Ramming

Pipe ramming is also a non steered but very accurate method where a pneumatic hammer drives a steel pipe used for product or liner from a launch pit to its target pit. This method is exceptionally quick in good ground conditions. This system can be used to install pipe sizes ranging from 150mm - 2000mm dia over distances of up to 100mtrs where minimal heave is required, as the loose materials remain inside the pipe until the completion of the bore, and down time is governed only by the lengths of pipe to be welded to the already driven pipes. (index.html)

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Horizontal Directional Drilling

http://www.idswater.com/water/us/ISTT/Trenchless_NoDig_Events/10_0/g_supplier_1.html

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UNDERGROUND GUILDS & ASSOCIATIONS

Pipeline Industries Guild (UK)

http://www.pipeguild.com/Page.aspx?pid=193

The Pipeline Industries Guild was formed in 1957. Since then, it has evolved to be the only association world-wide to cater directly for the needs of the pipeline industry, regardless of engineering discipline, application, or qualification.
The Guild's membership comprises those with interests in pipelines world-wide, transporting hydrocarbon products, chemicals, water, wastewater, and many other substances, both on- and offshore. All are governed by the industry's twin need to combine quality with safety, while at the same time meeting all the latest environmental and legislative requirements.
The Guild is the respected authority within all branches of the pipeline industry, and there are few pipeline engineering problems its members cannot solve. Part of its increasing and unique strength is the Guild's ability to attract members from all sides of the pipeline industry, whether they be concerned with deep-sea pipelines or with the latest developments on land in no-dig and minimal-disturbance pipe and duct-laying technology.
The Pipeline Industries Guild, has a clear vision of its future, in which it will broaden its pipeline-engineering interests and continue to cater for the ever-widening horizons of its expanding membership.
From the point of view of pipeline engineering in all its aspects, the Pipeline Industries Guild is the place where the disciplines meet, and where leading-edge technology is discussed, analysed and disseminated.
As well as its technical function, the Guild members participate in a broad range of social activities, some of the most well-known of which are the yearly Branch Dinners and the Annual Dinner in London.

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15 UK Underground Pipeline Contractors

http://construction.kellysearch.co.uk/suppliers/underground+pipeline+installation/GB/67886

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Organisation for Trenchless Technologists

The International Society for **Trenchless Technology** (ISTT) exists to promote the benefits of **trenchless technology**, and to facilitate the development and implementation of **trenchless technology**, worldwide. There are now more than twenty such affiliated societies in five continents, and each is entitled to nominate a

director on the ISTT board. For efficient day-to-day running, an executive sub--committee is empowered to act for the full Board.

ORGANISATION FOR TRENCHLESS TECHNOLOGISTS

Since its formation in the United Kingdom in September 1986, as an international ``umbrella`` organisation for trenchless technologists worldwide, it has since encouraged the formation of national and regional organisations to serve these technologists wherever they live, by working locally using national languages and business practices. The ISTT board manages the affairs of the society and determines its broad strategic and policy direction. It meets once a year at the international **no dig event**. The chairman of the board is elected for a two or three year term. The ISTT also has charitable (not for profit) status in England and a separate Board of 12 Guarantors are the trustees of this charitable status, legally liable for ensuring the Society meets its charitable objectives and complies with UK law. The Secretariat, or administrative arm of the Society is managed by a part time Executive Secretary (the principal executive officer of the Society), who is supported by a Membership Secretary and part time Technical Secretary. International working groups are established from time to time by the Board for particular investigations, studies, activities and joint activities with other related specialist organisations. The Chairman of each Working Group is responsible for the activities of the Group, and reports to the Board at the International no dig events. The ISTT was established with the following aims and objectives:

Aims

- to advance the science, practice and application of trenchless technology for the public benefit worldwide
- in ``science``, this covers training, education, publications and research
- in ``practice`` this covers all the techniques, procedures and materials, including related activities such as condition monitoring, contracting , insurance and finance
- in ``application`` this covers all manner of underground work on utility networks and related civil engineering activities

National Societies

- Australasian Society for Trenchless Technology (ASTT)
- Austrian Society for Trenchless technology (AATT)
- Brazil Society for Trenchless Technology (ABRATT)
- China Hong Kong Society for Trenchless Technology (CHKSTT)
- China Society for Trenchless Technology (CHSTT)
- China Taipei Society for Trenchless Technology (CTSST)
- Czech Society for Trenchless Technology (CzSTT)
- Finland Society for Trenchless Technology (FiSTT)
- French Society for Trenchless Technology (FSTT)
- German Society for Trenchless Technology (GSTT)
- Hungarian Society for Trenchless Technology (HSTT)

- Iberian Society for Trenchless Technology (IbSTT)
- Indian Society for Trenchless Technology (ISTT)
- Italian Association for Trenchless Technology (IATT)
- Japan Society for Trenchless Technology (JSTT)
- Netherlands Society for Trenchless Technology (NSTT)
- North American Society for Trenchless Technology (NASTT)
- Polish Foundation for Trenchless Technology (PFTT)
- Russian Society For trenchless Technology (RSTT)
- Scandinavian Society for Trenchless Technology (SSTT)
- Slovak Society for Trenchless Technology (SVSTT)
- Southern Africa Society for Trenchless Technology (SASTT)
- Swiss Society for Trenchless Technology (CHSTT)
- Ukraine Society for Trenchless Technology (USTT)
- United Kingdom Society for Trenchless Technology (UKSTT)

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CONCRETE PIPELINE SYSTEMS ASSOCIATION

cpsa concrete pipeline systems association

Introduction

The UK has one of the largest sewerage networks in Europe, with an asset value of £108.8 billion [1]. It is also known to be one of the oldest sewerage systems in the world, with more than 40% of its networks constructed prior to 1945 [2]. The current state of the country's sewer network has been a major concern in the last three decades, OFWAT estimates that the cost of replacing this entire infrastructure requires £200 billion [3]. With such high stakes, the service/design life of sewer pipelines is a major requirement. OFWAT conducted a consultation in 2006 to investigate asset durability requirements as part of sustainability efforts in the sector, service life was identified by most participants as a main aspect that should affect assets' selection criteria [4].

Service life is already one of the main competitive advantages of concrete pipeline systems, as its performance is already supported by a long track record dating back for over a hundred years(1):
• A 30 inch diameter concrete sewer pipe laid in 1903 in Norwich was excavated and tested. The pipe was found to be compliant with current strength requirements.
• More recent estimations also offer long service life. The BRE Special Digest – 1 (SD-1) offers an estimate of a maximum exceeding 100 years if necessary [5].
• The Highway Agency specifications (including the HA Design Manual for Roads and Bridges) offer a 100 years service life in normal conditions subject to extension if the pipe is not Damaged [6].
• A similar span is also being recognised in other countries, all US states specifications approve a 100 year life for concrete pipes. The same applies to the US Army Corps of Engineers' Engineering and Design Manual for Conduits, Culverts and Pipes. The new concrete pipe standard for New Zealand and Australia *AS/NZS4058: 2007* states that the manufacture, design, and installation of reinforced concrete pipe should be completed to achieve a long, durable, 100-year service life.

Therefore it is reasonable to expect a correctly designed, installed and maintained pipeline system to achieve a 100 to 120 years if not more. Indeed studies at Manchester and Surrey Universities in the late 1990s offer a 400 to 500 service life for concrete pipes [7].

Factors affecting the service life of concrete pipes

There are factors that can affect the service life of concrete pipes, however these can be successfully managed. They include the following:

- **Product Quality:** All CPSA products are produced in accordance with BS EN 1916, BS EN 1917, BS 5911 parts 1, 3, 4, and 6 and are third party certified.
- **Chemical Resistance:** Concrete made in accordance with BRE SD-1 to typically chemical class DC-4, can withstand thaumasite sulphate attacks from most types of aggressive ground in the UK, including class AC-3 [8].
- **Product Strength:** Concrete pipeline systems are profound structures with inherent strength, and therefore the effects of poor installation are not as critical on service life as in other materials. Under the requirement of product standards, routine strength tests are required.
- **Design:** It is important with any pipeline system design that proper attention is paid to hydraulic design as this will help negate chemical attacks.
- **Poor Installation:** Good supervision is essential as the most common cause for sewers to collapse is poor pipe laying techniques, Martin Jones [9] specifically identifies sewers laid in the 1920s-60s. The most common faults include failing to remove temporary laying supports, poor connections, problems with bedding, consolidation, third party damage, faults with pressure testing, and other engineering and workmanship faults.
- **Maintenance:** As with any structure, routine maintenance is essential to maintain the system's longevity.

(1)The earliest reference made about concrete pipes production was in Portland cement its Manufacture and uses by Henry Reid, published by
Spoon in 1877. The book offered a description of concrete pipe production with two images showing production operations.

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Trenchless Techniques

http://www.idswater.com/water/us/ISTT/Trenchless_Techniques/10_0/g_supplier_3.html

TRENCHLESS PIPE INSTALLATION

The method of forming a bore, usually from a **drive pit**, using a rotating cutting head is called the **Auger boring** method. Soil is removed back to the drive pit by helically wound **auger flights** rotating in a steel casing. The equipment may have limited steering capability. Guided Auger boring is the term applied to Auger boring systems which are similar to **microtunneling**, but with the guidance mechanism actuator sited in the drive shaft (e.g. a hydraulic wrench which turns a steel casing with an asymmetric face at the cutting head). The term may also be applied to those *Auger boring* systems with rudimentary articulation of the casing near the cutting head activated by the rods from the drive pit. The advantages of this tunneling system are that it causes little or no disruption to soil surface and no disruption to traffic. Its limitations include a very rudimentary steering system, thorough site investigations required and large boulders or very soft ground can cause problems.

HORIZONTAL DIRECTIONAL DRILLING METHOD (HDD)

The HDD method contains impact support and is called the **Grundodrill technique**. It enables trenchless installations up to 500 m length. The spectrum of application includes all pipe construction measures within the bounds of gas, **district heating** and **drinking water supply**, the installation of **pressure lines** for **sewers** as well as **cable protection pipes** for television or telephone cables, **traffic routing systems**, emergency call boxes or low, medium, high voltage and optical fibre cables. The HDD method is extremely protective towards the environment and causes no ecological damage at all. There are several reasons for the application of the directional technique in central town areas. They mainly concern the construction costs, construction periods, permission procedures, **soil displacement, surface restoration** and the traffic, compared to **open trenching** methods. The normal course taken by the drilling operation includes: planning, preliminary survey, selecting the drilling units and drilling tools, **pilot bore** and detection, **backreaming**(s) or **upsizing bore**(s) and pulling in the pipe. To overcome mechanical soil resistance high thrust and tension forces are required. The application of **Bentonite** might relieve the pilot bore and the pipe traction and provide the ability to steer in difficult soil qualities up to soil grade 5 or even 6. The HDD method is advantageous because surfaces worth conserving are neither broken up nor damaged, restoration and repair are not required, which leads to high economical advantages, low social costs because detours are avoided, short equipping as well as drilling and construction times, economic for river crossings, supported by the dynamic impact of the striking mechanism, the propulsion and ability to steer are improved in soil qualities of up to grade 5 and 6, it is an acknowledged procedure and pulling force measurement and position determination are possible.

PIPE JACKING TECHNIQUE

Pipe jacking, generally referred to in the smaller diameters as microtunneling, is a technique for installing underground pipelines, ducts and culverts. Powerful hydraulic jacks are used to push specially designed pipes through the ground behind a shield and at the same time, excavation takes place within the shield. The method provides a flexible, structural, watertight, finished pipeline as the tunnel is excavated. Practical engineering considerations and economics may impose restrictions. A number of **excavation systems** are available including manual, mechanical and remote control. Pipes in the range of 150mm to 3000mm can be installed. Excavation methods are either manual or machine excavation. To install a pipeline thrust and reception pits are constructed, usually at **manhole positions**. The dimension and construction of a thrust pit may vary according to the specific requirements. Mechanised excavation may require larger pits than hand excavated drives, although pipe jacking can be carried out from small shafts to meet special site circumstances.

A thrust wall is constructed to provide a reaction against the jack. High-pressure jacks provide the substantial forces required for jacking concrete pipes.

SOIL DISPLACEMENT METHOD

The soil displacement method is a method for **underground pipe installation**. A **displacement hammer**, driven by pneumatics, creates a cavity underground, ready for pulling in short or long pipes made of plastic and metal, preferably without socket ends, up to DN 200, but also any type of cable in drill lengths up to 40 m (depending on the soil quality). This allows trenchless **traffic route crossings**, private service line installations, the preparation of anchoring, bypassing obstacles and supporting further measures. This is a better method to be used in rocky soils because the complete impact capacity can first be concentrated on the multi-cutter cone.

DRY BORING METHOD

This is a combination of the soil displacement method with steered displacement hammer. Its advantages include: surfaces worth conserving are neither broken up nor damaged, economic advantages such as low social costs because detours, half-sided barriers and set up of signal facilities are avoided, it is suitable for longer private connections and traffic route crossings, no residential problems when installing private connections, short set up and propulsion time required, small pits used for short and long pipes without socket ends to 200 mm displaceable pipe diameter.

MICROTUNNELING

Microtunneling is a process that uses a remotely controlled **Microtunnel Boring Machine** (MTBM) combined with the pipe jacking technique to directly install product pipelines underground in a single pass. This process avoids the need to have long stretches of open trench for pipe laying, which causes extreme disruption to the community. Typical microtunnel equipment spread consists of an MTBM matched to the expected subsurface conditions and the pipe diameter to be installed, a hydraulic jacking system to pipejack the pipeline, a closed loop slurry system to remove the excavated tunnel spoil, a slurry cleaning system to remove the spoil from the slurry water, a lubrication system to lubricate the exterior of the pipeline during installation, a guidance system to provide installation accuracy, an electrical supply and distribution system to power all of the above equipment.

PERCO - More on Micro-tunnelling

Mictrotunelling is a process that uses a remotely controlled Microtunnel Boring Machine combined with the pipe jacking technique to directly install product pipelines underground in a single pass. This process avoids the need to have long stretches of open trench for pipe laying, which causes extreme disruption to the community. Product pipes of a variety of materials can be used, but typically consist of steel, concrete and GRP.

- Minimal reinstatement
- Inherent strength of lining
- Smooth internal finish giving good flow characteristics
- Minimal surface disruption
- Less risk of settlement

- Reduced requirement for utilities diversions in urban areas
- No requirement for secondary lining
- Considerably less joints than a segmental tunnel
- Provision of invert channels in larger pipes to contain the dry weather flow of a sewer in a combined system
- Significant reduction in social costs when compared to open cut trenching in urban areas
- Reduced environmental disturbance

Perco works closely with its Microtunnelling partner, Iseki of Japan. For more information about microtunnelling, please contact Nick Sheehan.

Microtunnelling

http://www.perco.co.uk/services/microtunnelling.asp

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EXAMPLE PROJECTS - COSTS & TIME SPAN

Epic Energy signed the contract with AGL earlier this month, which will see a new 180-kilometre Queensland to South Australia/NSW Link (QSN), built at a cost of around $140 million, to pump gas from South East Queensland

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SYDNEY, March 25 - Leighton International has been awarded a US$720 million contract for the construction of offshore pipelines in India for Oil and Natural Gas Corporation (ONGC).

The project, PRP - 2 (Pipeline Replacement Project - 2), involves engineering, procurement and installation of over 200 kilometres of fixed and flexible pipelines of various diameters in the Mumbai High field some 80 kilometres off the coast of Mumbai.

Offshore works on the project will commence in November this year and will take place during the period of suitable weather from November to May each year for the next three years. Stage one will be completed in May 2009, stage two in 2010, and stage three in 2011.

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OIL PIPE CONTRACT: 2007, 400km of 48 inch pipe, $21M. For Abu Dhabi by the Russian contractors CEPPC – 3years.

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Mon, October 05, 2009

Victorian company Tyco Water has been awarded an $A150 million contract to construct the 84 kilometre, 72 inch diameter pipeline for the Victorian Desalination Project.

Tyco Water will build the pipe at its Somerton factory, with BlueScope Steel providing 80 per cent of the steel needed for the pipes.

Tyco Water is Australia's largest pipe manufacturer, and will produce around 6,200 straight pipes for the pipeline which will transfer water from the plant site near Wonthaggi to Melbourne's existing water network near Cardinia Reservoir.

Sat, November 07, 2009

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More videos from Trenchless Australasia 2009

To watch the latest videos, including interviews with leading trenchless experts Australian Society for Trenchless Technology (ASTT) Councilllor Steve Apeldoorn and Director of the Water Reclamation Department PUB Singapore Tan Thai Pin, plus Interflow's Managing Director Geoff Weaver, click here.

The 8th National ASTT Conference and Exhibition is the biggest on record. Over 60 exhibitors, international and local speakers and fantastic social events made this event one of the most enjoyable to date.

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Griffin Pipe Products Co., Downers Grove, IL, was recently awarded two contracts to provide Citizens Utilities Company of Illinois with more than 30,000 ft of ductile iron pipe in suburban Chicago. Through these projects, Griffin Pipe joins Citizens' largest metropolitan effort to bring Lake Michigan water to suburban communities.

Installation began in June and is expected to continue through early 2001.

The first Citizens contract requires 20,000 ft of 36-in. diameter ductile iron transmission pipe. A second contract calls for over 12,000 ft of 20-,16-, and 12-in. diameter ductile iron water main interconnects, transmissions, and connections in residential neighborhoods.

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Article: Lametti & Sons completes wastewater pipe ...
Underground Construction; October 1, 2004 ; 580 words... Lametti & Sons, a licensee of Inliner Technologies, has completed the renewal of more than 7,000 feet of residential **wastewater pipe** under an approximately $1.47 million contract with the city of St. Paul, MN, Department of Public Works.

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Chicago- Kenny Construction is working under three term contracts valued at $26 million each for the city of Chicago's Department of Water Management (DWM) to renew aging wastewater pipe in the city's 100-year-old system. Kenny is using Inliner Technologies' method of cured-in-place pipe to rehabilitate up to 360,000

feet of combined sewer pipe over a five-year period, with each contract having a two-year option to renew.

The city is home to more than 4,400 miles of sewer, which has deteriorated throughout the years and is prone to collapse. DWM divided the rehabilitation area into three districts.

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LONDON, UK

The London Underground

http://www.tfl.gov.uk/corporate/modesoftransport/londonunderground/1608.aspx

Facts from Transport for London (TfL)

- Number of miles/km travelled by each Tube train each year: 76,800 miles/123,600km
- Number of passengers carried on the Tube each year: 1,073 million
- Number of individual passengers carried on the Tube each year: 28 million
- Average train speed: 33km per hour/20.5mph
- Length of network: 402km/249 miles
- Proportion of the network in tunnels: 45 per cent
- Longest continuous tunnel: East Finchley to Morden (via Bank) - 27.8km/17.25 miles
- Total number of escalators: 412
- Station with most escalators: Waterloo - 23 plus two passenger conveyors
- Longest escalator: Angel - 60m/197ft, with a vertical rise of 27.5m/90ft
- Shortest escalator: Stratford, with a vertical rise of 4.1m
- Total number of lifts: 122
- Deepest lift shaft: Hampstead - 55.2m/181ft
- Shortest lift shaft: Westminster - 2.5m/8ft
- Cars in London Underground's (LU's) fleet: 4070
- Total number of stations served: 270
- Total number of stations owned and managed: 260
- Total number of LU staff: 13,400
- Stations with the most platforms: Baker Street - 10. Moorgate has 11 platforms but only nine belong to LU

- Busiest stations: During the three-hour morning peak, London's busiest Tube station is Waterloo, with 51,100 people entering. The busiest station in terms of passengers each year is Victoria with 76 million
- London Underground has been known as the Tube since 1890, when the first deep-level electric railway line was opened

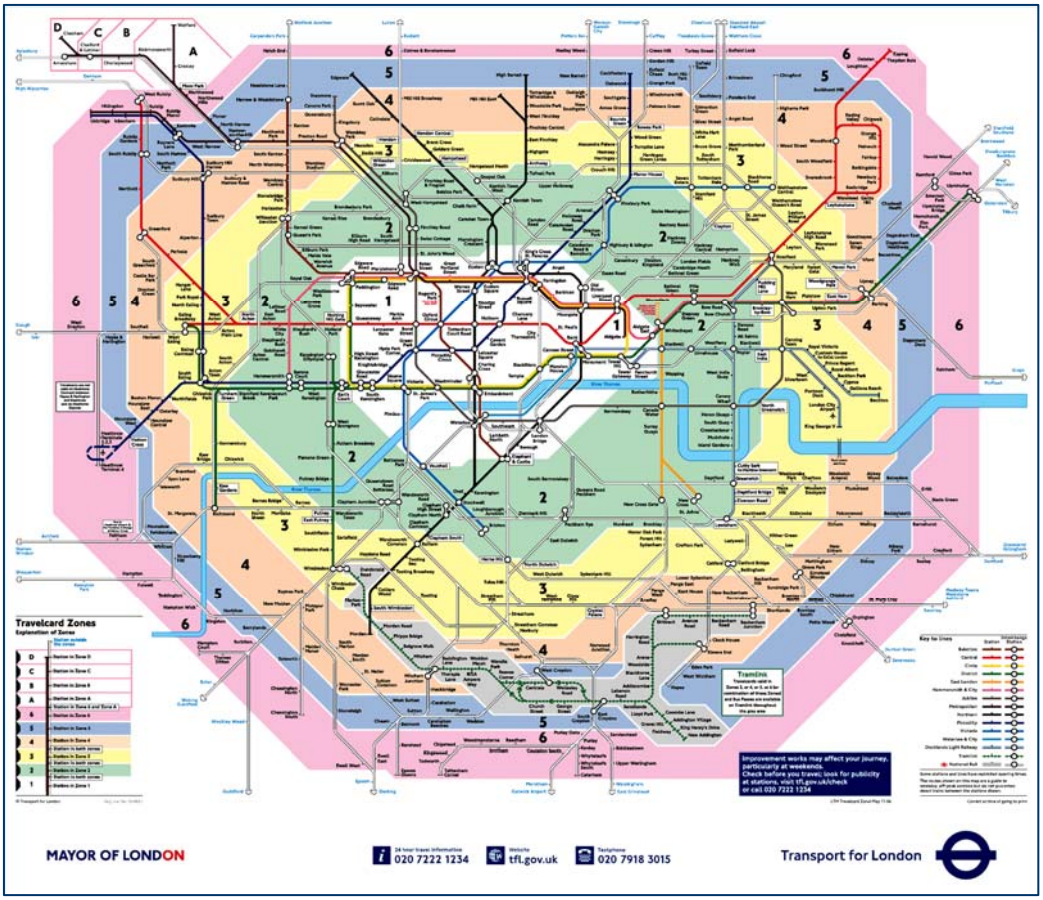

Figure 8 - London Underground trains - map

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The Sewers are the arteries of London

www.timesonline.co.uk/tol/news/uk/article1560485.ece

Tunnel vision

— London has 40,000 miles (64,500km) of sewers. The 1930s map, left, shows their complexity. Laid end to end they would stretch twice around the world.

— 52 million cubic metres of waste water pollutes the rivers Thames and Lee each year — enough to fill the Albert Hall 525 times.

— 100 tonnes of cooking fat are dumped each year, costing £7 million to clear.

Source: Times Database

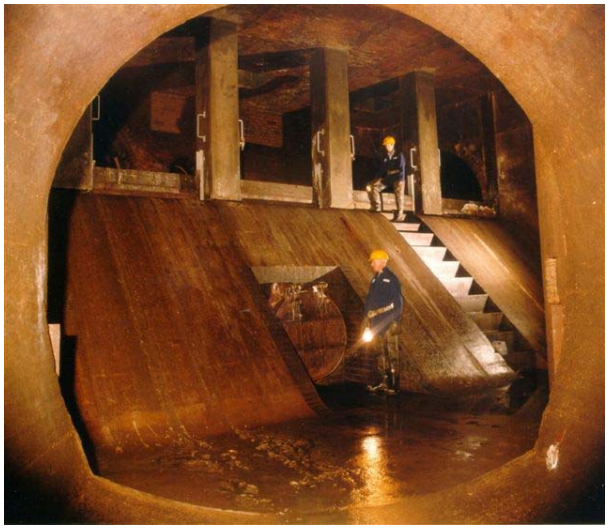

Figure 9 - Waterways under London

London's 21,000km sewerage system - Wikipedia

...Joseph Bazalgette, a civil engineer and Chief Engineer of the Metropolitan Board of Works, was given responsibility for the work. He designed an extensive underground sewerage system that diverted waste to the Thames Estuary, downstream of the main centre of population. Six main interceptory sewers, totalling almost 100 miles (160 km) in length, were constructed, some incorporating stretches of London's 'lost' rivers. Three of these sewers were north of the river, the southernmost, low-level one being incorporated in the Thames Embankment. The Embankment also allowed new roads to reduce traffic congestion, new public gardens, and the Circle Line of the London Underground. The intercepting sewers, constructed between 1859 and 1865, were fed by 450 miles (720 km) of main sewers that, in turn, conveyed the contents of some 13,000 miles (21,000 km) of smaller local sewers. Construction of the interceptor system required 318 million bricks, 2.7 million cubic metres of excavated earth and 670,000 cubic metres of concrete. [1]
Gravity allows the sewage to flow eastwards, but in places such as Chelsea, Deptford and Abbey Mills, pumping stations were built to raise the water and provide sufficient flow. Sewers north of the Thames feed into the Northern Outfall Sewer, which feeds into a major treatment works at Beckton. South of the river, the Southern Outfall Sewer extends to a similar facility at Crossness.
During the 20th century, major improvements were made to the sewerage system and to the sewage treatment provision to substantially reduce pollution of the Thames Estuary and the North Sea.

Victorian pipes now comprise less than 1% of the total sewerage network in London.
The original system was designed to cope with as much as 6.5 mm (1/4") of rainfall within the catchment area, and supported a smaller population than today's. London's growth has therefore put pressure on the capacity of the sewerage system. During storms, for example, high levels of rainfall (in excess of 6 mm) in a short period of time can overwhelm the system. Sewers and treatment works are unable to cope with the large volumes of rainwater entering the system. Rainwater mixes with sewage in combined sewers and excess mixed water is discharged into the Thames. If this does not happen quickly enough, localised flooding occurs (surcharge). Such sanitary sewer overflow can mean streets becoming flooded with a mixture of water and sewage, causing a health risk.
In redeveloping the Isle of Dogs and Royal Docks areas of east London during the late 1980s and early 1990s, the London Docklands Development Corporation invested in major new drainage infrastructure to manage future sewage and surface water run-off from proposed developments. Consulting engineer Sir William Halcrow & Partners designed a system of large diameter tunnels served by new pumping stations. In the Royal Docks, approximately 16 miles (25 km) of foul and surface water drains were built, plus pumping stations at Tidal Basin (designed by Richard Rogers Partnership) and North Woolwich (architect: Nicholas Grimshaw). [2] The Isle of Dogs drainage network is served by a stormwater pumping station situated in Stewart Street, designed by John Outram Associates.
Increasing the carrying capacity of London's sewerage system has been debated for some years. Proposals for the 'Thames Tideway' include a wide diameter storage-and-transfer tunnel (internal diameters of 7.2 m and 9 m have been suggested), 22 miles (35 km) long, underneath the riverbed of the Thames between Hammersmith in the west and Beckton/Crossness in the east, [3] but as the cost of such a megaproject is likely to be substantial (estimated at £1.7 billion in 2004), investment decisions have been slow to be forthcoming. In March 2007 the Mayor of London announced that the project will proceed with completion expected by 2020. [4]
Because design and construction of such a tunnel will take an estimated 15 years, a shorter-term (and slightly lower cost) interim solution has also been developed. This £1.6 billion scheme (2006 prices) involves two shorter tunnels (one taking storm water from Hammersmith to Battersea for treatment or storage, the other carrying water from Abbey Mills south to the river at Beckton) and improvements to associated treatment facilities. [5

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London's Clean Water

Tuesday, 26th May 2009, 13::29

Those in engineering jobs in London will be embarking on a three-year project to install new water pipes in the City of London. Thames Water has initiated a £7.5 million scheme involving the replacement of outdated Victorian water mains in the EC3 area of the capital, with some pipes being 150 years old. Flexible plastic ones will be installed in their place, which will help Thames Water meet its commitment of replacing 1,300 miles of old pipes in London by next year.

Tim Owens, the water company's project manager, explained that 1,000 miles had been replaced since 2003, with leakage having been reduced by 24 per cent during the past four years. "The new

plastic pipes we're putting in are less susceptible to damage from soil corrosion and traffic vibrations than the old ones," he commented.

Currently the UK's largest water company, Thames Water supplies 2,600 million litres of tap water to 8.5 million customers in London and the Thames Valley every day.

Visit the rest of the site for site engineering jobs and other opportunities.

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Thames Water official website - Ring Main extensions

The London *Ring Main* is a 50-mile *water* tunnel that forms a complete *ring* **...** It is being extended to the north and south of the River *Thames* to enable it **...**
www.**thameswater**.co.uk/cps/rde/xchg/corp/hs.../2916.htm

Most of London's water still comes from the River Thames and River Lea, with the remainder being abstracted from underground sources.[19]

Much of the water piping in London is still cast iron piping which dates back to the nineteenth century and is slowly deteriorating. This has led to widespread criticism of Thames Water for the amount of water lost to leaks in its distribution network.[20] As of 2007, Thames Water is still in the process of a rolling program of upgrading the water supply network to use modern plastic piping.[21]

The single largest infrastructure project in recent years has been the creation of the Thames Water Ring Main, a "backbone network" for London's water supply.[22] This connects all the waterworks, and pumping stations,

Ring Main extensions - The London Ring Main is a 50-mile water tunnel that forms a complete ring around the capital. It is being extended to the north and south of the River Thames to enable it to keep up with growing demand by significantly boosting its ability to transfer larger volumes of water across a wider area.

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UK Parliament, 1961 debate about a 10 inch pipe.

TRUNK PIPELINES BILL (By Order) (Hansard, 27 April 1961)

MODERN LARGE BORE PIPELINE PROJECTS

South Wales Gas Pipeline

http://en.wikipedia.org/wiki/South_Wales_Gas_Pipeline

The **South Wales Gas Pipeline** (also known as the **Milford Haven pipeline**) is the UK's largest high-pressure gas pipeline. The 197 mile (316 km) pipeline passing through Wales was built for the National Grid and links Dragon and South Hook liquid natural gas (LNG) terminals at Milford Haven, Pembrokeshire with the national gas network at Tirley, Gloucestershire.

The pipeline was expected to cost around £700 million and was, according to the National Grid, expected to transport around 20% of the gas needed to meet UK consumption in future. Construction of the pipeline was estimated to take approximately three years, aiming to end in October 2007.[1] Environmental controversy surrounded the decision to build it, especially through the Brecon Beacons where the national park authority called it a "huge blow". [2] The pipeline was completed in November 2007.[3]

The pipeline is operated at a higher pressure than other gas pipelines in the UK: 94 barg (1364 psi) instead of 85 barg (1231 psi). This pressure is higher than most standard pipelines worldwide and will increase the chance of pipe leak and corrosion, though other such high-pressure pipelines have been successfully run in Germany, for example.[15] It is buried 1.2 metres underground for most of the route. National Grid states that after the pipe is buried, the large amount of vegetation, subsoil and topsoil removed covering the width of a dual carriageway will be replaced, levelled and cultivated to restore the land to its original condition. They consulted and used a wide range of environmental experts to help restore the environment.[16

Felindre - Tirley section

Starting from a new compressor station at Felindre near Swansea the pipeline runs to a new Pressure Reduction installation at Corse near Tirley, Gloucestershire, where it connects with the existing gas pipeline network. This 122 mile (196 km) section passes through 16 miles of the Brecon Beacons National Park. Pipeline routeing and environmental impact assessment took place from October 2004 to summer 2006 and consent and land acquisition took from winter 2005 to February 2007. The pipeline diameter is 1220 mm (48 inches). Construction began on this section on February 2007. The contactor for the Felindre to Brecon section was Nacap Land & Marine Joint Venture and for Brecon to Tirley section, Murphy Pipelines Ltd. The contentious nature of this section led to consultations with key statutory bodies, such as the Countryside Council for Wales, English Nature, the Brecon Beacons National Park, the Environment Agency, the Welsh Assembly Government and Blaenavon World Heritage Partnership.

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Gas Pipeline - Xinhua

East China Province Seeks Investment for Gas Pipeline Project

News Wire article from: Xinhua News Agency ...capital totalling 20 billion yuan ($2.43 billion U.S.dollars) for a 300 km section of the 4,200 km west-east natural **gas pipeline** under construction. The province has approved the establishment of Jiangsu Provincial Natural Gas Investment Company.

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50 Foot German Bore for Shanghai

2 November, 2009 | By Tracy Edwards

Herrenknecht has supplied the two largest tunnel boring machines in the world, with a diameter of 15.43 meters, for two gigantic traffic tunnels in Shanghai.

The two colossal machines crossed beneath the Yangtze River at a depth of 65m.

With mechanized tunnelling technology Herrenknecht is helping to create new links within several densely built-up Chinese cities. Tunnel construction takes place almost completely underground, without noise and impact on aboveground traffic and people.

At the same time, mechanised tunnelling is faster, more environmentally friendly and safer for tunnel workers than conventional procedures.

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Moffat Creek child labourers made redundant

November 19, 2009
BY KEVIN SWAYZE, RECORD STAFF

CAMBRIDGE — In a sewer project that was originally pitched by some city politicians as a showcase of high-tech, computer-directed micro-tunnelling, it's a case of back to the future. In a 1.5-metre diameter steel pipe under Moffat Creek, a pair of workers have started working eight-hour shifts to dig six metres a day. As the pipe is pushed slowly forward into the sandy soil by hydraulic rams, they use hand shovels to fill little carts with soil. The carts are pulled out of the pipe along a miniature railway track by a third worker hauling on a rope. They plan to be done in February, with 400 metres of tunnelling behind them.
http://news.therecord.com/News/Local/article/631659

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Spectacular underground Lord's redevelopment for all seasons

(Lord's is a famous cricket ground in London, UK)

November 18, 2009

Nursery End below ground The most striking plans are for the Nursery Ground, the practice area. A veritable village is to be created underground, extending from the disused railway tunnels and reached by stairs into the sunken undercroft and integrated street. There is direct access from this into the Compton and Edrich Stands, minimising congestion when Lord's is full. Sited there will be the new academy, with 16 long lanes that will enable fast bowlers to come off their full runs, a circulation ring around them, and ten pitches that will simulate conditions found overseas.

All-year food stands, clinic, gym, spa and squash courts Permanent food and beverage outlets will be located in this undercroft, some of which will be open all year round. There will be access from the museum, which is to be sited on St John's Wood Road, and this will house a theatre and cinema for educational and sporting events. A sports injury clinic, gym, pool, spa and squash courts will be also be built underground.

Apartments, underground parking and subterranean library This two-tier development will also feature parking for 350 cars, including spaces for residents living in the apartments. The library, at present within a building opposite the pavilion, will also be sited beneath the Nursery Ground, as will the Lord's shop.

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Swiss dig world's longest tunnel

By Imogen Foulkes
BBC News, Berne

For centuries, the Alps have served as a natural trade barrier between northern and southern Europe.

Sending Italian wine to the Netherlands, or German washing machines to Greece, means a long, slow journey along narrow alpine valleys, through tunnels and over passes. The amount of freight crossing the Alps in heavy goods vehicles has risen sharply over the last two decades. In 1990 an estimated 40m tonnes went by road, in 2001 that had risen to 90m tonnes, with further big increases expected by 2010.

But concerns for the Alpine environment and fears over safety have led to big pressure to move freight off the roads and onto the railways. Both Switzerland's Gotthard road tunnel and France's Mont Blanc road tunnel have suffered major fires in the last 10 years in which many died.

Faster than flying

As long ago as 1994, the Swiss voted in a nationwide referendum to put all freight crossing their country onto the railways. Naturally, such an ambitious plan was not going to happen overnight, but now the project dubbed the engineering feat of the 21st Century is slowly taking shape.

Deep beneath the Alps, the Swiss are building a high-speed rail link between Zurich and Milan. It will include, at 57 kilometres (35 miles), the world's longest tunnel.

A key feature of the project, which is new to alpine transport, is the fact that the entire railway line will stay at the same altitude of 500 metres (1,650ft) above sea level.

This will allow trains using the line to reach speeds of 240km/h (149mph), reducing the travel time between Zurich and Milan from today's four hours to just two-and-a-half. That would make the journey faster than flying.

To see the work in progress, it is necessary to travel two kilometres underground, to the construction site between the southern Swiss towns of Faido and Biasca.

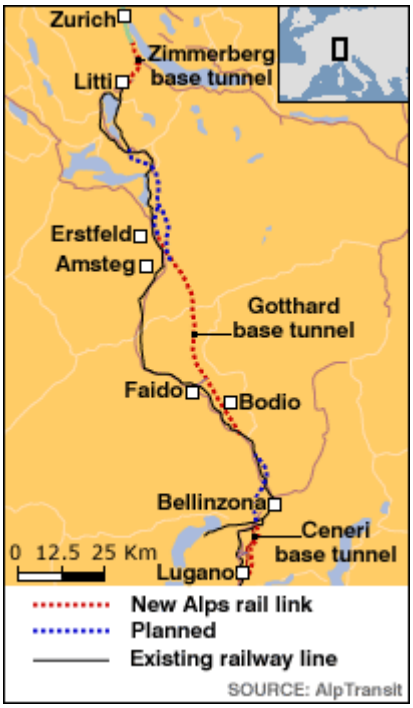

Figure 10 - World's longest tunnel

The scale of the work going on is enormous: 2,000 people are working on the tunnel, 24 hours a day, 365 days a year. Besides the two main railway tubes, the construction workers have to dig access tunnels for people and equipment. Huge fans ensure a fresh supply of air and cool things down. Yet the temperature is above 30C.

"We've got two-and-a-half kilometres of Alps above us," explains engineer Albert Schmid. "That means millions and millions of cubic metres of earth pressing down on us, that increases the pressure and the temperature."

Difficult work

It also means that every time the workers dig out another few metres of the tunnel, mother nature tries to close it up again. Along the tunnel's length, reinforced steel rings have to be inserted, to prevent it collapsing in on itself.

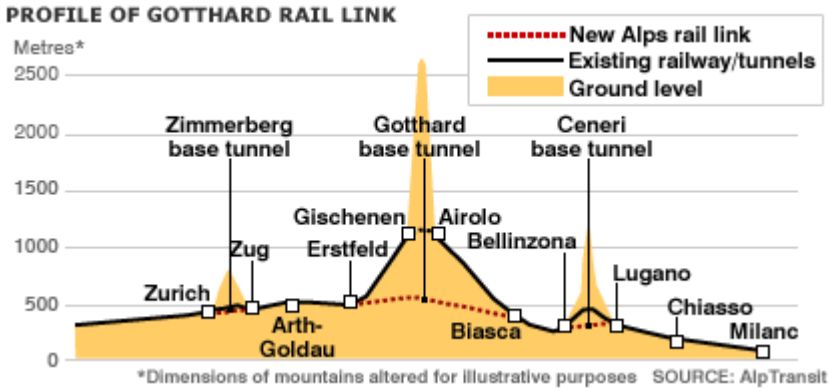

Figure 11 - Under the Alps

Building the tunnel requires a variety of techniques. At one section the workers are blasting away the rock, and the air reeks of ammonia from the explosives.

At another section the world's biggest tunnel-boring machine is in operation; it is ten metres in diameter and covered in dozens of rock-cutting blades, which as the machine turns, hack away at the rock face. "With this machine, in good conditions, we can excavate 40 metres in a day," says Mr Schmid. "That's an absolute record."

But conditions are not always good. The tunnel workers have run into serious geological problems; in some areas the rock is as soft as butter, making digging it out more complicated. "In poor rock conditions, where the rock is very soft, we can only excavate around half a metre a day," says Mr Schmid. "So in these situations, the work is delayed, and the costs rise."

Soaring costs

In fact the price tag for the entire rail link has soared from about $8bn (£4bn) to almost $15bn and final completion is unlikely to be before 2018.

But that has not stopped the alpine communities from supporting the project, and from trying to ensure that the rail link brings some social benefits too. The tiny village of Sedrun, population 1,500, lies along the tunnel's route, and while residents are pleased to be relieved of the heavy lorries, they are concerned that the tunnel may marginalise their community. "The thing about this tunnel is that it makes the Alps disappear," explains local architect Arthur Loretz. "At the moment, when you drive from Zurich to Milan, you get a beautiful panoramic view. But this tunnel turns the Alps into a big black hole."

Alpine gateway

The original plans for the tunnel involved trains rushing beneath the Alps without stopping. But in Sedrun a 1,000-metre elevator and underground railway station have been built just to get the workers to the construction site.

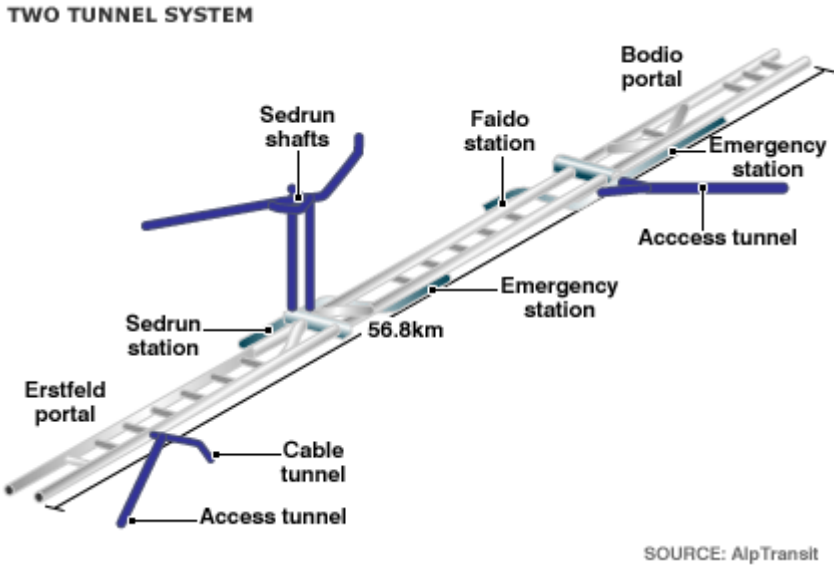

Figure 12 - Two tunnels for one

"All the infrastructure is already there," points out Arthur Loretz. "What we want to do is use it in the future." The plan is to create a station, deep in the mountains, known as "Porta Alpina" (Gateway to the Alps).

Tourists will be able to arrive by train in the Alps in record time, and then be whisked up to fresh mountain air by way of the world's longest elevator.

"I think it will have great benefits," says Mr Loretz. "Not just for tourists, but for us. Look, over that mountain people speak Italian, and over that one there they speak German."

"And here we speak Reto Romansch - a language only spoken by around 50,000 people. Traditionally the mountains have divided us, but with this rail link, and with Porta Alpina, we can bring people together."

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No Business Creek tunnel

GWINNETT COUNTY NEWS 4:41 p.m. Wednesday, October 28, 2009

By Shane Blatt The Atlanta Journal-Constitution

The new three-mile long No Business Creek tunnel in southern Gwinnett County has "holed through," Lynn Smarr, acting director of the Gwinnett Department of Water Resources, announced Wednesday.

This means that the tunnel-boring machine, which started at the No Business Creek pump station site, drilled through to the end shaft at the Jacks Creek Water Reclamation Facility site.

The No Business Creek tunnel will transport wastewater flows from the No Business Creek and Jacks Creek drainage basins in the southern end of the county to either the F.

Wayne Hill Water Resources Center near Buford or the Yellow River Water Reclamation Facility near Lilburn, Smarr said. The tunnel will allow wastewater to be pumped at a steady rate rather than having to meet peak flows at high usage times, she said.

The tunnel-boring work began 13 months ago and was performed primarily in deep, solid rock under Springdale and Everson roads. The $54 million tunnel, which is expected to go into service next summer, ranges from nearly 200 feet to 80 feet deep.

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Taweelah-Fujairah gas pipeline

In July 2008 Stroytransgaz signed a contract for construction of the Taweelah-Fujairah gas pipeline in the United Arab Emirates. This is the first large-scale project in the fuel and energy complex of the United Arab Emirates in which a Russian construction company has taken part.

Dolphin Energy Ltd. owned by the government of the UAE is principal for the project.

The gas pipeline, 240 kilometers in length and 48 inches in diameter, will traverse the entire territory of the United Arab Emirates and link the receiving terminal in Taweelah (Abu Dhabi Emirate) on the Persian Gulf coast with treatment facilities in Fujairah (Fujairah Emirate) on the coast of the Gulf of Oman.

In accordance with provisions of the contract, Stroytransgaz will carry out construction on EPC terms. The project provides for building the linear part of the pipeline, including two scraper launcher-receiver units, nine line valve units, a gas metering station as well as installing a SCADA system, a system for detecting gas leaks and ensuring fire safety, electrochemical erosion protection, self-regulating and control instrumentation, and telecommunications equipment.

The project has to be completed in 2010.

Dolphin Gas Project - From Wikipedia, the free encyclopedia

http://en.wikipedia.org/wiki/Dolphin_Gas_Project

The project involves:

- development of gas wells and installation of two platforms in Qatar's North Field;
- two multiphase sea lines from the wellheads to the processing plant;
- gas processing and compression plant at Ras Laffan in Qatar;
- offshore pipeline from Ras Laffan to Taweelah in the UAE;
- gas receiving facilities at Taweelah.

In addition, the gas supplies from Qatar to Oman are planned through the Al Ain – Fujairah pipeline, which is officially considered as separate project.[2]

The total costs of the project are US$7 billion, of which US$3.5 billion are costs of the offshore pipeline.

Al Ain – Fujairah gas pipeline

The Al-Ain – Fujairah pipeline is a 182 kilometres (113 mi) long 24 inches (610 mm) natural gas pipeline with capacity of 20 bcm of natural gas per annum.[6] The pipeline was constructed in 2003. In 2004-2005, the pipeline was operated by the Emirates General Petroleum Corporation (Emarat), and since 2006 by Dolphin Energy. Until 2008, the pipeline is used for supplying Omani natural gas to the Fujairah power and desalination plant.[2] Starting from November 2008, the pipeline is used for a regular natural gas export from Qatar to Oman.[7]

Taweelah - Fujairah gas pipeline
The Taweelah - Fujairah pipeline is a planned 240 kilometres (149 mi) long 48 inches (1,219 mm) pipeline between Taweelah gas receiving facilities and Fujairah to feed a new Fujairah power and desalination plant.[8] It will be the longest overland natural gas pipeline in the United Arab Emirates.[9] Five companies were invited to bid by 7 May 2008 for design and construction, and on 22 July 2008, the US$418 million contract was awarded to Stroytransgaz.[10] Coated line pipes would be supplied by Salzgitter Mannesmann International.[8] The construction started in March 2009.[11]

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Mackenzie Valley Pipeline

From Wikipedia, the free encyclopedia

Technical description

The capacity of the pipeline is predicted to be 18.5 billion cubic metres per annum (650×10^9 cu ft/a).[4] It will be 1,220 kilometres (760 mi) long and the cost of the project is estimated at C$16.2 billion.[5][6] As of mid-March, 2007, revised cost and schedule information included C$3.5 billion for the gas-gathering system, C$7.8 billion for the pipeline, and C$4.9 billion to other economic growth projects planned for three gas field sites in the Mackenzie River delta.[7] 2010, and also 2014 at the earliest, are current production and start-up milestones published for printed newsletters and on-line webpage articles of the pipeline project.[8]

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Modern Tools for underground projects

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http://www.undergroundconstructionmagazine.com/washington-watch

UNDERGROUND CONSTRUCTION MAGAZINE Conference January 2009

Includes WaterWorks: Jan. 19-20

The WaterWorks conference, sponsored by *Underground Construction* magazine, will focus on the water infrastructure by addressing the construction/rehabilitation of water transmission and distribution systems, examine issues and problems and explore solutions regarding this limited resource. The two-day conference will include a slate of nationally respected speakers who have committed to sharing their expertise and insight into the critically important water infrastructure market. Learn about the construction/rehabilitation of water transmission and distribution systems, examine issues and problems and explore solutions regarding this limited resource. To attend, simply sign-up for the UCT Educational Program—WaterWorks is included with your paid UCT registration. Questions on WaterWorks? E-mail: Rcarpenter@oildom.com.

Sessions Include:

- A Look at Carbon Fiber Reinforced Polymer (CFRP) As a Long Term Repair Solution Based on the Reported Structural Properties of Tested CFRP Samples Submerged in Water for 8 Years
- Teaming Trenchless Piercing Tools & Static Bursting Miami-Dade a Municipal Perspective
- Tampa Bay Water Tackles Growth With Diverse Underground Installations
- Pre-chlorinated Pipe Bursting Project: Largest Ever In North America
- In-Service Assessment Of Metallic Mains
- Design of Distribution Pipeline For Reclaimed Water System
- Managing and Maintaining Concrete Cylinder Pipe (CCP) Water Main

Global Demand For Plastic Pipe To Rise

Worldwide demand for plastic pipe is forecast to increase 4.6 percent annually through 2012 to 8.2 billion meters, or 18.2 million metric tons (Except in London which will shelve all pipeline work - to keep the streets clear).

http://www.pipelineandgasjournal.com

More USA projects - from Underground Construction magazine

Editor's log.

Oct 01, 2009; Carpenter, Robert ... It's no surprise that utilities in new subdivisions typically are placed underground. But what's really encouraging is that a growing number of cities and states are suggesting or, in some cases, actually stipulating that older lines should be moved underground when feasible. ...

New England communities face actions to improve storm sewer pollution.(NEWSline: Latest Industry Developments)

Oct 01, 2009; ... As part of a new integrated effort to combat illegal sewage connections that can lead to significant water pollution in New England's waters, EPA recently flied complaints against one New Hampshire and eight Massachusetts communities for failing to meet permit requirements designed to ...

Texas to map broadband availability, prioritize federal stimulus funding.(NEWSline: Latest Industry Developments)

Oct 01, 2009; ... Texas Agriculture Commissioner Todd Staples announced a partnership between the Texas Department of Agriculture and Connected Nation, a national nonprofit, to create a broadband initiative called Connected Texas and to develop a detailed broadband inventory map to better position Texas for ...

Call for papers for Plastic Pipes 2010.(NEWSline: Latest Industry Developments)

Oct 01, 2009; ... The Plastic Pipes Conference Association is now accepting abstracts for its Plastic Pipes XV Conference that will be held on Sept. 20-22, 2010 in Vancouver, BC, Canada. The deadline for abstract submission is Oct. 31, 2009. The conference will feature more than 100 presentations ...

GCTA scholarships awarded.(NEWSline: Latest Industry Developments)

Oct 01, 2009; ... The Gulf Coast Trenchless Association (GCTA) recognized the recipients of its college scholarships Aug. 12 at its monthly meeting. The association awarded $12,000 in scholarships to 12 students. [ILLUSTRATION OMITTED] The students were: Jason Ozment, son of Andy ...

Trench violations result in penalties.(NEWSline)

Oct 01, 2009; ... The Pipe Line Contractors Association reported that a Missouri based contractor working at a job site in Fort Smith, AR, has been assessed with one willful and nine serious violations of worker safety regulations by the Occupational Safety and Health Administration. OSHA said the will ...

Fiber network could be deal breaker.(NEWSline)

Oct 01, 2009; ... Recently, a local Delaware County, OH, official stated that the key to continuing economic growth for the county could lie in fiber optic wire, which can deliver information faster over the Internet than broadband services. In many cases it is the "deal breaker" when a company ...

Acoustic technology detects leaks in pipes.(NEWSline)

Oct 01, 2009; ... Using new technology to listen for clues in its pipes, New Jersey American Water is able to determine where significant problems could arise in its water system, sometimes before the break can occur in the water main. The new technology uses the Internet to continuously transmit ...

Free carbon calculator helps construction industry cut emissions, replace aging infrastructure.(NEWSline)

Oct 01, 2009; ... British Columbia-based PW Trenchless Construction Inc., with the help of a contribution from The National Research Council (NRC), Canada's premier science and technology research organization, is sponsoring the upgrade of a carbon calculator tool that will measure the environmental ...

Common Ground Alliance reports underground utility damages declining.(NEWSline)

Oct 01, 2009; ... The Common Ground Alliance (CGA), the nation's leading organization focused on protecting underground utility lines and the safety of people who dig near them, announced findings from its comprehensive Damage Information Reporting Tool (DIRT) Report. The estimated total number of ...

Pennsylvania water main gets upgrade.(NEWSline)

Oct 01, 2009; ... Pennsylvania American Water recently completed construction to replace an aging water main in West Lawn to improve service reliability for residents and increase water flows for firefighting. The company installed nearly 600 feet of new 12-inch ductile iron pipe along Woodside Avenue ...

Canadian steel company files motion on U.S. Steel.(NEWSline)

Oct 01, 2009; ... Lakeside Steel Inc. and its wholly-owned subsidiary Lakeside Steel Corp. filed a motion Aug. 5 to obtain "intervener status" in the July 17 suit filed by Canada's industry minister against U.S. Steel Corp. and its subsidiary, U.S. Steel Canada Inc. A sale of U.S. Steel Canada is ...

EPA widens buy American exemption for ARRA water projects.(WASHINGTON watch)

Oct 01, 2009; Barlas, Stephen ... Concerned about getting bogged down by "Buy American" waiver requests associated with sewer and drinking water projects funded with stimulus money, the EPA has published a new national waiver policy concerning "incidental components." A narrower waiver has been in place since May. It said ...

Environmental groups try to block Enbridge oil pipeline.(WASHINGTON watch)

Oct 01, 2009; Barlas, Stephen ... Environmental groups have filed a lawsuit to block a big oil sands pipeline Enbridge is building from northern Alberta to Superior, WI. The U.S. State Department approved the Alberta Clipper pipeline in August. The lawsuit filed in early September by groups such as Earthjustice ...

FERC considers changes to posting requirements.(WASHINGTON watch)

Oct 01, 2009; Barlas, Stephen ... Even though the natural gas posting requirements FERC established in Order 720 last November haven't even gone into effect for major non-interstate pipelines, the agency is already considering revising them. The order stimulated 24 requests--surely a FERC record or close to it--for ...

TT Technologies.(EQUIPMENT spotlight: PIERCING TOOLS)

Oct 01, 2009; ... [ILLUSTRATION OMITTED] The environmentally friendly Grundomat uses less air than other pneumatic piercing tools to provide a powerful, accurate bore. High air efficiency means smaller, more fuel-efficient air compressors can be used to power the tool. In addition, the tool has ...

HammerHead Mole.(EQUIPMENT spotlight: PIERCING TOOLS)

Oct 01, 2009; ... Active Head Mole piercing tools boasts a reciprocating head design that features a double-strike system that utilizes the initial impact force to increase production in difficult soils such as cobble, hard clay and hardpan. Active Head piercing tools are available in 2, 2 1/2 and 3 inch ...

Footage tools.(EQUIPMENT spotlight: PIERCING TOOLS)

Oct 01, 2009; ... All Big Shots (pneumatic piercing tools) are CNC machined to exact dimensional tolerances from a solid billet of nickel chromoly steel and fully heat treated for superior strength and wearability. The pistons are designed to withstand high impact conditions, are wear resistant and treated ...

Ditch Witch.(EQUIPMENT spotlight: PIERCING TOOLS)

Oct 01, 2009; ... [ILLUSTRATION OMITTED] The model PT30 piercing tool has 70 pounds of impact force per blow at 480 blows per minute. The 3.25-inch diameter PT30 offers three optional replaceable tool heads designed for specific soil types that enable the PT30 to bore through virtually any soil ...

Allied Construction products.(EQUIPMENT spotlight: PIERCING TOOLS)

Oct 01, 2009; ... Allied Hole-Hogs open clean, compacted, self-contained tunnels for pipe, cable, conduit or wiring at the lowest cost per foot. Hole-Hogs come in sizes 1 7/8- to 6-inch diameter to match a wide range of applications including tunneling/tooling, pipe pushing, pipe bursting and pipe pulling ....

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UNDERGROUND CITIES & TRAINS

Montreal’s and Toronto’s underground cities

MONTREAL: Possibly the most famous underground cities are Montreal's RÉSO, used by more people than any other locale and is the largest underground city network in the world, and Toronto's PATH, which according to Guinness World Records is the largest underground shopping complex in the world with 371,600 square metres of retail space. [1] Japan's underground networks, while individually smaller, are the most extensive overall with an estimated 76 underground shopping streets totalling over 900,000 square metres of floor space in 1996[2], with many expansions since then.

Figure 13 – Warm shopping under the winter freeze - Montreal

London - Crossrail invites bids for two more tunnel contracts

12 November 2009 | By Mark Hansford

London: Crossrail has invited tenders for the construction of the access shafts and sprayed concrete lining station tunnels at Liverpool Street and Whitechapel. The work includes the construction of platforms, concourses, cross-passages and escalator tunnels using sprayed concrete lining techniques. It also involves the construction of temporary access shafts.

The projects will also involve the removal of excavated materials from the works by road for transfer along the Thames. The Liverpool Street contract is set to last around 47 months. The Whitechapel contract is shorter at 37 months. Tenders are being invited for one or both lots. The deadline for tenders or requests to participate is 15 December. The announcement follows similar calls for tenders for Tottenham Court Road and Bond Street stations and two tunneled sections in the last two months

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The Channel Tunnel

Wikipedia - The **Channel Tunnel** (French: *Le tunnel sous la Manche*), known coloquially as the **Chunnel**, is a 50.5 km (31.4 mi) undersea rail tunnel linking Folkestone, Kent near Dover in the United Kingdom with Coquelles, Pas-de-Calais near Calais in northern France beneath the English Channel at the Strait of Dover. At its lowest point it is 75 m (250 ft) deep.[1][2][3] At 37.9 km (23.5 mi), the Channel Tunnel has the longest undersea portion of any tunnel in the world although the Seikan Tunnel in Japan is both longer overall, at 53.85 km (33.46 mi) and deeper, at 240 m (790 ft).

The tunnel carries high-speed Eurostar passenger trains, Eurotunnel roll-on/roll-off vehicle transport—the largest in the world—and international rail freight

trains.[4] In 1996 the American Society of Civil Engineers identified the tunnel as one of the Seven Wonders of the Modern World.[5]

Figure 14 - 31 miles - Channel Tunnel

Figure 15 - Channel Tunnel Route

THERE'S NOTHING NEW UNDER THE GROUND

Old tunnels under Manchester (UK)

Helen Clifton goes digging under the city and Jonathan Schofield offers you a tour of Underground Manchester

Beneath Manchester there's a subterranean world where time – to use a cliché – has stood still for many a long year. These eerie, vast underground caverns, canals and walkways (which could have run from the city centre to Salford, Reddish, and Old Trafford) were once home to thousands of people as well as huge narrow boats and entire workforces.

Figure 16 - Beneath Manchester, UK.

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Old tunnels under London

http://www.canalmuseum.org.uk/history/tunnels.htm

All London's canal tunnels are on the Regent's Canal. Are there two, or three canal tunnels? Only two are generally recognised today, Islington Tunnel (960 yards, or 886 metres) and Maida Hill Tunnel (272 yards or 251 metres). In fact a third very short tunnel exists, Eyre's tunnel, (53 yards or 48 metres) under Lisson Grove. Today this is usually incorrectly assumed to be a bridge. Maida Hill and Eyre's tunnels were opened in 1816 and are near to the junction with the Grand Junction Canal's

Paddington Arm which is now known as Little Venice. Islington Tunnel was opened in 1820 along with the completion of the canal, a procession of boats passing through with a band playing, to be met by a salute of cannon fire as they emerged at the eastern end.

Figure 17 - Islington Canal Tunnel

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Drainage Experts London – The GREAT 1858 STINK

http://www.drainageexpertslondon.com/londonsewerhistory.htm

In 1858 "The Great Stink," from the backed up Thames, caused thousands to flee the City, while Parliament remained in session. Windows of the parliament building were draped with curtains soaked in chloride of lime, to prevent closing of the Government. Upper class residents fled the city or drenched sheets with perfumes to mask the odor from the outside. Aging Sir Marc Isambard Brunel, together with his son Isambard Kingdom Brunel, submitted a plan to **drain London** to the lower side of the river by building a 1,600 foot tunnel under the Thames. Their audacious plan relied on constructing a 25 foot diameter shield behind which 9 men, donkeys and carts would work to remove earth and transport soil to the surface. The huge 25 foot diameter bore sloped from 35 feet under the river bed to 121 feet on the far side. Desperate for any solution, the Commissioners sanctioned the project. If successful, the Brunels would achieve what no one had ever attempted before. Work proceeded rapidly and, surprisingly, the project was completed without a single loss of life, though the younger Brunel was nearly killed in a collapse of shoring just a few feet from the entry of the excavation. When Queen Victoria learned of the success, she was so enthralled with the idea of travelling beneath the Thames that she ordered a small scale rail with open cars be constructed so that the entire Parliament could accompany her at the dedication journey through the tunnel. The public followed Victoria's enthusiasms. By popular demand, the **sewer tunnel** was transformed into a fashionable promenade for **London**ers. Victoria's railway became a tourist attraction.

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London under London by Richard Trench & Ellis Hillman

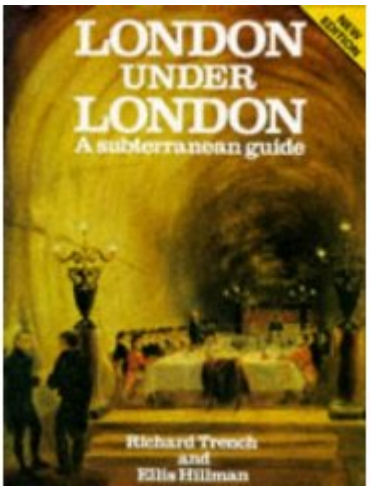

Figure 18 - Guide book to London's underground

One of the most popular books on London (it has been reprinted six times since it was first published in 1984) London under London has now been updated to take into account the latest subterranean developments. A new section covers: the pioneering deep level water main 80 kilometres in length, much longer even than the Channel Tunnel; new power tunnels and the enormous substation beneath Leicester Square; new underground railways; glass fibre communication; and much more. Clearly, metropolitan man is burrowing as actively as ever. The London we know and see is only the tip of the iceberg. Beneath the familiar surface lies an unknown city, a Hades of buried and forgotten rivers, sunken sewers, underground railways, pipes and passages, tubes and tunnels, crypts and cellars. These lifelines of the metropolis twist and turn hidden beneath the pavements of the city - fifteen hundred miles of Neo-Gothic sewers, a hundred miles of Neolithic rivers, eighty-two miles of tube tunnels, twelve miles of government tunnels and hundreds of thousands of miles of cables and pipes. Layer upon layer, they run their urgent errands, carrying people, delivering water, removing sewage, passing currents, sending messages, conveying parcels. Drawing extensively from the literature and visual archives of the underworld, London under London traces the history of the tunnellers and borers who have pierced the ground beneath the city for close on two thousand years. The authors trace the routes taken by man and nature, and enable us to follow them from the comfort of our armchairs. They can also tell us, gazetteer-style, exactly where we can get below and see the strange world which they depict, whom to ask for permission, and which of the public service authorities organizes trips underground.

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TUNNELS HAVE BEEN AND CAN BE DUG BY HAND

The World's Deepest Step-Well – Jaipur, India

Chand Baori is a famous stepwell situated in the village Abhaneri near Jaipur in Indian state of Rajasthan. This step well is located opposite to Harshat Mata Temple which shows that there must have been a religious connection with the step-well. The well is 35 m on each side with steps leading down from each side and water can be drawn from any level. This is one of the deepest and largest step wells in India. It was built in 9th century and has 3500 narrow steps and 13 stories and is 100 feet deep. The arid climate forced the locals to dig deep for a dependable water source, one that would last throughout an entire year. It is a fine example of the architectural excellence prevalent in the past.

Figure 19 - Deepest step-well - Jaipur, India

Under the Berlin Wall

Evelina Rudolf , now 68, escaped to West Berlin in September 1962 via Tunnel 54, so-called because 54 people escaped through it.

Once it had sunk in that they had built the wall, and it would stay, we sat with friends at night working out what to do. Some Italian friends – who could move between East and West Berlin – came up with the idea of a tunnel. I was kept informed of every aspect of the digging. It was hair-raising: lots of other tunnels collapsed and people were killed, but the idea of staying locked in a country was infinitely worse than the dangers involved in trying to escape. Once it had been dug over four months, we went to the entry point in a cellar. I was in a suit, which was wrecked by walking 135 metres through mud. We made it – I momentarily fainted – and I then tried to build my life again. I later fell in love with a tunneller, my husband Joachim. Every anniversary brings back the horrors of our flight but, more powerfully, the relief that we didn't spend nearly 30 years trapped in our own country

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Capadoccia, Turkey

The Eritreans too took up the underground world as their own. Tunnels have always been a place of refuge. In Turkey in Capa Doccia there is an entire underground town 100 metres down. It was used in the 14th and 15th Centuries to hide from the Mongul hoards - housing a staggering 100,000.

http://www.eco-action.org/dod/no8/tunnels.html

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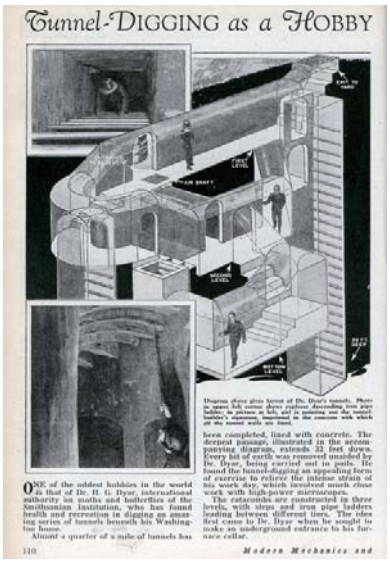
Dr Dyer digs tunnels by hand

From one of the pages of *Modern Mechanics and Invention*, scanned and transcribed here by *Modern Mechanix*, we learn that “one of the oddest hobbies in the world is that of Dr. H. G. Dyer, international authority on moths and butterflies of the Smithsonian Institution, who has found health and recreation in digging an amazing series of tunnels beneath his Washington home.”

And he was quite the mole: digging and removing the dirt without the help of heavy machinery, Dyar still managed to excavate “almost a quarter of a mile of tunnels,” which he “lined with concrete. The deepest passage, illustrated in the accompanying diagram, extends 32 feet down.”


Tunnel-DIGGING as a HOBBY

ONE of the oddest hobbies in the world is that of Dr. H. G. Dyar, international authority on moths and butterflies of the Smithsonian Institution, who has found health and recreation in digging an amazing series of tunnels beneath his Washington home.

Almost a quarter of a mile of tunnels has been completed, lined with concrete. The deepest passage, illustrated in the accompanying diagram, extends 32 feet down. Every bit of earth was removed unaided by Dr. Dyar, being carried out in pails. He found the tunnel-digging an appealing form of exercise to relieve the intense strain of his work day, which involved much close work with high-power microscopes.

The catacombs are constructed in three levels, with steps and iron pipe ladders leading between different tiers. The idea first came to Dr. Dyar when he sought to make an underground entrance to his furnace cellar.

110 Modern Mechanics and

Viet-Cong Tunnels

VIETNAM: Cu Chi Tunnel is 70 km from Ho Chi Minh City in the Northwest. It is miniature battle versatile of Cu Chi's military and people during the 30-year struggle longtime and fierce to fight invading enemy to receive independence, freedom for motherland. It also is the special architecture lying deeply underground with many stratums, nooks and crannies as complex as a cobweb, having spares for living, meeting and fighting with total lengths over **200 km.** Real legends coming from the Tunnel are over human imaginativeness. Creeping down into the tunnel, only some yards, you can find out why Vietnam, a tiny country, could defeat its enemy, the large and richest country in the world. Why Cu Chi, a barren and poor land could face strongly for 21 years to the army crowded many times compared with its force, warlike and equipped modern war weapons and means. In the fight, Cu Chi people won illustriously. Thanks to systems of tunnel ways, fortifications, combat trenches, soldiers and people of Cu Chi fought very bravely creating glorious feat of arms. The American invaders at first time stepped into Cu Chi land, they had to face so fierce resistances from tunnels from important and very difficult bases that they cried out, "Underground villages", "Dangerous secret zone", "cannot see any VC but they appear everywhere"… With its war pasture, Cu Chi Tunnels become a historical war hero of Vietnamese People like a 20th century legend and famous land in the world.

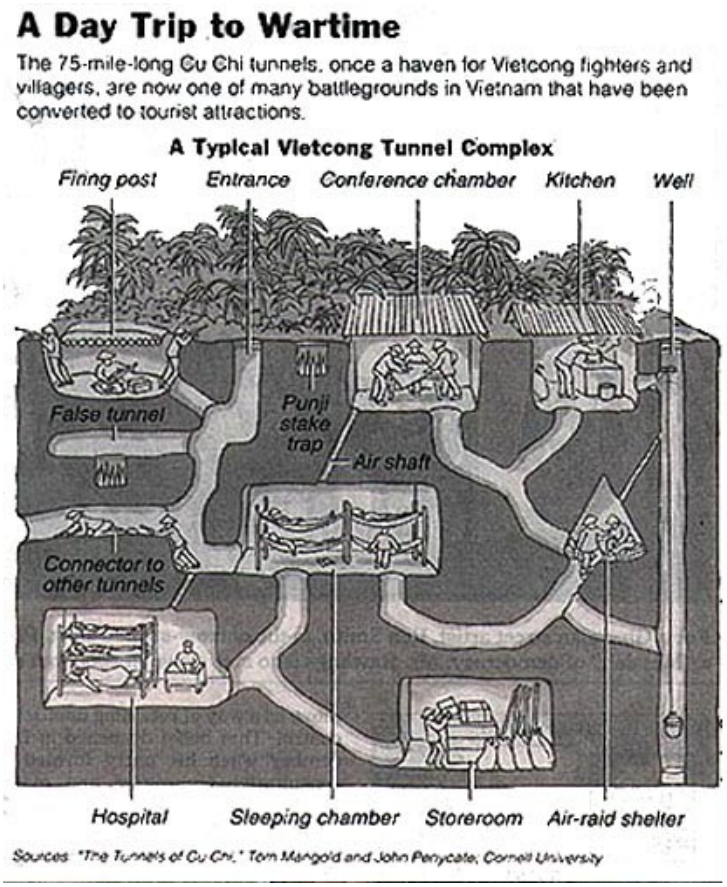


Figure 20 - Layout of a Vietnam tunnel

The Roman Catacombs

ROME: Christian excavators (fossors) built vast systems of galleries and passages on top of each other. They lie 7–19 metres (23–62 ft) below the surface in area of more than 2.4 square kilometres (590 acres). Narrow steps that descend as many as four stories join the levels. Passages are about 2.5 by 1 metres (8.2 ft × 3.3 ft). Burial niches (loculi) were carved into walls. They are 40–60 centimetres (16–24 in) high and 120–150 centimetres (47–59 in) long. Bodies were placed in chambers in stone sarcophagi in their clothes and bound in linen. Then the chamber was sealed with a slab bearing the name, age and the day of death. Fresco decorations were typically Roman. The catacomb of Saint Agnes is a small church. Some families were able to construct cubicula which would house various loculi and the architectural elements of the space would be a support for decoration. Another excellent place for artistic programs were the arcosoliums.

Figure 21 – All is vanity – the Roman Catacombs

THERE IS PLENTY OF ROOM UNDER OUR CITIES AND TOWNS FOR FOODTUBES PIPELINES – AND THERE ARE THOUSANDS OF SKILLED ENGINEERS WHO CAN INSTALL THE FOODTUBES PIPELINES WITH LITTLE DISRUPTION TO COMMUNITIES.

MODERN, TRENCHLESS, NO-DIG METHODS ENABLE PIPELINES TO BE LAID ECONOMICALLY, QUICKLY AND QUIETLY.