	TRENCHLESS TECHNOLOGIES RESOURCE CENTRE	
INTERNATIONAL SOCIETY FOR TRENCHLESS TECHNOLOGY	TRENCHLESS TECHNOLOGY GUIDELINES	SECOND EDITION
	SOCIAL COSTS AND ENVIRONMENTAL IMPACT AND SUSTAINABILITY	MARCH 2006

1 INTRODUCTION

It has long been accepted that the open trench approach to the installation of utility infrastructure is capable of causing major disruption to commerce and the general public. Indeed this was one of the motivating factors for Ted Flax man when he chaired those historic meetings in London in 1985 that heralded the birth of the ISTT. No doubt he believed that the new society would rapidly find a means of assessing the financial impact of such disruption so that it could be incorporated in the bid process. However, 21 years later, as these guidelines were being drafted, the following comment was made in a paper by Pucker, Allouche, and Sterling.
Delivered at the 2006 North American, No Dig Conference in Nashville,

"For the most part, social costs are not considered during a construction project's planning, design and bid evaluation stages because they cannot be calculated using standard estimating methods. In recent years efforts have been made to introduce approaches for predicting social costs associated with utility construction projects. Nevertheless, unit cost data needed for the verification of such prediction methods is lacking.

The efforts referred to in this extract, are chronicled in numerous papers presented at No-Dig Conferences, and listed in the papers and Bibliography attached to this section. As will be seen later in this document, social costs are now seen as just one component of the overall environmental impact of utility works. Fig 1 summarises some of the main impacts, and it can be seen, that in addition to the immediate impacts associated with the works, there are some broader issues. These are generally considered in an overall assessment of the ENVIRONMENTAL SUSTAINABILITY of a product, or process, which is considered in a subsequent section of this document.

HISTORY

The first serious attempt to assess the magnitude of the disruption, associated with open cut utility installation, was made by Thomson et al, in conjunction with the UK, Transport and Road Research Laboratory [TRRL]. .Based on observations of a number of contracts, it was concluded that social costs could be more than double the direct costs of an installation, and that the cost to society in the UK, was at least UKP 2.1 billion per annum. This figure has been frequently quoted, although, some argue it is a gross exaggeration. This project was intended to be the catalyst for a mass of new legislation aimed at encouraging the use of trenchless methods. This included such innovations as charging contractors for road occupancy, and for the extent of open trench used. Unfortunately it coincided with the privatisation of the UK Water Industry, and the legislation became a victim of politics.

In spite of all the detailed research carried out in the ensuing twenty years, there is still considerable controversy in the UK, and many other countries. The benefits of trenchless methods in reducing disruption are widely accepted. However, there is still no agreement over the magnitude of social costs, and their precise role in the bid process.

The paper quoted earlier, provides an excellent summary of the status of this endeavour, and is partially summarised below.

SOCIAL COST CATEGORIES

Social cost categories related to construction work are numerous. The case histories reported in this paper consider the following eight social cost categories:

1 Travel delay: Utility construction work can cause significant traffic delay due to lane closures or complete road closures. Pedestrians also can be forced to detour because of lane closure and other construction activities.

2 Vehicle operating costs: Longer travel distances and stop-and-go traffic induce higher vehicle operating costs. For example 1,000 speed changes from 50 mph to 15 mph and back to 50 mph cause an additional fuel consumption of 12.2 gallons for light duty vehicles. (Budhu and Isely, 1994).

3 Decreased road surface value: Open excavations can result in pavement deformations and asphalt cracking at the edges of the trench, which leads to an accelerated degradation of the pavement. Reduction in useful pavement life to due an open-cut excavation is estimated to be as high as 30% (Tithe, et al, 2002).

4 Loss of trade: Construction zones can decrease the accessibility to businesses due to congested traffic conditions, blocked parking spaces and barriers from the construction site itself. On one hand businesses lose customers, who prefer to go to more convenient places, while on the other hand businesses depending on deliveries may have problems with their supplies.

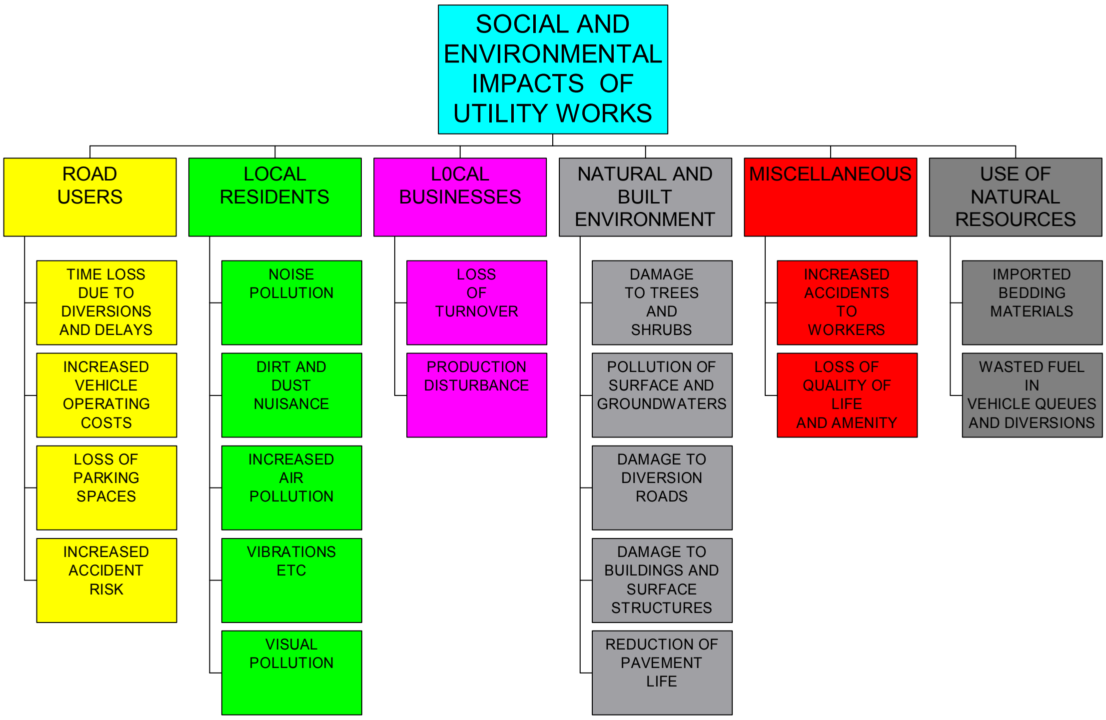
5 Loss of parking spaces: Loss of parking spaces leads to a decreased parking meter revenue for the city and lower revenues from parking fines.

6 Cost of dust control: Open excavations result in a significant amount of dust in their surrounding. Cleaning needs, and thus costs, increase. Also the quality of life for people living near the construction zone decreases.

7 Noise pollution costs: The use of heavy construction equipment results in a higher noise level in the vicinity of the work area. In addition construction work may lead to a higher noise pollution due to changing traffic conditions compared to the ‘normal’ situation.

8 Worker safety: Open trenches pose a higher risk to workers and pedestrians than trenchless technologies. Accidents related to trenching are about 112% higher than the average value for construction work in general. Each year more than 60 workers are killed in trenching accidents (Jung and Sinha, 2004).

FIG 6.1



a) The use of material and energy resources to extract the base material used
b) The use of energy to convert the materials to their final form
c) Pollution and safety hazards arising from these activities
d) Quantity and disposal of waste
e) impact of the use of the product or process on all aspects of the human, natural and built environment (The issues normally included in social costs)
f) Impacts arising from the operation of the product or process over its working life
g) Impacts arising from disposal – recyclabiliy

In 2000 the ISTT began collaboration with UNEP (United Nations Environmental Program) the background to this is summarised below using information extracted from various UNEP documents
ABOUT UNEP/IETC…

1.1. IETC is part of the UNEP Division of Technology Industry and Economics (DTIE)
1.2. IETC's mandate is the promotion and transfer of Environmentally Sound Technologies (ESTs) to developing countries and those with economies in transition

2. UNEP/IETC ASSISTS DECISION MAKERS BY:
    2.1. Identifying and helping to solve water and urban related environmental problems
    2.2. Developing tools and techniques to assist in the identification, selection and use of appropriate ESTs
    2.3. Promoting implementation of environmentally sound technologies (ESTs) and better practices
    2.4. Activities focus on water and urban environmental issues:
3. THE NEED FOR NEW APPROACHES
    3.1. Past environmental problems have arisen primarily because of inappropriate management and a lack of understanding of the impact of management practices upon the environment.
    3.2. New management methods and tools must be developed and applied.
4. SUSTAINABLE DEVELOPMENT
    4.1. Part of an integrated management and governance framework which addresses:
    4.2. The needs of the present without compromising the ability of future generations to meet their own needs (WCED 1987);
    4.3. Improving the quality of human life within the limits of supporting ecosystems (IUCN/UNEP/WWF 1991).
5. THIS MEANS INTEGRATING:
    5.1. Ecological imperative - living within the limits of global biophysical carrying capacity and biodiversity;
    5.2. Social imperative - ensuring that basic needs are met through democratic systems of governance and equity;
    5.3. Economic imperative - ensuring a vibrant economy based on eco-efficiency and sustainability.

6. ENVIRONMENTALLY SOUND TECHNOLOGYESTS
    6.1. Definition of Environmentally Sound Technologies (ESTs) is based on Agenda 21.
    6.2. … Arising from the 1992 United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit.
7. AGENDA 21 DEFINES ESTS ASTECHNOLOGIES WHICH:
    7.1. Protect the environment;
    7.2. Are less polluting;
    7.3. Use all resources in a more sustainable manner;
    7.4. Recycle more of their wastes and products;
    7.5. Handle residual wastes in a more acceptable manner than the technologies for which they are substitutes.
8. INHERENT TO THIS IS:
    8.1. The improvement of technology currently used
    8.2. Its replacement with more appropriate environmentally sound technology, and
    8.3. Its consideration within the ecological and socio-economic context.
9. ESTS AND SUSTAINABLE DEVELOPMENT N THE CONTEXT OF POLLUTION ESTS IS PROCESSES AND TECHNOLOGIES THAT:
    9.1. Generate little or no waste
    9.2. Prevent or avoid pollution
    9.3. Control or treat pollution after it has been generated.

10. NOT JUST INDIVIDUAL TECHNOLOGIES ESTS ARE ALSO TOTAL SYSTEMS THAT INCLUDE:
    10.1. Know-how,
    10.2. Operating procedures,
    10.3. Goods and services, and
    10.4. Equipment, as well as
    10.5. Organizational and managerial procedures.
11. HENCE, THE TERM EST:
    11.1. Applies to all technology and its transition in becoming more environmentally sound
    11.2. Covers the full spectrum from basic technologies adjunct to the production system, to fully integrated technologies where the EST is the production technology itself
12. Captures the full life cycle flow of the material, energy and water in the production and consumption system.

UNEP CHECKLIST OF CRITERIA FOR ENVIRONMENTAL SUSTAINABILITY

EST Criteria

Criteria are principles or standards against which something is judged. Appropriate criteria are needed to help guide the identification and selection of ESTs in a manner consistent with sustainable development objectives. Figures 4 and 5 each provide a checklist of selected generic criteria and indicators that can be used in assessing and evaluating ESTs. These checklists were developed by the UNEP/IETC Expert Group on Environmentally Sound Technologies as an initial working template in an effort to define the essential criteria and indicators for identifying and selecting ESTs. The checklist in Figure 4 provides environmental criteria and related indicators. Figure 5 provides a limited perspective on some of the relevant socio-economic indicators. IETC's immediate interest is to examine the relevance of the environmental criteria and indicators.

Figure 4: Proposed Checklist of Environmental Indicators for ESTs

(Prepared by UNEP/IETC Expert Group on Environmentally Sound Technologies)

Criteria	**Indicators**	**Yes**	**No**	**Quantitative Indicators** **(i.e., amount saved/spent and/or reduced/ increased)**	**Qualitative Indicators** **(i.e., based on potential local, regional and global impacts)**
Technical Suitability	• Addresses fundamental scientific and engineering principles (i.e., laws of thermodynamics and reactivity) • Production or process yield • Contaminant removal rates or treatment efficiency • Potential for generation of secondary pollutants/by-products • Noise • Thermal losses and radiation emissions • Performance at different settings and different locations • Sensitivity to specific operating conditions • Reliability • Replicability • Potential for system failure • Profiling of risks and uncertainties				
Compliance with Regulations and Standards	• Quantity of waste generated (water, air and solids) • Quantity of waste controlled by environmental permits • Compliance with local and regional standards • Compliance with MEAs (i.e., POPs, Biosafety, etc.) and other internationally recognised standards (i.e., ISO, etc.) • Availability of reliable data • Part of a 3rd party assessment programme (i.e., Ecolabelling, ETV, etc.)				

Eco-Efficiency and Conservation of Biodiversity	• Useful life (in accordance with optimal performance specifications) • Efficiency of energy, water and materials use relative to the service provided • Lifecycle performance (i.e., overall GHG emissions throughout lifecycle) • Use of renewable resources • Incorporation of closed loop processes • Design for the environment • Cumulative air, water and waste emissions • Impact on ecosystems health & integrity (including biodiversity and ecological footprint)				
Protection of Water Resources	• Water use • Conservation of water • % use of recycled water • Wastewater treatment requirements • Level of treatment (primary, secondary, tertiary) • Overall water efficiency				
Optimisation of Materials and Energy Use	• Use of fuels and energy resources • Quantity of renewable resources • Quantity of non-renewable resources • % of recyclable and reused materials in the production process • Use of environmentally friendly materials • Use of locally sustainable resources • Duration of product use or useful life • Energy efficiency and savings • Overall efficiency of resource use				
Minimisation of Toxic Materials and Waste	• Quantity of waste (air, water and solids) • Quantity of toxic and hazardous waste used and generated • % of waste materials used as raw materials for other industries (i.e., based on industrial ecology and CASE principles) • Quantity of by-product recovered • Cost of pollution control abatement technology • Need for waste treatment and disposal • Ultimate disposal costs of unmarketable by-products and waste • Overall operations and maintenance cost				
Protection of Terrestrial Resources	• Space required for construction • Compatibility with immediate or adjoining facilities and systems • Transportation and materials flow requirements • Potential for soil contamination • Potential for geomorphology, landscape and ecohydrological impacts				
Protection of the Atmosphere	• Air emissions • Potential for long range transport of atmospheric pollutants • Potential for climate change impacts				

Figure 5: Proposed Checklist of Socio-Economic Indicators for ESTs

(Prepared by UNEP/IETC Expert Group on Environmentally Sound Technologies)

Criteria	Indicators	Yes	No	Quantitative Indicators (i.e., amount saved/spent and/or reduced/ increased)	Qualitative Indicators (i.e., based on potential local, regional and global impacts)
Financial Viability	• Capital investment • Return on investment • Payback period				
Operations & Maintenance Viability	• Management and labour costs • Expertise and skills requirements for operation and maintenance • Utilities cost (water and energy) • Cost of other consumables • Cost of pollution prevention and control • Cost of residuals management and solid waste disposal • Cost of environmental remediation and restoration • Cost of natural capital • Cost of environmental health and safety liabilities • Frequency of maintenance • Parts and service cost • Overall cost effectiveness				
Responsive to Local Needs and Benefits	• Public acceptance • Public health & safety risk • Social benefits • Cultural value • Employment • Use of local resources • Capacity building requirements				
Quality of Information	• Reliability of data • Existence of a QA/QC programme • Available comparisons to existing systems • Transparency of data collection and reporting • 3rd party substantiation				

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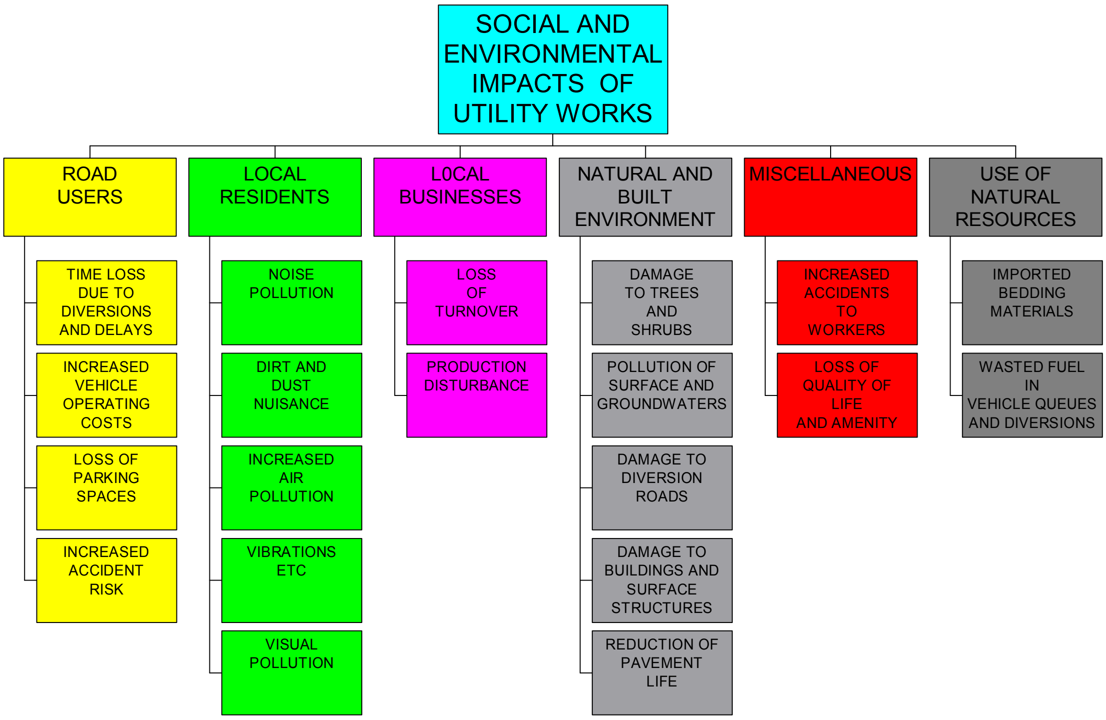
SOCIAL AND ENVIRONMENTAL IMPACTS OF UTILITY WORKS
ROAD USERS
TIME LOSS DUE TO DIVERSIONS AND DELAYS
INCREASED VEHICLE OPERATING COSTS
LOSS OF PARKING SPACES
INCREASED ACCIDENT RISK
LOCAL RESIDENTS
NOISE POLLUTION
DIRT AND DUST NUISANCE
INCREASED AIR POLLUTION
VIBRATIONS ETC
VISUAL POLLUTION
L0CAL BUSINESSES
LOSS OF TURNOVER
PRODUCTION DISTURBANCE
NATURAL AND BUILT ENVIRONMENT
DAMAGE TO TREES AND SHRUBS
POLLUTION OF SURFACE AND GROUNDWATERS
DAMAGE TO DIVERSION ROADS
DAMAGE TO BUILDINGS AND SURFACE STRUCTURES
REDUCTION OF PAVEMENT LIFE
MISCELLANEOUS
INCREASED ACCIDENTS TO WORKERS
LOSS OF QUALITY OF LIFE AND AMENITY
USE OF NATURAL RESOURCES
IMPORTED BEDDING MATERIALS
WASTED FUEL IN VEHICLE QUEUES AND DIVERSIONS