Utilidor Working Group

<u>Not</u> Digging up the Streets and Making NYC a 21st Century "Smart" City

After noise, the biggest complaint from New York City residents and businesses is the constant ripping up of streets to repair, replace or install sewer, water, gas, electric, steam and telecommunications transmission infrastructure leading to complete or partial road and sidewalk closures that impede mobility and impose direct and social costs. For NYC government to address these complaints in a meaningful and lasting way, NYC must transform the nature and practices of the infrastructure systems responsible for those complaints.

Why do street excavations happen so often and why do they take so long? The main answer is that we decided over a hundred years ago that most of these utilities should be buried directly in the dirt under NYC's public right of way (PROW). Direct burial seemed like a good idea at the time, but now we have massive tangles of utility infrastructure lying in dirt under the PROW creating a "subsurface spaghetti problem," which can be seen in open street pits for the NYC's roadway reconstruction projects. Often, NYC and its utilities don't even know what is down there until the streets are opened up, and that itself takes time to sort out.

40 Worth Street, NYC, roadway reconstruction project, November 2021.

Why haven't we fixed this when there is a solution used in some other cities and even in a limited way in NYC? There are now concrete tubes used to carry cables for telephone and cable TV that can be accessed without tearing up the street. We now need a bigger compartmentalized tube, known as the "Multi-purpose Utility Tunnel", to accommodate all utility transmission infrastructure for water, gas and electric, steam, other telecommunications lines and possibly, wastewater, which would provide access to the infrastructure via manholes instead of digging up the street. Then, the continual need for routine street excavations would end, and NYC would realize the cost savings and other benefits from MUTs!

MUTs will:

- protect infrastructure assets from subsurface environmental damage, damage from other utilities' physical properties, and accidental strikes from work to adjacent utilities which will result in extending the lifespan of the assets
- allow easy access for maintaining individual utilities in a state of good repair at a significantly lower life cycle cost thereby improving the asset's overall condition and reducing the number of predictable failures
- lengthen surface roadway design lives, reducing NYC's PROW capital roadway costs
- permit real time remote sensoring and monitoring of utility infrastructure asset and commodity conditions for proactive state of good repair response
- increase utility system resiliency and environmental sustainability
- increase mobility and neighborhood quality of life

The reason we haven't done this already is three-fold – cost, legal and logistical.

We need to:

- pay for it and share the costs, while acknowledging the long-term savings that MUTs will realize
- find a model for ownership and allocation of the MUT spaces.
- find a way to install them without disrupting the utility service for too long a period

The good news is that we have solutions for all of these. We just need the will to do it.

The attached paper summarizes the work the Utilidor Working Group within Town+Gown:NYC has done in more detail and provides a direction on how to move forward.

MUT Costs/Benefits and Finance. The "rule of thumb" estimate for MUTs is twice the cost of direct burial, which becomes a significant impediment to MUT implementation in NYC because standard capital project cost analysis does not typically include evaluating the life cycle costs and benefits, which will be necessary for MUT financing decisions. Life cycle cost benefit analysis (LCCBA) conducted by a 2020 Columbia/School of International and Public Affairs (SIPA) capstone team for the Utilidor Working Group produced a positive benefit-cost ratio for a Lower Manhattan case study street segment, which suggests that, despite the higher initial capital costs, MUTs are economically justified and a good candidate for fee-based financing. A follow-up 2022 SIPA capstone project will refine the original LCCBA model to precisely quantify direct cost and social cost savings; analyze the economic value to utilities operating in NYC (subsurface PROW value) and negative externality costs of street excavations that are not priced and captured by current utility franchise agreements; and analyze direct cost savings to utilities from better integrated computer technology (ITC) to sensor subsurface infrastructure for real-time asset condition monitoring to provide a complete foundation for capital investment decisions.

The Location Analysis Method for Priority (LAMP) methodology, a 2021 New York University/Tandon School of Engineering—Management of Technology capstone project, used a variety of publicly available data to identify and map subsurface infrastructure vulnerabilities to provide a planning tool for implementing innovative subsurface infrastructure designs, in the absence of meaningful subsurface PROW infrastructure locational data, and the related data visualization tool will help support planning for MUT implementation in conjunction with the refined LCCBA model. A planned 2022 University of Toronto School of Cities capstone project will develop a companion methodology focusing on community needs that innovative subsurface infrastructure designs can help solve.

Subsurface PROW utility infrastructure and their connections to the larger systems are largely unseen and not understood by most people. Pratt Communications Design research projects in 2013 and 2016 explored ways to make the invisible visible and use the City's roadway reconstruction projects as opportunities to increase public awareness about subsurface PROW infrastructure and their linkages to the larger systems to increase public stewardship of PROW elements.

40 Worth Street, NYC, post project completion, December 2021

Costs. Burying utility transmissions infrastructure in the dirt not only contributes to the subsurface spaghetti problem, but also exposes the infrastructure to degrading subsurface conditions, adverse impacts from other utility commodities' physical properties, and risks of accidental strikes from excavations. Direct burial requires continual and expensive street excavation for public and private utilities' state of good repair (SOGR) activities, such as regular inspection, maintenance, repair, rehabilitation or replacement, leading to suboptimal levels of SOGR activities and predictable failures causing personal injury and property damage. Frequent street excavations reduce the design lives of NYC roads and lead to suboptimal roadway conditions that NYC's road resurfacing and roadway reconstruction projects can only partially address. Road closures and construction activities for extended periods of time impose costs on the public—adjacent businesses and residences and travelers using all modes of transportation. The direct burial method, which was the only method available when existing franchises were granted, contributes to the subsurface spaghetti problem and the lack of locational data sharing. These are the "negative direct burial externality costs" that MUT implementation addresses.

Benefits. Locating infrastructure in MUTs designed for each utility infrastructure's physical needs not only protects them from the adverse impacts of subsurface conditions, utility commodities' physical properties and accidental strikes, but also permits easier access with no excavation for individual utility SOGR activities at a lower life cycle cost than street excavation and would result in improved subsurface infrastructure asset condition with reductions in predictable failures causing personal injury and property damage. Eliminating street excavations would significantly lengthen roadway design lives and reduce NYC's PROW capital roadway costs. These benefits would produce direct cost savings to the public and private utilities operating in NYC and to NYC as a municipality. MUTs can support the application of integrated computer technology (ICT) for real time remote sensoring and monitoring of utility infrastructure asset and commodity conditions, driving greater direct cost savings through proactive operational responses facilitated with ICT ("smart city" direct cost savings).

Finance. There are three potential MUT financing options with different trade-offs:

1. A combination of NYC general obligation debt, New York City Transitional Finance Authority (NYCTFA) debt, and New York City Municipal Water Finance Authority (NYCMFWA) debt, supported by agreements with each utility to occupy the MUT space and pay debt service, operating and maintenance costs, which are independent of their franchises, would have NYC, as a municipality, control finance as part of the MUT transition, but NYC debt would be subject to state constitutional debt and operating limits as well as competing capital needs for limited debt capacity, and NYCTFA and NYCMFWA debt would be subject to debt-service coverage ratios.

2. The “63-20” financing vehicle permitted under Internal Revenue Code Revenue Procedure 82-26 (formerly Revenue Ruling 63-20) would permit NYC and the utilities to test MUTs on a project-by-project basis and approximate the benefits of a true public private partnership financing, which New York State law does not authorize. The board of directors for the nonprofit corporation issuing the 63-20 debt, which would not be NYC debt, could include all subsurface PROW stakeholders and provide them with a “safer” space to resolve their relationship issues on specific projects.

3. A state authority created on behalf of NYC to finance, construct and/or operate “smart city” infrastructure would authorize debt service, operating and maintenance payments by each utility, which would appropriately leverage utility revenue-based financing for utility-created problems. Legislation creating the authority would resolve vexing franchise issues in tandem with New York State Public Service Commission (NYS PSC) rate tariff changes for private utilities operating in NYC to channel captured subsurface PROW value and negative direct burial externality costs toward an infrastructural solution and also establish parameters for an operating agreement that also address liability issues. The new tariff rates would make current direct burial practice no longer the economically rational choice.

MUT Legal Issues. Legal issues for MUTs begin with MUT ownership and space allocation, which will depend on the finance strategy selected. The selected finance strategy will determine the nature of the governance structure and agreements to cover construction, operations and maintenance, including liability. But vexing issues from existing franchises impact all legal issues.

MUT ownership and allocation. NYC can treat the MUT as a purely public asset and construct and finance it through NYC debt and operate it with the private utilities under separate agreements that provide space within the MUTs in exchange for payment of allocable shares of debt service and operation and maintenance costs. NYC, as a municipality, effectively owns the PROW from the road surface through the dirt beneath, including the sidewalks, on behalf of the public, and, as a delegated power from the State, can fully regulate the PROW including private utility use for transmission infrastructure and the discretion to require undergrounding of utility infrastructure in Brooklyn, Queens and Staten Island where a significant portion of some transmission infrastructure is still above ground, subject to increasing climate change effects.

Alternatively, NYC can treat the MUT as a mixed public-private asset that can be financed initially with 63-20 debt, which does not require additional State authority, under separate agreements that provide space within the MUTs in exchange for payment of allocable shares of debt service and operation and maintenance costs. Private use restrictions under the federal tax code will likely make the debt attributable to private utilities taxable, with marginally increased debt service costs. If the State were to create a “smart city” authority for the NYC to finance MUTs on a revenue basis, that debt would also likely include taxable component debt.

The LCCBA to support MUT debt would first evaluate costs and benefits for the MUT project, as a project, and then focus on costs and benefits among utility participants in a way that balances risk, cost-benefit ratios and contributed and gained benefits. This LCCBA model permits assessment of NYC's dual roles as owner of the PROW and as owner of the public water and sewer utilities that share benefits similar to those of private utilities and permits determination of fair cost allocation as a basis for the operating agreements. If the two-step LCCBA shows benefits exceeding costs in both steps, MUTs are good candidates for revenue-based debt-finance.

Construction and operating agreements including liability issues. Participation of all utilities in MUTs is essential to optimizing benefits from MUTs, which will require a governance and management structure able to coordinate municipal and private interests and responsibilities, likely through a series of binding agreements reflecting legal, engineering and planning requirements. Such a structure and agreements should be sufficiently flexible to accommodate necessary modifications to the MUT model as implementation across the city encounters different subsurface and surface conditions, but they must also address the following considerations in a global manner to support MUT financing:

- Long-term planning and design/construction activities for MUT installation, including determination and coordination of criteria for installation and operation of all MUT systems.
- Responsibilities for construction, including regulatory compliance, and ongoing operations and maintenance and their related cost reimbursement formulas to support debt service and operations and maintenance costs, determination of which will be aided by the two-step LCCBA.
- Provisions to handle disputes that arise during MUT construction and operations that would be based on current practice but modified to reflect the MUT environment.
- Provisions governing all MUT security and access control procedures and MUT safety procedures for workers.
- Provisions requiring insurance for construction and operations that would be based on current insurance practices but modified to reflect the MUT environment; the private utilities have some form of private insurance for their construction projects and current operations, while NYC self-insures its construction-related claims and operations.
- Provisions dealing with potential liability for accidents in the MUT environment, which should be safer for all infrastructure located in the MUTs and workers compared to direct burial; in current practice, liability responsibility is covered, in part, by permit and, possibly, franchise terms and, in certain accidents, determined through litigation.

Franchise Issues. Official NYC planning activities for private real property started around the turn of the 20th century and led to increased local surface densities and increased subsurface PROW infrastructure densities to supply utility services for NYC's planned development. Official NYC activities, however, never included complementary subsurface PROW planning to address the inevitable subsurface PROW congestion that would result. This absence was likely the result of practical deference to the franchises that NYC had granted to private utilities for location of their transmission infrastructure. Depending on the time of the grant (ranging from before the 1898 NYC consolidation, to the period from consolidation until the 1989 City Charter revisions, to after 1989), these franchises were granted under a variety of then-existing legal authority. They are all, however, protected by the "contracts clause" of the US Constitution, which prohibits public franchisors from revising franchise terms unilaterally to reflect changing conditions, which makes reform of franchise pricing to support MUT financing difficult and thus requires negotiation of separate agreements with each utility as discussed above to support allocation of debt service and operations and maintenance costs. The NYS PSC rate tariff process for NYC utilities could, however, capture subsurface PROW value, based on the correlation between higher surface density and higher utility revenues, and negative direct burial externality costs to create a revenue source for utilities to pay their respective shares of debt service on MUT debt service and operation and maintenance costs to support MUT finance and reimburse NYC for negative direct burial externality costs.

MUT Planning and Logistical Issues. MUT implementation requires long-term subsurface PROW planning and leveraging innovative design and construction technology to make MUT implementation as cost-effective as possible.

Planning. The New York City Department of City Planning (DCP) focuses almost exclusively on NYC's buildable surface, but DCP's authorizing law does not limit its planning powers to the surface. DCP can focus its powers under the PROW through its street mapping power and through the City Planning Commission's authority to "plan for the city's development and . . . the physical planning and public improvement aspects of all matters related to the development of the city." The reciprocal relationship between the surface and the subsurface with private and public utilities supporting the economic vitality of an urban area and creating high urban surface densities with residential and commercial buildings that translate into customers for various utilities and utility revenues is the foundation for subsurface PROW mapping and comprehensive planning. NYC abandoned, in 1975, the master plan as the legal comprehensive planning standard for zoning activities and now uses flexible requirements for comprehensive planning on a sub-city geographic scale to operationalize changing public policy objectives through planning. Ensuring NYC becomes a "smart city" could be such a public policy objective supported by DCP planning. NYC can revise its uniform land use review process (ULURP) to include consideration of subsurface PROW network impacts for more action types and require DCP to add a subsurface PROW layer to the NYC street map with subsurface

infrastructure location data that NYC would require the utilities to disclose for public safety purposes.

Logistical. Direct burial already causes substantial disruption including road closures, which for roadway reconstruction projects can be on a longer-term basis, and utility shutoffs. MUTs can be designed within a shared civic information model (the infrastructure version of the building information model), which is a shareable 3- and 4-D computer platform that can generate design and construction drawings with budget and schedule information and efficiently support off-site prefabricated MUT construction to reduce construction costs compared to on site-construction and minimize installation time that might require temporary utility provision and/or utility shut offs. Continuing technical "state-of-the-art" MUT materials and construction research can lead to further construction and installation cost reductions over the long-term MUT installation period.

Roadmap to Action. The history of NYC's "subsurface spaghetti problem" and its experience with the MUT solution demonstrates the NYC's potential to innovate and the impediments to implementing MUTs, suggesting a roadmap for incremental change in the absence of strong external pressures requiring the MUT solution. Direct subsurface burial of utility transmission infrastructure beneath NYC's PROW began with its earliest water and sewer transmission services and was eventually expanded to include gas, electricity (and steam), and telecommunication technologies. NYC's subsurface spaghetti problem emerged in the early 19th century when each new utility sunk its mains in other utility ditches to reduce their own installation costs, which they financed individually with traditional debt. While water, sewer and gas were always underground, direct burial of electricity and telephony transmission lines began after the Blizzard of 1888 in parts of NYC where high surface densities existed and represented a technical improvement over their initial sidewalk pole location. Not all electric and telecommunications transmissions infrastructure is buried in NYC.

During early 20thcentury subway construction, politics prevented installation of engineering designs for utility "pipe subways" alongside the subway tubes, revealing excavation contractors as the losing stakeholder in city-wide MUT implementation, which would significantly reduce their business. In the late 1970s, OMB rejected DEP's proposal for a coherent system of subsurface utility separation for several major Manhattan roadway reconstruction projects on financial grounds because NYC's financial resources and market access were constrained as a result of the 1975 Fiscal Crisis. Twenty-five years later, in 2006, post-9/11 budget constraints stopped similar Con Edison and multi-agency proposals for targeted MUT implementation as a cost-effective solution to NYC's subsurface spaghetti problem. In 2013, the City Council required the Mayor's Office of Long-Term Planning and Sustainability (OLTPS) to produce a financial feasibility study for under-grounding overhead utility transmission lines to reduce storm-induced power outages. OLTPS's report reflected the embedded technology and finance practices that predisposed a negative result due to an unrealistic scope, reliance on data from a

larger system analysis, failure to consider social costs, and, without any reference to the 2006 Con Edison proposal, including costs that MUTs would have mitigated.

The linkage of subsurface infrastructure design and construction technology and finance embedded within the regulatory framework, evidenced in this history, makes reform difficult but not impossible. This existing framework impedes innovation, which is possible at the municipal level, so that multiple individually rational decisions continually lead to collectively irrational outcomes with increasingly iterative negative impacts. NYC is the only actor within the subsurface PROW stakeholder group that can change the calculus of utilities operating within its boundaries to move them from direct burial to MUT implementation and reduce direct costs to NYC and private utilities over the long-term while increasing roadway and infrastructure transmission systems' asset condition, resilience and sustainability by:

- treating consumption of inelastic subsurface PROW area as a market issue in the same way it treats consumption of a city's buildable surface area to accurately price subsurface PROW value
- accurately pricing negative direct burial externality costs imposed on the City's surface roadway system and its taxpayers
- regulating and planning for the subsurface PROW
- compelling production of subsurface infrastructure location data for public safety purposes
- revising NYS PSC tariffs for NYC utilities to include an incrementally higher level to reflect (a) subsurface PROW value to finance utilidor construction, operation and maintenance, reducing long-term costs and increasing system performance and resiliency, and (b) reflect negative direct burial externality costs to NYC until full MUT implementation achieved, both of which represent costs that are avoidable with MUT implementation.

In the absence of any galvanizing external pressure requiring MUTs, NYC can pursue an incremental approach.

NYC agencies could use innovative designs and technology short of implementing utilidors, such as trenchless technology techniques, removable pre-cast pavements and moving feasible private utility assignments under the sidewalks.	2006 Value Engineering recommendation from multiple agencies.
DOT could leverage its existing powers and revise its roadway excavation permit rules to implement most aspects of Chicago's life cycle damage prevention program, including assessing fees for stakeholder participation to cover additional expenses of DOT's proactive role in planning, inspection and enforcement. Over time, this would increase roadway design lives, reduce subsurface infrastructure damage from accidental excavation strikes, and produce current subsurface infrastructure locational data on a prospective basis.	State legislation likely necessary for DOT to operate the 811 system within NYC.

OMB to add opportunities during capital budget planning for multiple agencies identifying capital needs implicating the subsurface and utilizing the LAMP methodology and tool to consider innovative subsurface infrastructure designs, such as MUT's, which would support development of a pilot utilidor program as proposed in 2006 by Con Ed and city agencies (2006 VE recommendation), using 63-20 project-based financings.	Potential for a fresh round of road excavations under the recently approved series of franchises (New York City Council Resolution 1445-A, 2020) could accelerate movement to a pilot program.
If Intro. No. 2189 becomes law, which requires OLTPS again to study undergrounding power lines in NYC, OLTPS to use local city and utility (from joint bidding projects) construction cost data and utility trenching cost data instead of area-wide construction cost data; include analysis of social costs; and use Con Edison's 2006 pilot MUT implementation proposal to analyze mitigation of some of the costs identified in OLTPS 2013 study.	Con Edison's testimony at the November 19, 2021 hearing pointed to its plan to underground power lines in locations with overground transmission infrastructure, providing additional opportunities for pilot program.
DCP to revise ULURP to include consideration of subsurface PROW network impacts for more land use action types and to add a subsurface infrastructure layer to the city street map with subsurface infrastructure location data that NYC would require the utilities to disclose for public safety purposes.	2014 Harlem explosion and numerous but predictable major utility transmission main breaks provide the basis for public safety purpose rationale.
In future franchise authorizations, NYC could require pricing reflect subsurface PROW value and negative direct burial externality costs and compel utilities to disclose subsurface infrastructure location.	Prospective benefits not immaterial; post 1989 franchises have term limits requiring new franchise authorization.
A 2022 SIPA capstone project refined the 2020l LCCBA model focusing on quantifiable direct costs demonstrating a positive benefit: cost ratio for utilidor implementation and analyzed potential additional "smart city" direct cost savings from ITC applications made possible with utilidors.	Analysis would support NYS PSC rate tariff change discussed above.
Planned 2022 University of Toronto capstone project to develop a companion methodology to LAMP focusing on community needs that innovative subsurface infrastructure designs can help solve.	
Develop a public education campaign on the subsurface PROW infrastructure and connection to the larger systems for greater public awareness and stewardship of PROW assets.	Communications design and strategy to include collateral such as website, signage including construction hoarding with QR links to publicly available project information, brochures, ads.

If the 2014 East Harlem gas explosion did not operate as a galvanizing event to move toward implementing MUTs, it is difficult to imagine what would. The many other predictable major utility transmission main breaks that are too many to catalogue, most of which have root causes in inaccessible infrastructure causing suboptimal SOGR levels and asset conditions, have also not operated in the aggregate as a galvanizing pressure. There are several galvanizing pressures, however, that alone or together could move NYC closer toward MUT implementation. These include the potential for the State to tap the City's water resources to serve Nassau County, limits of taxation to resolve surface PROW congestion and the application of "smart" city technology to NYC's PROW.

- The State budget authorized a Water Supply Regionalization feasibility study to evaluate using NYC's water supply to provide Nassau County with an additional source of drinking water to help resolve water stress issues from Long Island aquifer pollution. If this study results in the State tapping the water system it created for the *developing* NYC metropolitan area to service Nassau County that is now within the *current* NYC metropolitan area, it could operate as an effective pressure for NYC, which has been able to tolerate water loss from undetected leaks, to move more quickly to MUT implementation.

- At some point, the limits of taxation in the form of congestion pricing to help reduce Manhattan's surface PROW congestion will become clearer. Road congestion will always be an urban problem in successful cities because surface PROW area supply is inelastic. Once the limits of taxation become clearer, subsurface infrastructure solutions amenable to user fees, such as underground parking garages and subsurface traffic bypass tunnels, would become attractive municipal options to reduce surface PROW congestion, pollution and noise, further supporting utilidor implementation.

- A city cannot be "smart" when its utility infrastructure is buried in the dirt , which constrains the ability of public and private utilities to take advantage of advanced ICT to monitor and manage their systems remotely to optimize system performance, realizing "smart city" direct cost savings, and improve systems' resiliency. Quickly evolving technology for electric vehicles will permit vehicles to "connect" with surface PROW infrastructure and communicate with them to realize a number of "smart" city transportation policies that "dumb" infrastructure will not permit. Construction material technology may also permit the roadway to charge electric vehicles. Cutting into the surface PROW, as a "complete" street that now includes a variety of sustainable street applications, such as porous asphalt and pervious concrete and a variety of landscape features to capture stormwater, will increase the cost of street excavations for buried infrastructure. To the extent the surface PROW includes more "smart city" technology, the cost of street excavations will only increase and limit the ability of NYC to achieve various policy objectives that can be accomplished with surface PROW materials and designs.