

FROST & SULLIVAN

BEST PRACTICES

AWARDS

FROST & SULLIVAN

2020 BEST PRACTICES AWARD



**2020 GLOBAL
SUBSURFACE UTILITY ENGINEERING DATA
ENABLING TECHNOLOGY LEADERSHIP AWARD**

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Background and Company Performance

Industry Challenges

Across the globe, stakeholders in and around construction projects need accurate location information to map out the complex web of underground infrastructure (water, electric, sewer, gas, drainage, and communications) pipes and lines. Knowing the location of this underground infrastructure is important for regular inspection and maintenance; critically, new construction projects require accurate location information of all the potential obstacles in an area. Subsurface utility engineering (SUE) aims to map and verify underground infrastructure and utilities. While records and precautions may already exist for working in urban settings, rural areas pose a more significant challenge over survey zones that are orders of magnitude larger.

While builders, professional bodies, and regulators may have established processes for ensuring a clear understanding of a subsurface area of interest, the number of potential safety issues, cost overruns, and excavation strikes highlight the shortcomings of existing processes. The American Society of Civil Engineers defines and recommends four quality levels (QL) for collecting and presenting subsurface utility data: (QLD-manual records search, QLC-manual field investigation, QLB geophysical utility locating, and QLA-utility exposing). Unfortunately, records searches may not present an accurate or up to date picture of existing underground engineering, in which case the on-site manual processes (QLB and QLA) becomes necessary for a larger area. Using ground-penetrating radar and excavation machinery to detect piping is a painfully slow and expensive process.

For major projects, SUE costs run into the tens of millions of dollars. The SUE surveying process can take several months to complete, in large part due to the painfully slow manual detection methods tracing the course of pipes and infrastructure across numerous miles of rural area. Moreover, each time the actual location of underground utilities does not match records and building plans, it drives up construction delays, claims and change orders, and budget overruns. Additionally, relocating the utilities can open the door to even more extensive and expensive delays and overruns. The safety risks, as well as direct and indirect costs, of relocating subsurface utilities and piping can become immense.

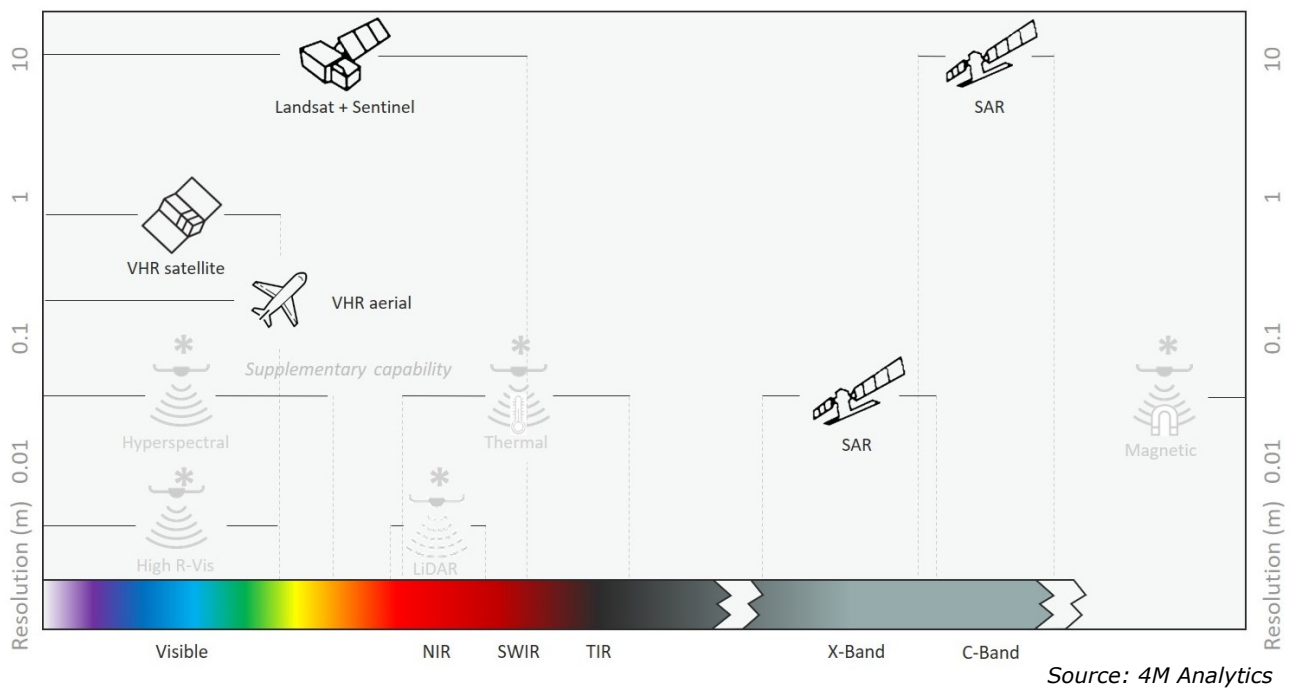
Construction companies and consultants, water and gas utilities, telecommunications providers, energy companies, as well as departments of transportation and local regulators each routinely spend 1.5% or more of multi-billion dollar projects on SUE. A more efficient SUE mapping process could save substantial costs and speed overall construction substantially. Additionally, in the midst of the COVID-19 pandemic builders are embracing digital transformation efforts that can minimize costly and manual fieldwork. The landscape of SUE services remains bound to traditional practices for data collection and analysis, while stakeholders appeal for more streamlined solutions.

Technology Leverage and Customer Impact of 4M Analytics

Realizing that new technologies brought to bear upon the classic issues of SUE could yield significant time and cost savings, 4M Analytics (4M) developed a distinctive solution to pinpoint underground utilities. After more than three years of research and development, the company launched in January 2019 and is already selling services commercially and gaining seed funding to expand globally. Collecting massive amounts of data and utilizing advanced remote sensing capabilities, artificial intelligence (AI) and computer vision in a data fusion engine delivering meaningful insights from the data captured, 4M defines and delineates the SUE in an area of interest and minimizes the areas requiring manual investigation.

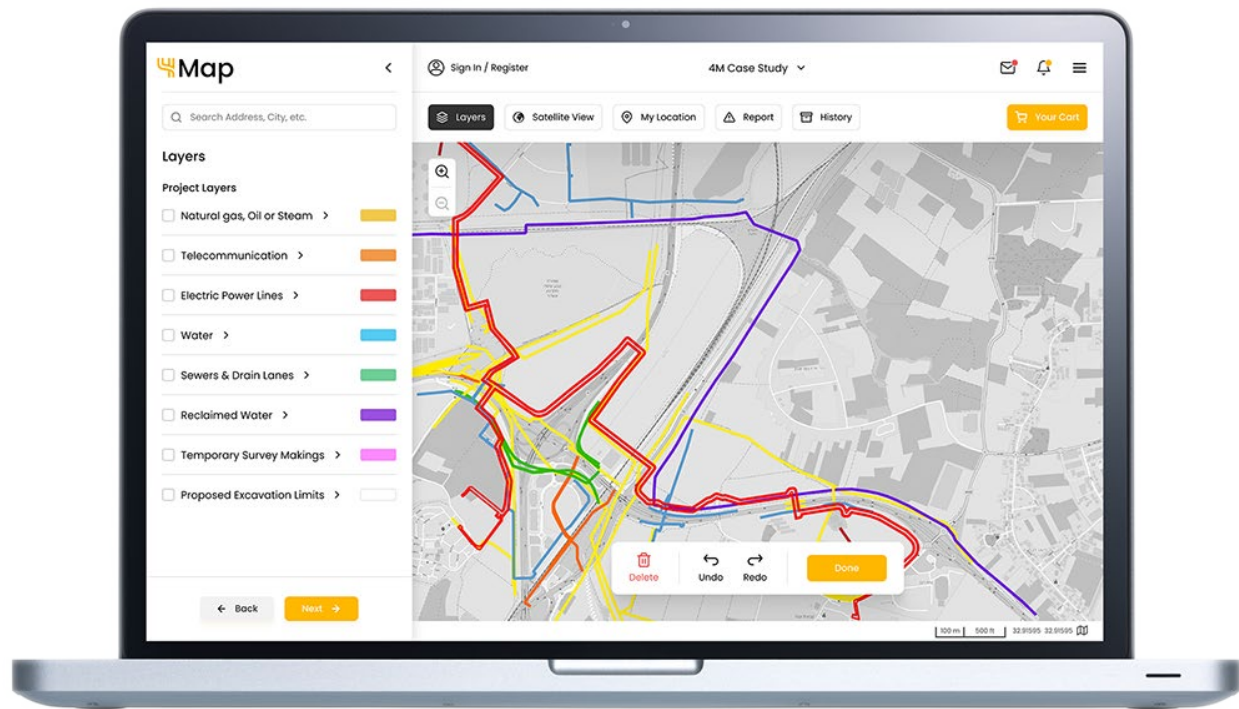
An Innovative Data Fusion Engine

With its proprietary data fusion engine, 4M harvests, analyzes, and presents massive amounts of data in a clear and precise utility conflict map of the most up-to-date and comprehensive subsurface utilities. When a client marks out the area of interest or a pipeline of interest, 4M automates much of the process unfolding in multiple data collection and analysis stages.



Applying computer vision algorithms to the data sets, the data fusion engine detects and identifies all surface unique phenomenon that indicates on subsurface utilities. The data fusion engine aggregates and performs data mining processes to detect patterns and define the parameters and path of pipelines and infrastructure in question. After rating the sources and resolving conflicts to express a single truth, 4M will place the entire dataset into the growing database of surveys. Finally, 4M will deliver to clients a comprehensive multi-layered utility conflict map of the area.

Multi-layered Smart Maps



Source: 4M Analytics

100% Coverage

Unlike traditional SUE surveying methods that document only a fraction of the area with high-quality investigation methods (QLB and QLA), 4M acquires 100% data coverage over an area. 4M's multi-source methods make QLD-level research redundant, automate QLC level field investigation, and expand QLB level geophysical utility locating to include the entire area of interest. Rather than using ground-penetrating radar to trace the specific line or path of subsurface utility, 4M precisely locates all of the underground structures in the demarcated polygon or square mile area. As 4M uses automated and remote sensing methods to gain highly accurate QLC and QLB level data, the survey can expand easily to the entire area of interest and minimize the need for QLA utility exposing.

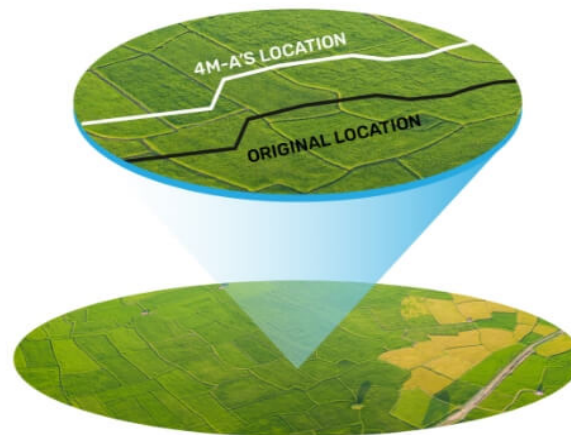
Scalable Solution Enables Cost Savings

Impressing Frost & Sullivan, 4M's innovative approach enables a highly scalable and efficient solution that can yield massive savings for customers. Leveraging multiple layers of remote data acquisition, 4M reduces the amount of fieldwork required. Minimizing the groundwork cuts costs dramatically and makes scaling up the scope of a project or survey area simple. While current SUE methods require three to twelve months to collect, process, and a survey (from manual records search to manual field locating), 4M can produce the same quality and more easily digestible results (in a smart map) in only days.

For example, as an early proof of concept for a gas company, 4M is aiming to undertake an investigation of Israel's entire land area. Working in one-kilometer by one-kilometer

grid squares and using the multi-temporal algorithms, 4M detected all the subsurface utilities and aggregated all of the grids together into a unified map. Within one week, the company produced a result for the customer and did all the work remotely from the office. In forthcoming commercial releases, 4M can then format the map into a comprehensive database, which can grow dynamically to include larger and larger areas. The company will cover large portions of a given country, with the United States as the first market, in an easily accessible platform that can be delivered as-a-service and with the vision to scale up a database to include the entire United States, and eventually the entire globe.

Highly Accurate Location Information Minimizes Manual Investigation



Source: 4M Analytics

Map-as-a-Service Makes Data Applicable in Real-Time

Preparing to launch its mapping as a service product, 4M will deliver the enhanced maps through its 4MAP and 4DIG applications (apps). In the easily consumable app format, the mapping-as-a-service model facilitates relevant stakeholders in a project to optimize planning and collaborate over a single source of truth for all subsurface infrastructures. In the 4MAP application, a customer can draw a polygon at the desired location on the map, press purchase, and gain access to all of the area's utilities based on 4M's cloud. Customers can also upload their planning files, draw the area of interest in a polygon and select the designated quality level desired. The app can display different utilities in the area and relevant details, enabling the customer to purchase detailed subsurface maps quickly and easily.



Source: 4M Analytics

The 4DIG mobile app, slated for release by the end of 2020, serves as a real-time tool for matching excavation with underground utility locations. Leveraging the highly accurate location information, the app monitors the position of heavy machinery operators digging in an area and alerts them, and supervisors, when in proximity to underground utilities. Informing operators where to take caution and when underground utilities present a hazard, the 4DIG app enhances situational awareness and helps prevent damage and accidental strikes.

A Field Focus Derived from Experience

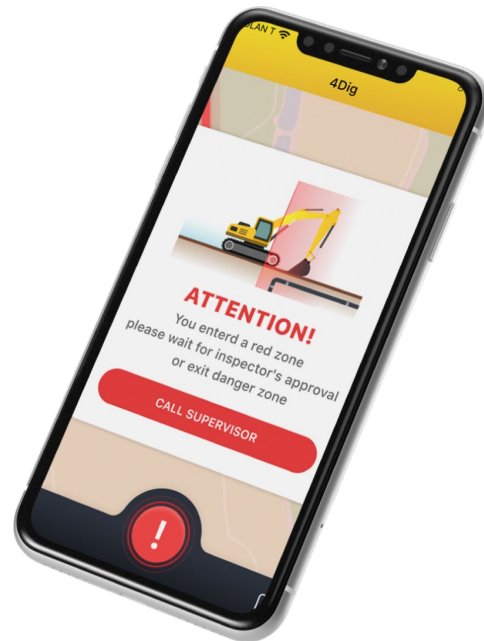
Admirably, 4M maintains its core value as a field-oriented solutions provider. Supporting the needs of those in the field, and minimizing the extra work required, 4M prioritizes listening and learning to customers. This orientation stretches back through the experience of many 4M team members, coming from military engineering and utility engineering backgrounds. Indeed, many of the same founders and team members at 4M Analytics worked in a previous permutation of the company, called 4M Defense, which used similar technology in buried explosive ordnance clearance applications. With that knowledge of the consequences of excavating an area without awareness of the underground structures, 4M combines expertise and dedication.

Conclusion

While subsurface utilities engineering (SUE) surveys can require months, if information proves inaccurate relocating underground utilities can delay timelines and send project costs spiraling upward. Leveraging automation to harvest and process massive amounts of data in its multi-source data fusion engine, 4M Analytics (4M) delivers to customers a highly detailed and highly accurate, up-to-date, interactive smart map of all underground utilities and structures. In contrast to typical SUE surveying programs, which typically require several months to compile, 4M's solution requires only days and informs builders with a real-time picture of the infrastructure landscape below the surface, before the construction planning phase. Covering more area with greater accuracy, 4M offers an actionable solution at unprecedented scale and low cost.

With its innovative technology generating a scalable and reliable subsurface mapping solution, 4M Analytics earns Frost & Sullivan's Global 2020 Enabling Technology Leadership Award in subsurface utility engineering data.

4DIG App Alerts Near Hazards



Source: 4M Analytics

Significance of Enabling Technology Leadership

Ultimately, growth in any organization depends on customers purchasing from a company and then making the decision to return time and again. In a sense, then, everything is truly about the customer. Making customers happy is the cornerstone of any successful, long-term growth strategy. To achieve these goals through enabling technology leadership, an organization must be best in class in three key areas: understanding demand, nurturing the brand, and differentiating from the competition.



Understanding Enabling Technology Leadership

Product quality (driven by innovative technology) is the foundation of delivering customer value. When complemented by an equally rigorous focus on the customer, companies can begin to differentiate themselves from the competition. From awareness, to consideration, to purchase, to follow-up support, organizations that demonstrate best practices deliver a unique and enjoyable experience that gives customers confidence in the company, its products, and its integrity.

Key Benchmarking Criteria

For the Enabling Technology Leadership Award, Frost & Sullivan analysts independently evaluated Technology Leverage and Customer Impact according to the criteria identified below.

Technology Leverage

Criterion 1: Commitment to Innovation

Requirement: Conscious, ongoing adoption of emerging technologies that enables new product development and enhances product performance

Criterion 2: Commitment to Creativity

Requirement: Technology leveraged to push the limits of form and function in the pursuit of “white space” innovation

Criterion 3: Stage Gate Efficiency

Requirement: Adoption of technology to enhance the stage gate process for launching new products and solutions

Criterion 4: Commercialization Success

Requirement: A proven track record of taking new technologies to market with a high rate of success

Criterion 5: Application Diversity

Requirement: The development and/or integration of technologies that serve multiple applications and can be embraced in multiple environments

Customer Impact

Criterion 1: Price/Performance Value

Requirement: Products or services offer the best value for the price, compared to similar offerings in the market.

Criterion 2: Customer Purchase Experience

Requirement: Customers feel they are buying the most optimal solution that addresses both their unique needs and their unique constraints.

Criterion 3: Customer Ownership Experience

Requirement: Customers are proud to own the company’s product or service and have a positive experience throughout the life of the product or service.

Criterion 4: Customer Service Experience

Requirement: Customer service is accessible, fast, stress-free, and of high quality.

Criterion 5: Brand Equity

Requirement: Customers have a positive view of the brand and exhibit high brand loyalty.

Best Practices Recognition: 10 Steps to Researching, Identifying, and Recognizing Best Practices

Frost & Sullivan analysts follow a 10-step process to evaluate Award candidates and assess their fit with select best practice criteria. The reputation and integrity of the Awards are based on close adherence to this process.

STEP	OBJECTIVE	KEY ACTIVITIES	OUTPUT
1 Monitor, target, and screen	Identify Award recipient candidates from around the globe	<ul style="list-style-type: none"> • Conduct in-depth industry research • Identify emerging sectors • Scan multiple geographies 	Pipeline of candidates who potentially meet all best-practice criteria
2 Perform 360-degree research	Perform comprehensive, 360-degree research on all candidates in the pipeline	<ul style="list-style-type: none"> • Interview thought leaders and industry practitioners • Assess candidates' fit with best-practice criteria • Rank all candidates 	Matrix positioning of all candidates' performance relative to one another
3 Invite thought leadership in best practices	Perform in-depth examination of all candidates	<ul style="list-style-type: none"> • Confirm best-practice criteria • Examine eligibility of all candidates • Identify any information gaps 	Detailed profiles of all ranked candidates
4 Initiate research director review	Conduct an unbiased evaluation of all candidate profiles	<ul style="list-style-type: none"> • Brainstorm ranking options • Invite multiple perspectives on candidates' performance • Update candidate profiles 	Final prioritization of all eligible candidates and companion best-practice positioning paper
5 Assemble panel of industry experts	Present findings to an expert panel of industry thought leaders	<ul style="list-style-type: none"> • Share findings • Strengthen cases for candidate eligibility • Prioritize candidates 	Refined list of prioritized Award candidates
6 Conduct global industry review	Build consensus on Award candidates' eligibility	<ul style="list-style-type: none"> • Hold global team meeting to review all candidates • Pressure-test fit with criteria • Confirm inclusion of all eligible candidates 	Final list of eligible Award candidates, representing success stories worldwide
7 Perform quality check	Develop official Award consideration materials	<ul style="list-style-type: none"> • Perform final performance benchmarking activities • Write nominations • Perform quality review 	High-quality, accurate, and creative presentation of nominees' successes
8 Reconnect with panel of industry experts	Finalize the selection of the best-practice Award recipient	<ul style="list-style-type: none"> • Review analysis with panel • Build consensus • Select recipient 	Decision on which company performs best against all best-practice criteria
9 Communicate recognition	Inform Award recipient of Award recognition	<ul style="list-style-type: none"> • Announce Award to the CEO • Inspire the organization for continued success • Celebrate the recipient's performance 	Announcement of Award and plan for how recipient can use the Award to enhance the brand
10 Take strategic action	Upon licensing, company is able to share Award news with stakeholders and customers	<ul style="list-style-type: none"> • Coordinate media outreach • Design a marketing plan • Assess Award's role in future strategic planning 	Widespread awareness of recipient's Award status among investors, media personnel, and employees

The Intersection between 360-Degree Research and Best Practices Awards

Research Methodology

Frost & Sullivan's 360-degree research methodology represents the analytical rigor of our research process. It offers a 360-degree-view of industry challenges, trends, and issues by integrating all 7 of Frost & Sullivan's research methodologies. Too often companies make important growth decisions based on a narrow understanding of their environment, leading to errors of both omission and commission. Successful growth strategies are founded on a thorough understanding of market, technical, economic, financial, customer, best practices, and demographic analyses. The integration of these research disciplines into the 360-degree research methodology provides an evaluation platform for benchmarking industry participants and for identifying those performing at best-in-class levels.



About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, enables clients to accelerate growth and achieve best-in-class positions in growth, innovation and leadership. The company's Growth Partnership Service provides the CEO and the CEO's Growth Team with disciplined research and best practice models to drive the generation, evaluation and implementation of powerful growth strategies. Frost & Sullivan leverages more than 50 years of experience in partnering with Global 1000 companies, emerging businesses, and the investment community from 45 offices on six continents. To join our Growth Partnership, please visit <http://www.frost.com>.