How can a natural gas pipeline, just a few tens of miles long, produce more headaches, frustration, delays and public opposition – and cost more – than a line of a few hundred miles? It can, if that line is in a dense urban environment. Learning how to embrace the complexity involved in urban pipeline routing is the key to success for many distribution pipeline system operators.

This is because the worldwide growth of cities is causing them to be denser and more compact, with many competing demands on the available space. Yet, those city dwellers also want access to cheap and reliable natural gas, so utilities must provide service where they want it.

Another worldwide problem is that many of the gas distribution systems in city centers are undersized and antiquated – “legacy” systems that may date back to the 1950s or even before. They weren’t designed for the service life being asked of them. Many of these lines may have stress corrosion issues and other risk factors that can put the public at increased risk of a leak, or even explosion.

So, there is an increasing need for new, replacement gas pipelines 20 inches (508 mm) or more, squeezed into tight spaces that are already crowded with other utilities – and aboveground uses as roadways, pedestrian and bicycle routes, green spaces and other purposes.

Our experience with urban pipelines has found that success involves a new, inclusive way of planning, backed by current information technology.

The good news is that the principles that work for large-diameter lines under cities can also make pipeline construction easier in more open areas.

Leaving the Silo

One of the barriers to successful urban pipelines comes from the traditional design of many organizations, including pipeline operators – the corporate silo.

Usually, the first designs of a pipeline route would come from engineers, who would select a route that is as straight, constructible and low-cost as possible. They would then pass that design, optimized for its technical aspects, over to permitting to obtain approval from municipal and other authorities.

The permitting people would shake their heads because they know that city public works department and elected officials will never approve certain aspects of the route selected. This might be because construction would involve too much traffic congestion, disturbance of green space...
or conflict with other underground utilities. Other regulatory authorities, at other levels of government, will also have their requirements the project must meet.

After some back-and-forth, a compromise routing is selected that is expected to be buildable and able to obtain regulatory approval.

The plan then gets passed on to a third silo, which is responsible for engaging with the public and other key stakeholders, to hopefully gain their support for the project – or at least to prevent public opposition from stopping or slowing the work.

These people, in turn, shake their heads over what they’ve been given to work with, because they can see elements of the routing that will be flash points for public opposition. They point these problem areas out, and eventually a routing and work plan slowly and painfully evolve.

Each of those three functions – technical, regulatory and environmental, and socioeconomic – has its own priorities. From the perspective of other disciplines, they are not even speaking the same language.

Optimizing for one of those aspects might well result in choices that would be unworkable from the perspective of the other two functions. What is needed is a plan that all involved can, even if reluctantly, support.

What we have found best is a process that breaks down those silos to develop a solution that avoids hard stops that would make a pipeline impossible.

Even in an age of virtual meetings and shared databases, there is still huge benefit to bringing together representatives of all stakeholder groups into a single room, so they can provide their perspective and expertise, and point out aspects of a possible route that would be unworkable.

This can include people from engineering, permitting, social engagement, environmental, customer relations, marketing and other divisions within the organization. There may be need for external expertise not available in-house, possibly including consulting archaeology and indigenous representatives.

Each of these representatives shares their concerns and priorities about route selection. Facilitators record these concerns and attach a weighting to each. Sometimes it takes two or three meetings to uncover all the aspects that need to be considered.

Use Technology

Current information technology can take the input from those meetings to better understand the factors at work. For example, the technical function may like the idea of a long, straight section of the route, as it can be optimal for horizontal directional drilling. If this design also works for the other two functional areas, that might be a routing option that gets chosen.

Many pipeline route planners like the idea of using existing roadways, because almost every customer will be located beside a road or street, particularly in an urban environment. But, it may be that this would not be constructible because the space under the roadway is already packed tight with sewers, water mains, fibre optic cable and other utilities.

Software is available that uses geographic information systems (GIS) data to factor in a wide range of spatial and 3-D considerations, including existing utilities, land uses, topography, watercourses, natural habitat and parkland. Values are assigned to each of these factors – a park might be a complete no-go area for pipeline routing, for example, while a stretch of roadway not underlain with many other utilities might be considered a strong “attractant” for the pipeline route.

The software then uses a “quadruple bottom line” approach – environmental, technical, regulatory and social factors – to evaluate the desirability of various options and trade-offs to find the best-fit solution. The result is a transparent process, easily understood by all stakeholders, that helps determine the best – or least-bad – choices in pipeline routing.

This hard data, including technical and nontechnical risks, give project proponents something credible and transparent to use not just in costing the project, but in understanding the constraints on building it. For example, a cut-and-cover section in a roadway might have to be carried out only
at night, and the work covered over with steel plates each morning before the commuter traffic starts to build. This aspect needs to be factored into the financial budget, timeline and work plan.

**Network of Possibilities**

One of the growing areas of focus in pipeline route planning is the idea that the routing choices do not form a single line, or even a choice between several possible competing routes. Rather, the potential routes together may comprise a network of individual sections between nodal points on a map. This means the planning process involves a network of possible routes, each segment of that network meeting at those nodes.

If a segment between two nodes is found problematic due to some constraint, another route can be chosen. This means that planners can assemble a best-possible route combining the most workable segments between nodes, to meet the purpose of the pipeline.

The objective is to maximize “optionality” – the generation of a wide range of options all prescreened for quadruple bottom-line factors, partly to demonstrate to all involved that every practical alternative has been considered, and to allow the best combination of segments to emerge.

**Project ‘De-Risking’**

One of the trends in large projects today is toward a greater and earlier role for stakeholder consultation. Experience has shown that people affected by urban pipeline projects take a keen interest in the work and how it will be done, often because they live, work or play nearby. It’s their roads that will be torn up for pipeline installation, and they who will be affected by the noise of construction equipment. On the other hand, these people are also aware that the buildings they use would be uninhabitable in the winter without access to natural gas, so they are willing to put up with the disruption – it’s a necessary evil.

Face-to-face meetings and presentations, open houses and other in-person communication are key. The proponent’s message can be spread further, however, by current information technology. Interactive informational kiosks set up in the project area can provide information on the project, the routing choices under consideration, and public invitations so the community can weigh in on their preferences. Websites and apps can support this process.

Stakeholders can try out various scenarios by changing the weights assigned to aspects of the project, such as weighing the advantages of a faster completion that might involve more road closures versus a longer schedule that will have less impact on traffic.

Sometimes, there are win-win aspects to the project, such as having the project proponent add some high-quality green space to be completed after the pipeline is installed.

This focus on public consultation can help “de-risk” the project, in that the public is given a forum in which they can make their views known, making it less likely that they will protest the project. For all operators, risk and delay equal unnecessary cost that otherwise may have been avoided.

This process for pipeline route planning helps uncover no-go areas from any perspective. It also helps uncover caution areas, possibly those for which strategic public engagement is particularly important, or studies will need to be done to determine the pipeline’s impact. The result is a route that is workable from all perspectives and can be built relatively quickly, in that potential problems have already been discovered and risk management steps taken. **PG&J**

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