FEDERAL TRANSIT ADMINISTRATION (FTA)
PROJECT MANAGEMENT OVERSIGHT PROGRAM

Utility Relocation - Challenges and Proposed Solutions

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EXECUTIVE SUMMARY

Background

Utilities within most public rights-of-way serve public and private consumers. Transit projects involve the development and/or modification to this existing underground and overhead infrastructure. The need to relocate or remove existing utilities on transit project sets up encounters with known, unknown, unmarked, or abandoned utilities. Along with dealing with the existing utilities, the new transit project utilities must work within the overall existing infrastructure.

Developing an effective plan to manage utility relocations on any project is critical to the overall project success. Utility relocation can become one of the greatest risk factors to the schedule and cost of transit projects. This *Utility Relocation White Paper* defines the best practices to deal with utility relocation challenges through proper risk evaluation, planning, and implementation.

Note that the naming of specific software packages throughout this *White Paper* is not an endorsement of such software by the FTA. The mention of these software packages stems only from the fact that such software was used in this *White Paper's* study projects. There are other, comparable software packages that are at least equivalent to the named software packages.

Utility Relocation White Paper Method of Study

FTA chose six projects for the *White Paper*, four with challenges related to utility relocations and two with successes. The FTA's Project Management Oversight Contractors (PMOCs) who helped in this effort interviewed both the FTA Regional staff and the Project Sponsors of each project.

The projects with utility relocation challenges are identified as:

- Project A – A bus rapid transit project in an urban region.
- Project B – A streetcar project in a large city center.
- Project C – A light rail project in a downtown.
- Project D – A light rail transit extension project in a mid-sized city.

The successful utility relocation study projects are identified as:

- Project E – A trolley, light rail extension project in a large city.
- Project F – A streetcar extension project in a mid-sized city.

Each PMOC used the same questionnaire to guide the interviews. This questioning format yielded consistency among the PMOCs, the regional offices, and the project sponsors. After the interviews were completed, each PMOC wrote a short summary of each interview within this common framework.

The findings of this *White Paper* are driven by actual projects and project experiences, highlighting lessons learned and best practices that may be employed to yield positive future outcomes with respect to utility relocations. The process utilized a high-level empirical method to identify engineering and project management practices for utility relocations.

Utility Relocation White Paper Summary/Conclusions

Utility relocations often represent the greatest risks to scope, cost, and schedule of a project. Mitigating these risks within project constraints is daunting, even for those experienced in project management, design, and construction. This *Utility Relocation White Paper* offers practical advice for managing the data acquisition, data management, partnering and stakeholder relations, design, project contracting, and tools for project data management.

These best practices, integrated into projects, can result in fewer contractor delay claims and change orders, that is, less lost time and reduced chance of cost overruns, which should help the transit project to enter revenue service on schedule and meet the public's expectations. Best practices are found under Section 3 of this *White Paper*. The section includes general discussions to a recommended framework for handling project utility relocations.

Section 1: Utility Relocation Challenges

Four FTA projects that faced challenges during Utility Relocations

1. Project A - A bus rapid transit project in an urban region

   Challenges:

   The Project Sponsor had Utility Agreements and an Advance Utility Relocation Contract associated with the Project. As such, the Project Sponsor attended Weekly Utility Coordination meetings hosted by the City to help mitigate the utility conflicts. However, these measures were not as effective as expected as the City did not enforce its Franchise Agreements with the affected utilities; therefore, the Project Sponsor had to coordinate and pay for the required utility relocations using project resources. Neither the Master Cooperation Agreements (MCAs) with the City nor the Utility Agreements with the utility providers included provisions for expediting the permitting process due to the segmented and disjointed distribution of the jurisdictional authority within multiple local agencies.

   The Franchise Agreements put the responsibility and cost for resolving conflicts on the utility providers, but did not prioritize the work to align with the Bus Rapid Transit (BRT) schedule. This mismatch created an inherent tension between the utility owners and the Project team. Even though a Franchise Agreement was in place for the State portion of the corridor, the absence of franchise rights in the City portion meant that the utility conflict costs had to be paid as a project expense.

   The as-built drawings provided to the Project Sponsor by the City and various utility companies were not accurate or current, so there were numerous claims by the contractor for differing site conditions.

   The advance utility relocation contract was limited to resolving conflicts near or under planned bus-stop platforms, but as the project developed, some platforms were withdrawn from the project. Even with a lesser scope of work, the main contract still contained a significant amount of utility mitigation work that was scheduled at the same time as other BRT construction.

   The utility representatives attending the Utility Coordination meetings did not have the technical knowledge, control over internal operations, or decision-making authority to make commitments to address utility issues in a timely manner consistent with the construction schedule.

   The Project required over 150 traffic signal modifications and new installations which exposed underground and overhead utility conflicts. These conflicts had to be resolved with the utilities, but also with the City and State's review process to approve deviations from plans to avoid the utilities which resulted in additional schedule delays.

The inability to get the utility relocation work designed, permitted, and completed in a timely manner resulted in 460 days of delay to the Project, and included significant delay claims which resulted in increased costs to complete the project.

2. Project B - A streetcar project in a large city center

Challenges:

With some utilities that date back to the mid-19th century and without accurate records of underground utilities, the project encountered issues like many other projects in older cities in the United States. Often, if utilities were no longer needed, they were abandoned in place. Newer utilities, especially those that were not gravity-flow lines, were laid atop *or even inside* abandoned lines. Project B engineers referred to this state of the existing utilities as a "bowl of spaghetti."

During the design phase, the Project Sponsor conducted Weekly meetings to coordinate the known utility relocation information, and at most meetings, all of the utility companies were present. At the 30% design, the plans showed nearly the entire alignment of the project, and by the 60% design, 100% of the alignment layout was completed, with stations and offset details. At the 60% design, the utilities had the needed assurances of the project alignment and became more engaged in the Weekly meeting process.

The City Project Sponsor held the Franchise Agreements for all utilities within the streetcar right-of-way. Delays in identifying owners of unknown utilities adversely impacted the project. Overall, there were 17 utilities within the right-of-way of Project B. Though potholing and water-jetting were implemented on the project, unknown utilities were discovered during construction, and often no utility company would claim ownership of the unknown utility. This "not ours" stance by the utility owners caused time and cost delays, and opened the project to schedule risk and cost overruns.

Project B was defined by three distinct loops, and three-block sections were cleared of utilities within the three loops. Once a section was cleared, the track-slab crew began work within that section. The utility work-plan was to be sequential, but track slab crews often needed to "leap-frog" to the cleared sections that were out-of-sequence. This resulted in change orders for the costs of leap-frogging, but there was no lengthy downtime on any one section of construction.

The greatest problem with Project B, aside from delays related to identifying unknown utilities, was related to ownership of the Franchise Agreements. Franchise agreements are typically drafted between a local government and the private/public utilities, allowing those utilities restricted use of the public right-of-way. Most often in these agreements, the utilities must relocate their utilities at no cost to the local government.

As noted before, the City held the Franchise Agreements for all utilities within the streetcar right-of-way. By way of background, the City had submitted the Grant Agreement (GA) and named the City as the recipient/grantee of the funds. However, since the City was not a FTA grantee at the time, another agency had to step in as their Limited Agent/Designee for the FTA to grant the award and perform the design/construction of the project.

The other agency that had to step in was the Project B Project Sponsor responsible for overseeing the design and construction. However, the agency's charter documents within the State stated, "…*for any* *agency project, the agency would compensate utilities for clearing within their new right-of-way.*" Even though the agency was the implementing agency and grant holder for Project B, the agency did not hold the Franchise Agreements, and the agency did not have title to the right-of-way. Many of the private utility companies, perhaps sensing a "weakness" between the Franchise Agreements and the agency's root charter, made the claim that they did not have to honor the Franchise Agreements since those agreements were with City and not the agency. The complex relationship between the agency and City also accounted for why the utility companies challenged the Franchise Agreements.

This was an unforeseen cost risk for Project B. Through a series of negotiations by agency/City, the City Franchise Agreements withstood this challenge.

3. Project C - A light rail project in a downtown

Challenges:

The Project Sponsor described the reasons for the challenges with utility relocations within the City Center section of the project. According to the Project Sponsor, the corridor through downtown is very constrained, especially for relocating utilities underground. The Project Sponsor noted that there were many utilities in the City Center area, and the designs had to be coordinated to get agreement from all utility owners on the final locations for each owner's wet or dry utility line. One of the more difficult challenges was getting third party approvals and construction permits. The Project Sponsor had to coordinate the designs of multiple utility owners in very constrained right-of-way. Each of the utilities required maximizing the clearance area around their specific utility line. This requirement left the Project Sponsor in the role of negotiating designs for each of the utilities. Each time a utility needed or requested a change in location, the Project Sponsor had to go back to each of the other utilities affected to obtain their approvals. This often led to multiple iterations of designs before reaching consensus.

Another challenging issue included several value engineering efforts that led to unsuccessful design changes. The Project Sponsor also experienced delays in acquiring the needed right-of-way to allow work to proceed in some key areas. Real estate acquisition delays were caused by late identification of properties that would be needed for the project. The Project Sponsor also noted that utility owners would change their requirements after the designs had been completed and/or the relocation work had been started.

Perhaps the biggest utility relocation problem experienced by the Project Sponsor was the result of the Project Sponsor's assumption that they could get waivers for some of the clearance requirements. The Project Sponsor's basis of design at the outset was to minimize the right-of-way needed for the project. As a result, there were locations where the required minimum utility clearances could not be met within the right of way. As the Project Sponsor started seeking construction permits for these designs, the utility departments refused to grant the variances/waivers needed by the Project Sponsor to relocate the utilities within the acquired right-of-way. The refusal resulted in the Project Sponsor having to redesign without the need for variances. The time to complete a redesign led to the Project Sponsor's decision to cancel its $400M contract for the City Center utility relocations. This misperception between the Project Sponsor and the Project Sponsor's utility departments caused an approximate three-year delay to the project, which placed the City Center utility relocation work on the critical path.

4. Project D - A light rail transit extension project in a mid-sized city

   Challenges:

   The Master Cooperation Agreements (MCAs), Franchise Agreements, and Weekly Coordination meetings were not as effective in expediting the required utility relocations as expected. The Project Sponsor did not enforce its Franchise Agreement with the utility owner. Although the Project Sponsor could have challenged the claim (and likely win), a Settlement Agreement was reached to split the relocation costs and keep the project on schedule. In addition, the utility representatives attending the Coordination meetings had segmented responsibilities and decision-making authority, so it was difficult to get commitments to perform the utility work.

   The utility as-built drawings, provided by the City Project Sponsor to the Project Sponsor, were not accurate or up-to-date. This resulted in design changes and claims for differing site conditions.

   As a consequence of the inaccuracy of the Project Sponsor's as-built drawings, the Project Sponsor underestimated the scope, schedule, and costs for utility relocations during the Project Development and the Engineering Design phases.

   Due to early "budget concerns," the Sponsor chose to do minimal advance potholing during the design phase to verify the location of the utilities, did not clearly define the scope of the utility relocations, and did not establish the means to expedite the utility relocation work. These actions, early in the project, resulted in higher costs by the end of the project. In addition, the potholing by the contractor was not used to inform the mitigation of potential utility conflicts (per the contract specifications).

   The utility relocations required redesign by the Project Sponsor and approvals by the Project Sponsor that resulted in contractor claims for delays and additional costs for utility impacts.

Section 2: Utility Relocation Successes

Two FTA projects that were successful during Utility Relocations:

1. Project E - A trolley, light rail extension project in a large city

   Successes:

   Lines of communication were established early in the project at high levels of management, between the Project Board of Directors and utility company Chief Executive Officers (CEOs). These lines were established because the Project Board was engaged and wanted to be involved. This significant political support for communications with the utility companies set the stage for cooperation and coordination. This communications protocol also provided a natural means to escalate issues, though there were few instances where escalation was needed.

   Significant effort to identify utility information and conflicts started early in the design process. At this early stage, team members were assigned responsibility for initial utility identification and subsequent coordination. These same team members remained dedicated to the assignment throughout the design and construction phases. The longevity and consistency of these personnel assignments allowed strong relationships and lines of direct communication to develop between agency and utility counterparts.

Prior to construction, the Project Sponsor entered in to a Pre-Construction Services Agreement with its Construction Manager/General Contractor (CM/GC). This Agreement included utility relocation coordination, and provided a smooth transition into construction. During the construction phase, the CM/GC led and took over responsibility for utility relocations, with the original Planning/Design team continuing to participate as needed, for continuity. As new partners were introduced into the process, the Project Sponsor was careful to maintain a consistent process for utility relocations and executed the established plan.

Various approaches were implemented to address the inherent utility relocation challenges. Utility relocations posed significant risks to the project throughout the corridor, and it was only navigated through active, on-going implementation of mitigations. Mitigations included meetings, tracking, following-up on action items to maintain accountability, schedule workarounds, communication, cost negotiations, enforcement of compliance with federal regulations, and dedicated attention throughout the project. Some of the specific solutions to the utility relocation challenges are noted below:

a) Agreements:

Executive leadership's close relationship with utility executives was critical to set up agreements to document delivery commitments and cost-sharing. On occasion, legal counsel from both organizations needed to meet in order to resolve agreement terms. Reservation of Rights Agreements allowed both parties to push areas of dispute into the future so that work could continue unimpeded.

b) Early Identification of Utility Conflicts:

Identification of utilities started early, dedicated staff were assigned to utility coordination, and there was consistency in the Project Sponsor's team over the course of the project. The consistency in staff allowed strong relationships with utility company counterparts to be developed. Utility impacts were documented, kept updated, and tracked on utility maps and matrices.

c) Relocating Utilities into Joint Trench Alignments:

Relocated utilities were grouped at shared crossings locations, where possible, to minimize the number of individual crossings. Shared conduit banks were used, where possible. The CM/GC's involvement during Pre-Construction allowed them to provide input on relocation alignments and refinements to project design, considering the planned sequence of construction and minimizing the potential impact to other construction activities.

d) Coordinating with Groups of Utility Stakeholders that Shared Common Issues:

Utility stakeholders that shared commonality were put into functional working groups (e.g., electrical distribution team, gas team, telecommunication team, etc.) Recurring meetings were held (monthly or bi-weekly, as needed) for on-going coordination.

e) Transitioning Utility Coordination to the CM/GC:

Once the CM/GC was under contract for Construction, Utility Coordination meetings were transitioned to the CM/GC, while the Project Sponsor retained ultimate responsibility for relocations. This allowed the parties directly involved in relocations and construction to coordinate directly and work out solutions during Weekly Construction Status meetings. Thus, the CM/GC played an integral role in utility coordination using dedicated resources for communicating construction sequencing, field support, and coordinating inspections. The CM/GC worked closely with the Planning and Design team throughout construction in successful collaboration controlling risks of utility delays.

f) Cost Control:

There were sticking points on cost sharing and in determining who bears responsibility for which cost. It was difficult to validate the utility company pricing that was provided. Reviewing pricing with designers and contractors was time consuming; and, in some cases, independent cost estimators had to be brought in to assist in cost negotiation and resolution.

g) Keeping Agency Team Members Informed:

Utility items were tracked on the Project Risk Matrix, which was in turn provided to approximately 45 key individuals involved with the project. This helped assure that all key project participants shared a common understanding of the utility and other risks.

h) Complex Utility Relocation with Limited Shut-Down Windows:

The relocation of a jet fuel line had extremely limited shut-down windows. Specialists and specialty contractors were brought in due to the intricacy and sensitivity associated with this relocation within an operating railroad corridor. A single, dedicated point of contact was assigned to work directly with the fuel line owner, to ensure consistency and maintain momentum. The CM/GC rose to the challenge by being extremely adaptive in working within the shut-down windows and by developing a sequence of construction that adapted to the fuel line owner's constraints.

i) Schedule Control and Maintaining Schedule Accountability:

There were challenges in holding utility companies accountable to comply with schedules. Most of the utilities were not forthcoming with providing schedules. To address this, the Project Sponsor took whatever schedule input was provided from the utilities and created simple schedules for each utility work order that captured basic items (e.g. design, issuance for bid, contract procurement, materials procurement, and construction). The Project Sponsor maintained these individual schedules to use for discussions with the individual utilities; but also linked them to the Master Project Schedule. These individual schedules were reviewed with the utility representatives at each Construction meeting. This allowed for the identification of potential slips in the schedule and the development of mitigations.

j) Federal Compliance:

For Buy America compliance, the Project Sponsor held a number of meetings with utility companies where cost sharing was involved in relocation efforts to ensure understanding of the requirements and familiarity with compliance documentation. In some cases, the Project Sponsor directed removal of non-compliant materials, using the leverage that the Project Sponsor would not pay for non-compliant materials. For labor compliance, the Project Sponsor held discussions with the utility companies – especially with small businesses and subcontractors that were not clear on the Federal compliance requirements – to help them understand the requirements. The Project Sponsor assigned a representative to serve as point of contact and to monitor compliance.

k) Field Staking prior to Construction:

In the field, the team proactively staked out the utilities and conducted pre-identification activities to confirm there were no conflicts. This was extremely important when working with tight construction windows, which in some instances included nighttime construction windows with the need to restore traffic and driveway access the following morning. This extra pre-identification effort helped prevent field surprises and rework.

2. Project F - A streetcar extension project in a mid-sized city

Successes:

a) Pre-Planning:

Planning activities with utilities allowed for adjustments prior to the actual utility relocations. This was initially accomplished using Bluebeam[1] to identify utility conflicts. In addition, a more intensive utility pre-planning coordination began after the FTA Risk Workshop for Entry into Engineering. An example was certain manhole reconstruction plans left too many structures in conflict with the track slab. Having the Sponsor's Project team know about this ahead of time, allowed for corrective actions with additional input and further engineering effort by the contractor, the utility company, and the Project Sponsor.

In addition, the designer went through a Risk Register exercise and identified the utility relocation as a top risk item. Then, through risk mitigation measures and discussion, the Sponsor's Project team enhanced some of the planning efforts to address this risk which included hiring additional staff and scheduling the utility relocations well in advance of the rail construction.

b) Governance and Institutional Knowledge:

The Project Sponsor, having jurisdiction of the public right-of-way on which public utilities are located, provided valuable institutional knowledge of potential public utility conflicts. The Project Sponsor indicated that they had Franchise Agreements with many of the utilities in the corridor. The Project Sponsor provided the PMOC with an opinion letter from the Project Sponsor Attorney's office claiming Project Sponsor's authority over the right of way.

The Project Sponsor's approach with utility companies was to work cooperatively with them, provide the planned streetcar alignment and give them an opportunity to voluntarily relocate their facilities away from the streetcar corridor and complete their work prior to streetcar construction. The Project Sponsor did not require large-scale utility relocations but once the new streetcar system was complete, utility companies located under or adjacent to the streetcar line would be severely restricted as to when and how they would be able to maintain or repair their facilities. In large part, for their future convenience, the utilities chose to relocate their facilities.

[1] Bluebeam, Bluebeam, Inc.

According to the Project Sponsor, the Franchise Agreements between the Project Sponsor and various utility companies required the utility companies to move their utilities at their own expense and in coordination with the Project Sponsor, since the utilities were located within the Project Sponsor streets. The Project Sponsor was able to effectively enforce their Franchise Agreements with the utility companies, a key component to the overall success of the project delivery. These agreements saved costs and eliminated the Buy America compliance for the utility relocation costs, since these costs were outside of the project cost as a whole. The PMOC did not observe any challenge to the Franchise Agreements by the utility companies.

Knowledge and experience of the original downtown streetcar starter line construction helped to streamline decision making and avoid potential conflicts and schedule delays during utility relocations. This governance structure simplified legal and administrative hurdles and reduced risk to this project and the stakeholders.

c) Management Capacity and Capability:

i. The Project Manager assigned had previously worked on the starter line. Experience and relationships garnered on the starter line fed directly into working on this project.

ii. The fact that the Project Sponsor's Construction Manager worked on the starter line and was full time on site was greatly beneficial to the utility relocation effort. All traffic control and relocation plans were reviewed prior to the Project Sponsor releasing any construction permits. This integration allowed for smoother traffic control, and for utility contractors to share traffic control when feasible, and to continue progress on the utility relocations with reduced delays.

iii. The development of a SharePoint[2] site allowed for the utility information initially shared on Bluebeam to be continually updated as new information was received. The SharePoint site also acts as a Central Repository It has allowed a convenient one-stop location for review, record keeping and mapping utilities.

iv. A dedicated Utility team was created for utility management. Team members have engineering, construction, and traffic control expertise, all of which have been beneficial to the project. Main Street has over 15 utilities present. By having a team with various skills, it has made managing relocations a smooth process. The Utility Management team included: the Utility Manager, Project Sponsor Construction Staff, Design Consultant, CM/GC Contractor and their utility management consultant, the Project Sponsor's Water Services Division's Construction Manager and Public Involvement team.

v. The integration of the Public Involvement team into the Utility Management team has proven to be very beneficial to the project. Consistent messaging to stakeholders through the Public Involvement team has also been a benefit to the Utility Companies and their contractors. It takes the burden off the utility companies and the contractors and places it within the Utility Management Team, where it belongs. Requiring as-built records from

[2] SharePoint, Microsoft

Utility Companies has been and will continue to be beneficial to the Utility Companies and to the Project Sponsor.

Section 3: Some Proposed Solutions

1. What are the utility relocation problems?

   The following sections discuss some of the utility relocation risks with each of the common transit modes in the United States (Rail, Bus Rapid Transit), followed by a bullet-point list of All Project Types as derived from the *White Paper* study projects.

   a) Rail

      Transit rail projects (light rail, heavy rail, streetcars) in and near cities typically involve utility relocations. City streets and other rights-of-way are underlain by a wide variety of utilities for water, natural gas, fuel, and chemical feeds; stormwater, wastewater, electrical power, telephone, cable/TV/Internet fiber, street lighting, and traffic signaling; sometimes owned by competing private utility companies. Fiber optic demands special care, given the practice of threading the fiber through older, abandoned utilities such as gas lines. Projects with alignments near federal buildings such as court houses, or near public or law enforcement agencies may encounter communications lines or other infrastructure that are not readily identified. These buildings and their utilities require special handling by the Project team.

      Depending on the water table and climate, any of these utilities may be buried near the ground surface. While such shallow-buried utilities may not be overloaded from trucks on a city street, heavier rail transit vehicles, along with 18- to 24-inch thick track slabs, will overload utilities if those utilities are left in "as is." If such a utility alignment is normal to the track alignment, and clearing the shallow utility outside of the track slab footprint is not possible, then the utility will need to be "shielded" from the rail loading with an engineered design.

      In addition to loading issues from rail projects, electrified rail projects bring a stray-current risk. Most, if not all heavy rail, light rail, and streetcar ownership agencies monitor stray currents from their operations. Stray currents, if left without engineered mitigations in the form of stray current dampening systems, can set up corrosion "cells" within the ground that "rust out" the steel and iron of buried utilities, and even the steel reinforcement in nearby concrete structures.

      Furthermore, for future utility access, the normal practice is to relocate the utilities outside of the transit project footprint. For those utilities that must align under any track structure, loading on such utilities must be accounted for in the design. Certain utilities, such as stormwater and wastewater pipes, are constrained in both depth and plan locations, since such water conveyances are normally free-flowing by gravity. With the need for specific grades and alignments, the engineering of gravity-flow piping quickly can become awkward or even infeasible.

      The design of utility relocations must accommodate track slabs, rail-tie-ballast track roadbed, catenary poles, signal masts, gravity flow stormwater drainage, station platforms, signage, lighting, signaling, communications lines, power lines, bridge abutments and piers, earth retaining walls, noise walls, streetscaping, landscaping, and other new infrastructure.

Even underground projects, unless deep enough to be tunneled beneath the utilities, will impact those utilities below ground surface. Cut and cover tunneling, along with the sheeting and shoring of the excavation, requires relocating the utilities or hanging the utilities over the open excavation until the tunnel structure below is complete. In such situations, utilities may need to be relocated off to the sides of the cut and cover tunnel, either temporarily or permanently.

Relocation of utilities under intersections and sidewalks is even more complicated, given that the intersection contains twice the utility density of the streets, and that sidewalks are underlain by building services and basement "vaults." For both light rail and streetcar projects, sidewalk spaces are often used for catenary poles, from which hang the overhead contact system traction power wires. "Station" stops, other than stations in the middle of the roadway and within buildings, are also within the sidewalk width, and existing, interfering utilities must be cleared from under the station footprints.

Another issue that often comes with overhead contact system wires (light rail and streetcars) is the potential for electrical interference between the traction power wires and other overhead, non-transit, high voltage lines. Other power, telephone, and signaling wires may also present physical barriers and impair the clearances associated with the new project's vehicles, overhead catenary wires, or station stops. At times, catenary support wire is hung from building structures along the right-of-way, using easements and agreements for such catenary support. The lesson is to look not only down into the ground, but up, when thinking about utility relocations.

City streets in older cities are often no more than 40-feet wide from inside curb to inside curb. A single-track, track slab is about 12-feet wide and takes up more than one traffic lane. If the rail project calls for double tracking or crossovers, nearly the entire roadway width can be taken by the new project. On such streets, there is little other remaining room for the relocated utilities.

b) Bus Rapid Transit (BRT)

BRT projects can be as sensitive to these utility relocation issues as rail projects, having much in common with light rail transit and highway projects in urban areas. Like rail, BRT travels in a dedicated lane (guideway) either center-running or side-running and utilizing a heavier hybrid-electric or all electric bus fleet.

Often with these projects, surface stormwater drainage patterns are reworked, and grades are changed. Utility loading issues can come into play if the grade is changed. Drainage structures and piping, required utility separations, station platforms, structures, and new traffic control signaling often result in utility relocations on BRT projects.

Urban streets in older cities have an existing width, depth, and grade that are often constrained and difficult to modify or expand. BRT projects with center-running lanes can take up a significant portion of the roadway leaving little options for relocating utilities.

In addition, utility systems in older cities are typically as old as the city itself and in a continuous state of deferred maintenance. Old utilities are often dilapidated, fragile, and can be easily damaged by direct (or even indirect) construction activity. Even though the old utility may not pose a physical conflict, it may still pose a risk to the project budget and schedule if it must be repaired due to accidental damage.

Intersections and sidewalks typically contain twice the utility density of the main roadway, including underlying building services in basement “vaults.” BRT projects with side-running stations will encounter these utilities in proximity to station platforms or along the path of travel to the station. Sidewalk spaces are often used for service or controller cabinets, pedestrian push buttons, and new signals, which means that interfering utilities must be cleared from under the station footprints, pole foundations, or curb ramps.

BRT projects deploying the heavier hybrid-electric or all electric buses may require the roadway to be reconstructed to accommodate the heavier vehicle and to mitigate risks to shallow buried utilities.

Sponsors often underestimate and understaff relatively small BRT projects even though such projects can encounter the same (or higher) levels of utility relocation complexity than larger, elevated guideway projects that run through congested urban corridors.

c) All Project Types

The following is a list of common utility relocation problems as reported in the study projects. This list is not meant to include all such problems that may be encountered in any one project, but rather to instill an awareness of those frequently encountered.

i. Utility relocation challenges always trigger the need to develop agreements, control utility relocation schedules and costs, and manage betterments. The Sponsor’s Project team devises technical solutions that work within the project constraints and meet the satisfaction of other impacted third parties, including railroads, local and state governments, and environmental agencies.

ii. The nature and contract terms of the Utility Franchise Agreements held by each utility company with the jurisdictions within the project limits must not be assumed. These agreements do not always transfer terms and rights directly to a transit project in the public right-of-way. While it may seem like such rights could be assumed, broach the issue early and within the framework of local and state law. Utility companies are often slow to respond to transit project needs since transit projects are outside of their normal workflow and activities. Getting firm commitments from the utilities for items such as completing a design review within a specific timeframe can be daunting. Many utility companies’ lack of commitment to other agencies, in combination with the internal resource limitations, often causes Project Schedule delays and cost impacts.

iii. Inaccurate as-built drawings result in underestimating the utility relocation impacts to the costs and schedule in the Planning/ Project Development and Engineering Design phases of a project. The best approach is to use caution with these records and to implement other means to determine what is beneath the ground or overhead within the project footprint.

iv. The probability of finding unknown structures and utilities, especially in older cities, is high. Some of these unknowns may be building basements underlying sidewalks, which are inside the public right-of-way, older buried structures, and historic rail from earlier streetcar operations.

v. The lack of defined design and construction expectations from the local government reviewers can be problematic. For example, less than fully defined requirements by local government review agencies can lead to incomplete designs as perceived by the local agencies. These "incomplete designs" are then rejected by local permitting reviewers based upon their own ambiguous expectations.

2. How do we mitigate the risks?

We have cast the best practices for utility relocations into three sections, all derived from the best practices learned from the six *White Paper* study projects. These three sections may seem somewhat repetitive, but each has a distinctive purpose in this *White Paper*. In Section 3.2.A - *General Approach for Utility Relocations* is a section that is meant for project managers and executives, giving high-level information that is needed to manage utility relocations within a project. This is followed by Section 3.2.B - *A Quick Checklist for Utility Relocations*, and this section is meant for project managers looking for a quick checklist approach for managing the utilities within their project. Lastly, in Section 3.2.C - *A Suggested Framework for Utility Relocations* is designed for anyone who organizes a Project Utility team within a Project team as a whole with an emphasis upon team organization and behavior.

a) General Approach for Utility Relocations

i. Pre-planning for utility relocations is the keystone to project success. Utility relocations are completed ahead of any new construction at any one specific location in a project. Details are worked out with the utilities, the layouts, and in the construction schedules. With that premise, early in a project, all project stakeholders draft and agree to the terms of a Third-Party Utility Relocation Agreement (within the overall Stakeholder Agreement). This is particularly important for projects that have many stakeholders who have not worked together previously. This agreement serves as the groundwork for all future project interactions between and among the stakeholders and identifies who is responsible for specific utility relocations and the costs associated with those relocations, identify approving bodies in the Third-Party Utility Relocation Agreement, and acknowledge the need for interdisciplinary schedule reviews by stakeholders and contractors; establish a partnering and escalation process that can be used to facilitate a resolution when various utility and agency staff cannot reach agreement.

Acknowledge any existing Franchise Agreements between the utilities and local governments in the Third-Party Utility Relocation Agreement, with the understanding that these agreements can be assigned to the transit agency or Project Sponsor. Where the Project Sponsor lacks the necessary standing to compel the relocation of a utility, the Project Sponsor must acquire that right through a real estate transaction or work with a local jurisdiction who has the authority to compel the relocation. In this later case, executing an agreement with the local jurisdiction to compel the relocation of the affected utilities is critical. This agreement should include enforcement provisions as well as payment of costs to the jurisdiction.

All plans developed before and after a Third-Party Utility Relocation Agreement, including but not limited to the Project Management Plan (PMP) and the Safety and Security Management Plan (SSMP), acknowledge and follow the Third-Party Utility Relocation Agreement. If needed, the Third-Party Utility Relocation Agreement can be amended by procedures that are documented within that agreement. Identify a high-level and respected local political champion who is responsible for encouraging and fostering project stakeholder support and establishing clear roles and responsibilities for all parties.

The Project Management team meets with local permit reviewers to engender a spirit of cooperation, and to gain an understanding of the reviewers' expectations. All parties understand, document, and agree to the expectations of the local permit reviewers. From these meetings, the Project Management team develops a Memorandum of Understanding (MOU) with the local permitting agencies. This MOU must address and clearly document design and permit expectations and does not rely upon unsaid or unwritten assumptions.

If the project is within a historically sensitive jurisdiction, the impact of historical review committees and agencies is included in the MOU. In such areas, utilities are among the various project elements on which the Sponsor's Project team works within the historical concerns and sensitivities of the communities. Even the utilities themselves can become historical items in some jurisdictions.

The utility companies' responsiveness can be a major challenge in early stages of design. If, for example, a transit project design is at 30%, but the transit project is not fully funded, the utilities can be slow in responding, putting other utility projects ahead of the transit project.

ii. One helpful method to engage utility companies is to hold weekly meetings with all the stakeholders present, including representatives of utility companies who are directly responsible and have decision-making authority. A "focused workshop" approach is key in these meetings. At these meetings, discuss each intersection and utility, one by one, so that the appropriate stakeholder in attendance acknowledges ownership of the utility in question. Project Sponsors should clearly understand the specific requirements for each utility relocation (e.g. specific design criteria, technical specifications, administrative requirements, communication protocols, and primary point of contact). Each utility relocation is managed as a "mini-project" that includes a person in charge, defined scope, risk-based budget, critical path schedule, utility point of contact, and an informed Risk Register. The design team then shows all the decisions that were made in these focused workshops on the design drawings. (See Section 3 - *What are some utility location tools*? The Third-Party Utility Relocation Agreement are drafted and written with the design drawings as backdrop and basis of the agreements.

iii. Project Sponsors should establish cost estimates with conservative contingency budgets for *each* utility relocation and not oversimplify the utility costs by "bundling" them into a single item. Each utility has unique requirements relative to the scope of work, who performs the work, how much it will cost, who will pay (and when), and if it is consistent with the Project Sponsor's expectations.

iv. For the Project Risk Register, Project Sponsors must be mindful of the potential risks for *each* utility and not oversimplify the utility risks by "bundling" them into a single risk item. This holds true for both schedule and cost risk calculations.

v. As the project develops, the project stakeholders participate in partnering sessions to define common goals for the project and to make a commitment to meet those goals as a team. During the partnering session, roles and responsibilities of the partners and lines of communication need to be defined or clarified so the decision-making process is understood. However, such sessions are usually not convened until after the Design-Bid-Build or Design-Build contract is secured. Convening these partnering sessions earlier, before the contractor is engaged, can make for better teamwork during the early phases of the project. After the contractor is under contract, additional partnering sessions can bring everyone together, including the construction contractors, into the partnering outcomes.

   Stakeholders may encompass government agencies, local governments, community development organizations, state government transportation project teams, utility companies, consultants, project developers, construction contractors, impacted businesses, and even the public; however, though the partnering concept may engage all of these project stakeholders, not all stakeholders draft and execute the Third-Party Utility Relocation Agreement (within the overall Stakeholder Agreement).

vi. One helpful utility design strategy for above-ground transit projects is to cast the project into segments that are one or two Project Sponsor blocks long. In this way, as a segment is cleared of existing utilities, the new construction can begin. The strategy is to have at least two open segments available at any time. In this way, if the relocation of utilities hits a scheduling snag in any one segment, the transit construction crews can still work on a cleared segment. The downside to this strategy is that cities and businesses do not want too many segments along the alignment under construction at any one time. Nonetheless, this is a mindful strategy that is best included in the project planning phase.

vii. Follow through in the construction phase by establishing the following practices on the project:

   - General contracting terms and conditions (often called "Division 1 Specifications") are drafted that require the contractor to comply with the project change approval processes.

   - Field work areas and restrictions need to be shown on the Design/Permit Plans.

   - All construction permits are best made the contractor's responsibility, and the contract includes the work permits that must be approved before construction. The contractor's Permit Plan defines the permit packaging and provides for logical grouping of permits and supporting documentation.

   - Weekly Coordination meetings with follow-up action items should be documented using a tracking system available to everyone working on the project.

   - For utility change order (CO) negotiations, identify a limit for small contract adjustments and limit CO negotiations to direct costs only in the project's contracts. Design a project CO template in the specifications that has established overhead, profit, and bonding to save time in CO negotiations.

- An accessible, easy-to-use, electronic document control (also known as EDC) system is recommended, ensuring everyone has access to the most current, approved documentation.

b) A Quick Checklist for Utility Relocations

i. Determine if the Project Sponsor and/or Transit Agency can enforce the Utility Franchise Agreements within the project limits.

ii. Have a written and well-established chain of command for utility relocations. Consider establishing a Utility Coordinator position, within the Project Sponsor agency, with the authority, capacity, and capability to expedite the utility relocation work. This level of utility management is not only for the larger projects, but also smaller projects, since smaller projects typically short shrift utility relocations.

iii. Spend sufficient time and effort as early as possible to determine the extent, location, and ownership of overhead and underground utilities within the project area. Institute adequate site investigation/characterization to yield a detailed understanding of the utilities within the project corridor and any issues or risks that could complicate the relocations work.

iv. Have Project Sponsors proactively address the utility relocations associated with street projects in congested urban corridors as early as possible. The Project Sponsor's technical capacity, with staff dedicated to utility coordination, is key.

v. Communicate early with the various project stakeholders to set priorities together.

vi. Understand the terms of existing Third-Party Utility Relocation Agreement to define the potential risks. Work out issues, if any, early in the process in situations where Franchise Agreements exist. This could result in utilities successfully being relocated in advance so the construction Project Schedule is not adversely affected.

vii. Approve the project alignment early in the design process to assess the utility relocation impacts. Understand that alignment approving authorities vary depending on the project and the jurisdictions.

viii. Meet individually with each utility to discuss their schedule and allow the utilities to work together as conflicts arise in the same work area.

ix. Address the utility relocation work early in the project life with a detailed project scope and schedule.

x. Perform a full risk analysis during design, continue to identify any additional risks, and perform regular reviews of those risks throughout the lifecycle of the utility relocation effort, and update the Risk Register as needed.

xi. Develop design plans and contract specifications for utility relocations with a focus on protecting the Project Sponsor's interests relative to differing site conditions and potential delay claims.

xii. Save project costs by approving costs that affect the alignment of the project only (e.g. one side of street). If this method is used, the local government may have to allocate funding for full-width street repairs that are outside of the transit project footprint.

xiii. Institute constructability reviews. These can be effective in minimizing or avoiding potential utility impacts.

xiv. Obtain the technical specifications and permitting requirements from the utilities and include those requirements in the final bid documents. When utility betterments or adjacent project work is involved, clearly and proactively define the scope and cost allocation(s) associated with that work in a Concurrent Non-Project Activity (CNPA) Agreement with the jurisdictional municipality, utility, or third party. Undergrounding (burial of overhead utilities) of residential electrical services may bring out "hidden" betterments since local codes may require upgrades to the housing electrical panels (betterments).

xv. Maintain constant communication among project stakeholders before and during construction. This is key to mitigating utility relocation problems. Weekly Utility meetings are recommended to facilitate regular detailed communications with all stakeholders and are essential to maintaining schedules.

xvi. Handle the utility "spaghetti" effect by opening the utilities and sorting them out line by line. Such areas need to be isolated and dealt with early in the construction schedule as smaller projects within the full project.

xvii. Establish "no-build zones" for the relocated utilities. In other words, if a utility needs to be moved, there shall be "no-build zones" for areas that are going to be occupied by the new construction. It is helpful to mark these zones in the field beforehand, without the guesswork of interpreting design drawings.

c) A Suggested Framework for Utility Relocations

Implement all projects within a framework to lessen and to mitigate the project schedule and cost risks. What follows in this *White Paper* is a suggested, basic project framework for handling the project's utility relocations. The writing style of this section is purposefully bulleted, more in keeping with an instructional framework. Some of the thoughts in this framework draw from the previously described in Section 3.2.A - *General Approach for Utility Relocations* and Section 3.2.B - *A Quick Checklist for Utility Relocations*, but the thrust of this framework differs from those sections. Behavior between and among project stakeholders seems to have a great impact upon successful project utilities outcomes. In keeping with this observation, this framework emphasizes teamwork and project organizational structures that enhance such behaviors throughout the life of the project from planning through construction.

The following is such a framework:

<u>Planning and Early Work</u>

i. Plan all utility relocations as far ahead as feasible, starting early in Project Development and Environmental Reviews. Project governance structure and Third-Party Utility Relocation Agreements are best defined early in the project life to overcome administrative and legal hurdles. Form a team that represents all project stakeholders, with adequate technical capacity, capability, and institutional knowledge. Communicate early and often with utility companies, stakeholders and the public. Determine what utilities are present under, above, and along the proposed alignment, and make sure that all points of contact are established and updated frequently throughout the project life.

   On large or complicated projects, a Utility team within the design team can be assigned to utility relocations. On smaller projects, the utility team would be the civil design team for the project. Whatever the project size or complexity, organizing the Project Utility team with at least the following key sub-teams within the overall team is important:

   - Utility As-Built Records team:

     This team is responsible for gathering and blending as-built record drawings and documents from all the utility companies within the project limits. This work is the first step to determine the future field work and ground-truthing methods and technology tools. This information is shown on Computer aided design and drafting (CADD) drawings.

   - Utility Relocation Technology team:

     This team deals with the project's utility "technology." CADD files can be shared using digital markup and collaboration software solutions such as Bluebeam to ArcGIS[3] by way of a platform such as SharePoint. This platform becomes the repository for all utility information that is managed by the design consultant. A central data-bank allows both the utility companies and the construction managers in charge of utility relocations access to the most current information for review, record keeping, and as-built utility mapping.

   - Utility Relocation Public Involvement team:

     While most public works projects have a public Involvement team within the Sponsor's Project team, transit projects within built-up areas may find it helpful to have a special Utility Relocation Public Involvement team. This team works with the overall Project Public team and with the Utilities team within the Design team. Such

[3] ArcGIS, Environmental Systems Research Institute

items as closures and downtime for any service utilities are within the responsibilities of this Utility Relocation Public Involvement team.

One key aspect of any public works project, transit included, is for the Sponsor's Project team to understand and to work within the political governance and the available institutional knowledge. Local and state governments have jurisdiction over the public right-of-way on which public utilities are located and can give the Sponsor's Project team valuable institutional knowledge of the public utilities. Working with local and state governments can overcome legal and administrative hurdles and reduce project utility risks. These governments have sway with utilities by way of their Franchise Agreements, if not outright ownership. It is prudent to work closely with the governing authorities.

Notify the Utility Agency/Owner (UAO) of a proposed project, including the schematic "project corridor" plans and a return date by which the UAO is expected to return a set of marked up review plans. As plans develop, the Project Design team may determine that Field Review meetings are necessary. Conduct a field review that identifies and documents the following:

- ✓ UAOs within the limits of the project;
- ✓ Any known utility conflicts, and
- ✓ Possible resolutions to known conflicts.

Given that most of the utilities are buried and there are many unknowns at the beginning of a project, the field review may not resolve these items; however, field reviews are still a best practice for beginning utility relocation designs and information gathering.

ii. Determine the project alignment and physical space needs. Since these design elements define the project limits in space, these are best completed at the 30% design level or sooner. For the utility companies, utility relocation designs cannot proceed unless these design elements are known with some certainty.

iii. Understand what utilities will be impacted by contacting *all* impacted utility companies that may be within the proposed project limits for both the underground and overhead utilities. Share the 30% drawings with these utilities.

iv. Utility risk identification and management:

Conduct a Sponsor-led Risk Workshop and identify and document details of the risks for each utility in the Risk Register. Assess the risk for utility relocations with higher occurrence probabilities and cost beta factors than other project risks. Prepare a Utility Management Plan that includes how the utilities will be managed and update it weekly with information from both the Design and Construction Project meetings. Highlight the utility relocations in the project Design and construction meetings as a specific meeting agenda item. Include as much pertinent information as possible for each specific utility project and break tasks down into manageable pieces (work breakdown structure). This helps to clarify the effort and manage the critical activities in Project Schedule in coordination with utility relocations.

Federal Compliance

For Buy America compliance, the project stakeholders need to understand the requirements and become familiar with compliance documentation. Buy America requirements apply to utility relocation work if the utility relocation is within the scope and budget of the FTA project. In 2012, FTA summarized when Buy America applies to utility relocations in a letter addressed to the New Starts Working Group (available on FTA's website at https://www.transit.dot.gov/regulations-and-guidance/buy-america/new-starts-working-group-september-07-2012). FTA reiterated that it may obligate money for a project "only if the steel, iron, and manufactured goods used in the project are produced in the United States" (quoting 49 U.S.C. § 5323(j)). Therefore, with regard to "contracts that are within the scope and budget of an FTA-funded project", "Buy America rules apply to the entire project. Application to the entire project means that all contracts necessary to complete a project must include Buy America provisions."

For prevailing wage compliance, hold discussions with the construction firms, especially with small businesses that may not understand the Federal compliance requirements. While it is not a requirement, it is recommended to assign a Project Sponsor representative to serve as point of contact and monitor Federal compliance.

Detailed Design

i. Begin holding a series of meetings with *all* of the impacted utilities present. Establish the rules of engagement beforehand and insist that all follow the Project Third-Party, Utility Relocation Agreement (within the overall Stakeholder Agreement) understandings. Begin to identify known conflicts and ownership.

ii. As the project design develops, update the utility stakeholders on the status of the project and continue to work out problems in the utility meetings with design solutions that the affected utilities can agree to. If conflicts arise, work them out in these meetings or hold special meetings for such conflicts with only the affected parties.

iii. Use technologies/tools to further identify utility locations in the plan and their depths below ground. Incorporate this information into design drawings with detailed instructions. For further suggestions, refer to Section 3 - *What are some utility location tools?*

iv. Show all known utilities, their conflicts, and their new locations (plan (horizontal location), depth below a datum, and grade (slope)), if applicable, on the design drawings. The design plans and specifications are to define where special procedures, such as hand excavation, may be needed to confirm the location of the utility line, and any field location work that would need to be completed under the supervision of the utility owner.

v. Hold utility meetings that result in a Utility Plan and a Utility Work Schedule (UWS), including the following elements:

- Utility Conflict Matrices (See Section 3 - What are some utility location tools?) for further discussion of Utility Conflict Matrices and best practices.

- Organizational chart of utility owners and structure

- Utility risk identification and management (See the Section above, *Planning and Early Work*, for more information on this.)

- Develop the UWS with the UAO. Failure to comply with the UWS may result in the UAO being liable for additional costs resulting from delays to the contractor. This construction contract feature is worked out in the Project Partnering meetings and becomes a clause in the Project Third-Party Utility Relocation Agreements with the UAO. As a contracting tool, owners may institute a contractor allowance before construction to reduce change orders that are prompted by the need to relocate or protect underground utilities during construction.

vi. Plan a UWS that accurately reflects the following:

- Work to be performed

- Project restrictions

- Project and public notifications

- Dates for utility permitting

- Any special conditions for the project's utilities

Before and During Construction

i. When utility work needs to be performed during a construction project, the Sponsor's Project team executes Project Third-Party Utility Relocation Agreements to ensure the UAO work is scheduled and included in the construction contract to transition responsibility to the contractor. Once all agreements are executed, the Sponsor's Project team reviews and determines that the construction project can be built in accordance with the construction plans. This review is best done before the project advertisement, if contracted as a design-bid-build project. The review timing can be adjusted for other project delivery methods such as design-build to match the project needs. Nonetheless, with any project delivery method, such a review occurs before actual field construction begins. The UAO is obligated to operate in accordance with the UWS, utility permits, and any other Project Third-Party Utility Relocation Agreements, as executed.

ii. On Design-Build Projects, the Design-Build firm's Utility Coordinator is the most appropriate responsible party to coordinate with the UAO on execution of Relocation Agreements, schedules, and construction operations. The Sponsor's Project team monitors progress to ensure Project Third-Party Utility Relocation Agreements and permits are executed and approved.

iii. The Sponsor's Project team will schedule and conduct a preconstruction conference with the contractor and UAOs to discuss scheduling and the means and methods to accomplish the construction project in an expeditious manner. Invite all UAOs within the limits of construction to attend the preconstruction conference.

   If the Sponsor's Project team makes a change that impacts the utility work, and the utility work cannot be accomplished in accordance with the executed UWS, revise the schedule and seek the impacted parties' approval.

   When utility work is unforeseen, execute a new UWS that acknowledges the unforeseen conditions. To expedite project construction, the Sponsor's Project team may need to update and approve the changes to the UWS. The Sponsor's Project team is responsible for monitoring and documenting the impacts to the contractor's activities or other UAOs in the Daily Work Report. Construction managers are to record the location, date, time, and crews working on each utility in the Daily Work Report. Such record-keeping is essential and important for the potential disputes over third-party utility work. This Daily Work Report may become central in analyzing any contractor delay claims, including utility work that is not completed in a timely manner (the UWS).

   Typically, there are consequences in the construction contract for not holding to a construction contract schedule along with contingency plans for each project segment when the utilities are not cleared in time. These consequences are either directly stated in the Franchise Agreements or negotiated into the Third-Party Utility Relocation Agreements.

   At times, a Dispute Resolution Board, with un-conflicted, expert board members from the outside of the project, could be helpful in working through conflicts in a timely manner. All project stakeholders should agree to follow the Board's directives beforehand.

3. What are some utility location tools?

   Technologies/tools, such as the following, may be implemented to further identify utility locations both horizontally and vertically. Also included in this list are other best practices for project organization, risk identification and management, and utility relocation management systems.

   a) Record, as-built drawings and "One-Call Utility Location Services" are a good starting points for utility relocations, but are not reliable as the *only* means to locate existing utilities. An extensive field investigation program should include as-built drawings to determine utility locations and potential issues with utility relocations.

   b) The means below can be used to help with field location of utilities:

      i. With any of the field exploration methods, the areas of disturbance before construction can be greater than the threshold for an erosion and sediment control permit. Any of these field methods may need Sediment and Erosion Control Plans and permits or other environmental permits, along with contracts with a construction contractor (excavation method/backfill/paving). Exploratory data gathering nearly always results in the need for in-kind backfilling and paving of the disturbed areas.

ii. Ground penetrating radar (GPR) works well to find known and unknown utilities. Depending on the ground conditions and antenna frequency, GPR is effective to at least 15-feet deep, or even deeper, and can be followed up using other tools, if additional information is needed. However, GPR is of limited usefulness where the utilities are dense and stacked in many layers.

iii. "Potholing" or limited shallow pits can be used to check record drawings and GPR scans.

iv. Small backhoes can be used to carefully dig in the area of the proposed construction.

v. Water excavation is effective to expose bigger areas such as intersections, but the downside is saturated ground, "muck and mud."

vi. Air vacuum, either dry or wet (water excavation), is appropriate for a small footprint test -pitting during planning and design for deeper exploration without the need of an excavator. On one project, the Project Sponsor implemented a plan of using an air vacuum to confirm if utilities were beneath catenary pole footing/drilled shaft locations. At times, the catenary poles may need relocation from the plans, resulting in further design changes and cost impacts.

c) The organizational chart structure of utility owners and the Sponsor's Project team can be enhanced by open communication with and between key personnel at each utility. Such relationships are key to the development and execution of a proactive Project Third-Party Utility Relocation Plan.

d) Utility risk identification and management accounts for:

i. Utility identification (inventory/ as-built plans/ subsurface investigations) is the first step in the development of an effective utility relocation program.

ii. Subsurface investigations are critical in the identification, verification, and mitigation of potential utility conflicts early in the engineering design phase rather than during construction.

iii. Overhead utility conflicts are best identified and understood early in the project schedule for a complete utility relocation plan.

iv. Railroads, other existing transit, roads, highways, pipelines, waterways, environmental hazards and wildlife set-asides often need consideration and extensive permitting. Make an inventory of these items in the planning phase and followed through to understand the impacts of these elements upon the utility relocation aspects of the project.

e) Utility Relocation Electronic Document Management System (UREDMS) or Utility Relocation Management System (URMS) can include these tools:

i. Relocating utilities is much the same for both transit and highway projects. To that end, the Federal Highway Administration (FHWA) has some technical publications that could be helpful to transit project sponsors. See https://www.fhwa.dot.gov/utilities/publications.cfm. (2021)

ii. Most State Departments of Transportation (DOTs) have developed such systems. State DOTs are good starting points for any transit project utility relocation information.

iii. Pre-planning activities begin with CADD drawings with multiple layers shared on software applications such as Bluebeam, Civil 3D[4], and others that allows users to read, markup, takeoff, organize, and collaborate with PDF files. Later the information can be captured in a software system such as ArcGIS and then shifted to SharePoint. The SharePoint site hosts all utility plans, schedules, and information for all utilities to access and utilize, in addition to the Geographic Information System (GIS) mapping platform for viewing existing utilities and utility relocations in real time.

iv. Whole plan sets can be stored using Bluebeam on a hand-held, field device, and the field engineers and others can mark any field changes in real-time. Bluebeam works seamlessly with Civil 3D, another tool for utility drawings. A Utility Conflict Matrix can quickly become cumbersome to use and difficult to maintain. One project started with a utility conflict matrix but migrated to Bluebeam while keeping the Utility Conflict Matrix for updating utility contacts information. Nonetheless, Utility Conflict Matrices can be used effectively by following these practices as they relate to Utility Conflict Matrices:

- Develop the Utility Conflict Matrix as early as possible to identify jurisdictional agencies and third-party entities that may require utility relocation and/ or mitigation. This Matrix identifies the nature and extent of each of the public and private utility conflicts, as well as the ownership, responsible party, contact information, permitting requirements, occupancy rights (e.g., fee ownership, easements, or Franchise Agreements), and the utility locations.

- Track responsibilities, actions, and actual progress relative to the scope, design, cost, schedule, permitting, and construction.

Section 4: Final Summary/Conclusion

By way of six study projects, utility relocation challenges and successes are openly shared. From these study projects, best practices were developed. The best practices for utility relocations are outlined in the following formats: general background, a quick checklist, an overall project framework, and lastly, some utility location tools and practices.

Utility relocations are often the critical risks on transit projects for both cost and schedule. Within highly developed alignments, utility relocation can become the primary driver of project success. Handling this risk within the real-world of project constraints is daunting, even for those experienced in project management, design, and construction. This *Utility Relocation White Paper* offers practical advice for managing the data

[4] Civil 3D, Autodesk

acquisition, data management, stakeholder partnering, design documents, project contracting, and tools for project data management when dealing with utility relocations.

The heart of the *Utility Relocation White Paper* is Section 3 - *Some Proposed Solutions*. In Section 3.2 - *How do we mitigate the risks*? There are three different approaches to the utility relocations best practices, from the general to the specific. In Section 3.2.A - *General Approach* is for project executives; this is followed by Section 3.2.B – *A Quick Checklist* for project designers; lastly, there is also Section 3.2.C - *A Suggested Framework* for both project executives and designers.

Of these three sections, Section 3.2.A – *A General Approach* is the best for a high-level summary of utility relocation project issues and best practices. This section is recommended for anyone wanting quick, executive-level background and overview of utility relocations.

Transit and other civil engineering projects do not have to get bogged down with a tangle of utility relocation issues, either in planning or in design and construction. This *Utility Relocation White Paper* is only the beginning for information sharing, not only for transit projects, but for any project that has buried or overhead utilities that must be cleared to accommodate new construction.

These best practices, woven into the project as a whole, will result in fewer contractor delay claims and change orders, resulting in improved schedule and budget adherence, and greater assurance the transit project would enter revenue service on or before schedule, and meet the public's expectations.

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ATTACHMENT A – LIST OF ACRONYMS

BRT	Bus Rapid Transit
CADD	Computer Aided Design and Drafting
CEO	Chief Executive Officer
CM/GC	Construction Manager/General Contractor
CNPA	Concurrent Non-Project Activity
CO	Change Order
EDC	Electronic Document Control
FAR	Federal Acquisition Regulations
FTA	Federal Transit Administration
GA	Grant Agreement
CPR	Ground Penetrating Radar
DOT	Departments of Transportation
GIS	Geographic Information System
MCA	Master Cooperation Agreement
MOU	Memorandum of Understanding
PMOC	Project Management Oversight Contractors
UREDMS	Utility Relocation Electronic Document Management System
UAO	Utility Agency/Owner
URMS	Utility Relocation Management System
QWS	Utility Work Schedule