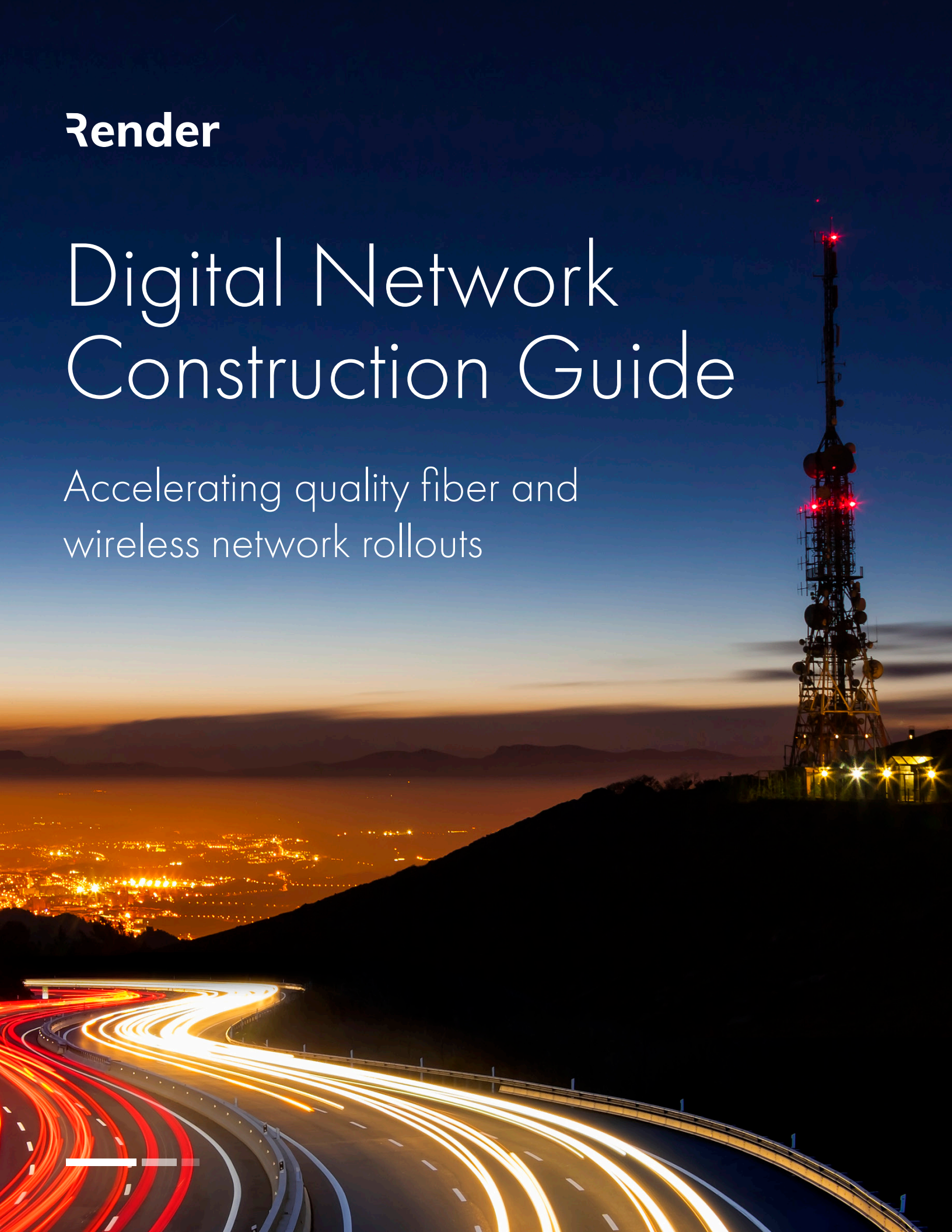


Render

Digital Network Construction Guide

Accelerating quality fiber and
wireless network rollouts



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Network deployment is ripe **for innovation**

With the expected demand for 5G globally, and commitment to deliver high-speed broadband to all communities across America, comes an unprecedented need to invest in telecommunications network infrastructure as a critical economic driver.

However, traditional network construction methods are struggling to keep pace with today's large-scale network deployments— which are increasingly more complex and distributed.

Despite the millions of tasks and transactions required, deployments still rely heavily on labor intensive construction packs that are disconnected between the field and office.

This means that expected productivities are often not achieved, financial returns are low, and the build simply takes longer than it should.

Almost counterintuitively, network projects have become less efficient as their scale increases.

The larger the aspiration, the greater the challenge.

The investment and delivery timelines of today's telecommunications networks are simply on a different scale. Previously, network operators deployed networks organically over decades, now they are being asked to deliver networks of the same scale in three or five years, while still delivering quality network outcomes, faster and more efficiently than ever before.

At Render, we believe that attempting to achieve these outcomes without innovation will deliver less-than-optimal results. Therefore, digitization and the adoption of new technologies present a significant business value opportunity – when done right.

This guide has been built for network operators, their trusted partners and construction teams looking to increase efficiencies and solve the complexities of large-scale fiber and wireless network deployment.



Market drivers
for fiber
infrastructure
demand

Demand is at an all-time high

According to Deloitte's report, "The Need for Deep Fiber", the United States requires a \$130-150 billion investment in fiber networks by 2025.

In 2020, consumer and business expectations for reliable broadband access have advanced several years in the space of a few months. Even before the global pandemic, mobile data traffic alone grew at a Compound Annual Growth Rate (CAGR) of over 43% per year². Wired demand, already high in today's homes and businesses, will be even greater over the next few years for broadband applications such as UHD streaming and 8K video.

Growing momentum behind 5G, and significant acceleration of the Federal Communications

Commission's (FCC's) broadband infrastructure construction subsidies, have boosted the resolve to build a foundation for current and future data demands – and to increase connectivity to all, particularly in rural America.

Despite the demand and potential economic benefits of fiber deployment, there are concerns that access networks have insufficient fiber density to support this growth. Leading telecom and utility network owners are exploring best practice approaches and operating models – incorporating a range of technologies and efficiency levers – to expand these networks faster without compromising quality or driving up costs.

130-150b

of fiber needed by 2025 in response to economic opportunity and foundational rural broadband coverage

Today's rollouts mean big numbers



100,000
homes or businesses passed

For example, a fiber to the home (FTTH) network deployment scenario that passes 100,000 homes or businesses.



80,000
tasks being completed

Taking the reasonable assumption that each home will result in the deployment of 0.8 assets, operations teams will turn over 80,000 network assets, and if no rework is required, this results in a conservative 80,000 tasks.



750,000
office transactions



375,000
field transactions

When you look at all of the transactions needed to carry out each task, you are faced with 750,000 office transactions and 375,000 field transactions.

Resulting in over **1,125,000** data transactions:
task data, photos, and geospatial data.

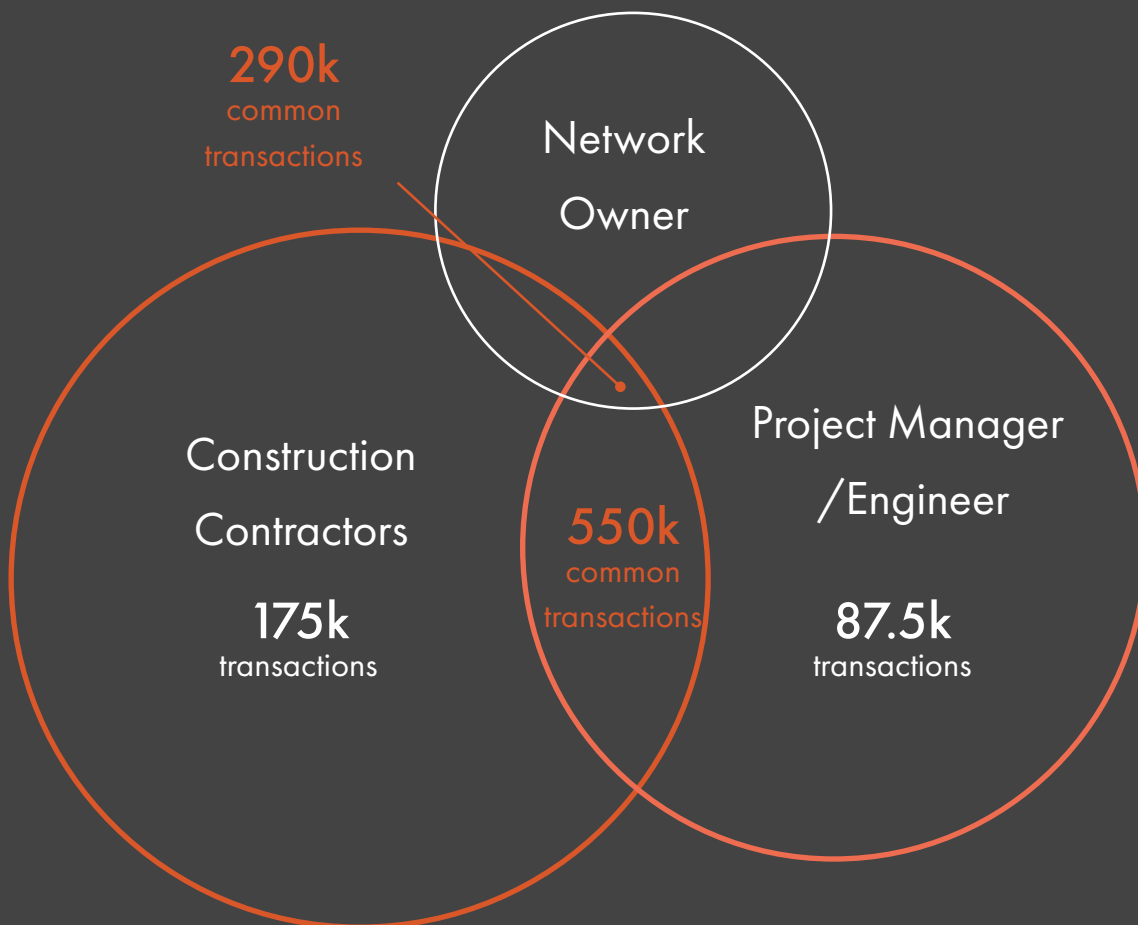
Experience has shown these assumptions and ratios to be consistent for different sized rollouts. In evaluating complex network delivery through this lens, it becomes clear just how quickly the overall administration effort and workload grows as scale increases.

Confidence in a single source of geospatial project data

As if the large volume of data wasn't enough, these transactions need to be managed across multiple stakeholders – including subcontractors, contractors, engineers, project managers, and network owners.

Each of these stakeholders has different goals. Network operators ultimately focus on the overall project, while project managers want a predictable construction process with real-time insights to make the best decisions possible. Meanwhile, construction contractors want to keep teams moving, achieve contractual obligations, and maximize quality and productivity to increase profit.

Despite their different objectives, one thing is common to all of them: the success of the project will be measured using the data. And much of that data is shared. Therefore, the accuracy and timeliness of that data – and each stakeholder's confidence in it – are paramount.



Challenges facing today's network rollouts

In addition to the broader challenges of keeping pace with demand and delivering complex projects to time and budget constraints, network operators and construction teams are looking to increase efficiency by solving specific data, visibility, hand-off, and process challenges. These include:



Scope Definition

There is a structural disconnect between design and construction:

1. Despite the level of detail contained in the design, construction scope definition is not detailed and relies on the experience and capability of construction crews in the field to work out what needs to be done and how to optimally deliver a complicated network architecture.
2. Traditional scope definition is not geospatial and fails to utilize all data required to optimally deliver the network. Prior to Digital Network Construction it has been difficult to visualize and update tasks in a geospatial view.



Construction Management

The construction phase of the network delivery lifecycle carries the greatest schedule and cost risk:

1. Traditional construction methods use a 'civil construction project' approach to delivery. This approach may well be suited to single site construction projects. Unfortunately, this is not suited to the geographically distributed, dependency-driven work using decentralized, mobile workforces for network delivery.
2. Productivity is reliant upon, and limited to, the dispatched work available to crews at any one time, often resulting in disrupted delivery if this is a required inspection, issue or insufficient work is allocated.



Key principles
of a successful
**Digital Network
Construction**
approach

An entirely new approach to network deployment

When looking for a solution to these challenges, it's evident that digital workflows, automation, and technology are what's needed to evolve traditional approaches. A successful digital network construction approach is built on four key principles:



1

Turn the design into work, and simply build the design using today's technology



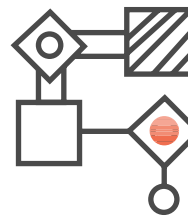
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Project workflow digitization, automation and optimization



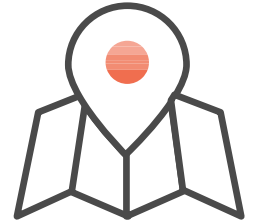
3

Real-time geospatial visibility for stakeholders



4

One integrated, geospatial workflow for construction, QA, change management and redlining



Principle 1

Turn the design into work, and simply build the design

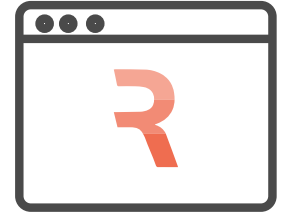
Digital scope “Blueprint”: Sequenced and task-levels

Render’s **Digital Construction Pack™** transforms design files into task-level deliverable work via a proprietary digital Blueprinting process.

The output is thousands of digital labor and material scopes, including BOQ/BOM sequenced to optimal delivery on a map.

Cloud-based GIS software with a mobile, connected workforce

Field teams are delivered tasks that are ready to commence, **based on an optimal build sequence through a cloud-based mobile platform.** Teams know exactly what they need to do and capture accurate, consistent data as soon as the work is completed in order to optimize quality and minimize costly rework.



Principle 2

Workflow digitization, automation and optimization

Daily, dependency-driven **resource optimization**

Greater resource utilization by releasing and managing work based on **sequenced, task-level work scope** at the individual and team level. Stakeholders can **dynamically reschedule work in real-time** to the most efficient contractors.

Replace manual, paper-based processes

Eliminate physical construction prints and the associated manual handoffs with an **entirely paperless network delivery** accelerated by rich, real-time project data and a new level of visibility on geospatial maps.

As-built data mapped to **downstream system requirements**

Construction, change, quality, digital redline, and photo data are collected at the task-level with mandatory data capture requirements.

Timely receipt of **complete, accurate As-built data for downstream utilization** results in a significantly reduced time-to-market.



Principle 3

Real-time geospatial visibility for all stakeholders

Make better decisions with unified data

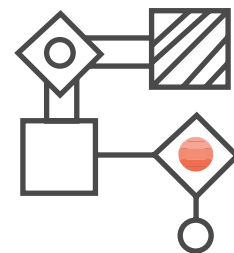
All project stakeholders require a **shared platform** at a program or portfolio level to predict, plan, optimize, and report progress. Identify where assets are, task completeness, and where to allocate more resources - in a simple, unified view.

Maximize investment and **integration** of existing project systems

Construction management **integration** with existing **GIS, master scheduling, work order, PNI, and finance** systems is critical to removing the need for error-prone end-user spreadsheets and delivering actionable insights.

Unequalled productivity from the field to the office

With access to real-time data in the field, management in the office knows **exactly what work has been done in real-time**, enabling them to **dynamically monitor** throughput and proactively **keep teams moving**.



Principle 4

One integrated, geospatial workflow for construction, QA, change management and redlining

Progressively identify and rectify quality issues, variations, and redlining **in a single, parallel digital workflow**, without any construction delays.

Digital tasks enable field and office teams to monitor progress and variations, manage issues, and deliver a timely and accurate record of the fiber or wireless network to streamline downstream systems and customer connections.

An aerial, grayscale view of a city street grid. A white grid is overlaid on the streets, and binary code (0s and 1s) is scattered across the bottom right. The text 'Render's unique technology-enabled approach' is written in white, sans-serif font across the middle of the image.

Render's unique
technology-enabled
approach



Continuously innovate and evolve technology to **Build Networks Better**

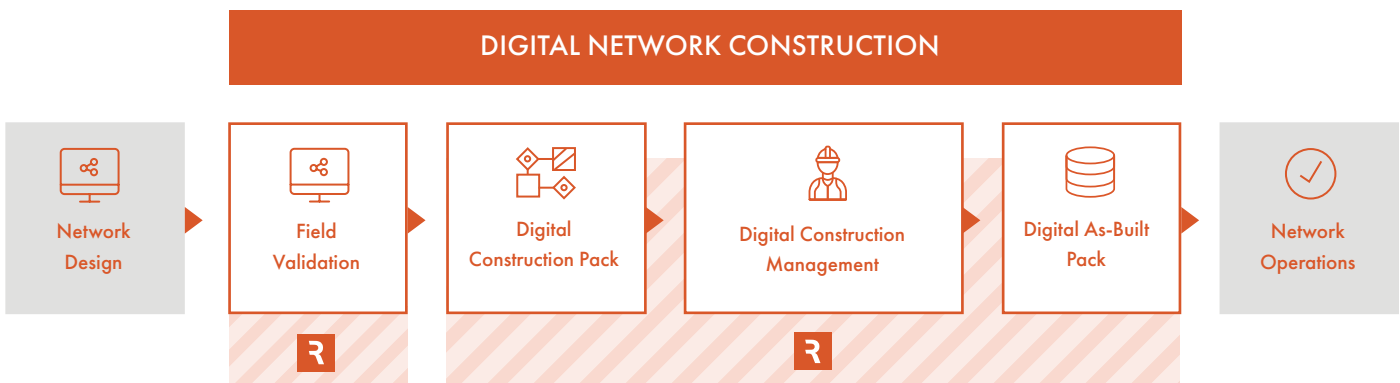
Utilizing today's GIS and mobile technology and the power of automation, Render's unique digital construction management platform solves the complexities associated with large-scale network deployment by eliminating manual handoffs and paper-based construction approaches.

Render validates network design in the field ensuring constructability, "blueprints" these designs into sequenced, deliverable tasks and allocates tasks to the field for maximum

productivity, resulting in schedule and cost efficiencies of up to 50% over traditional approaches.

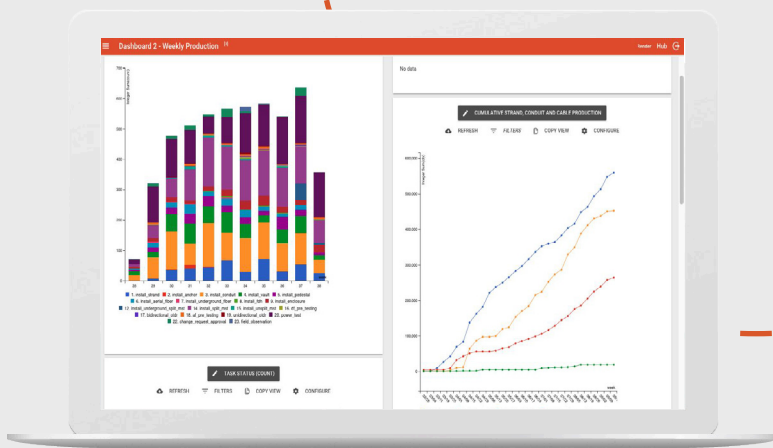
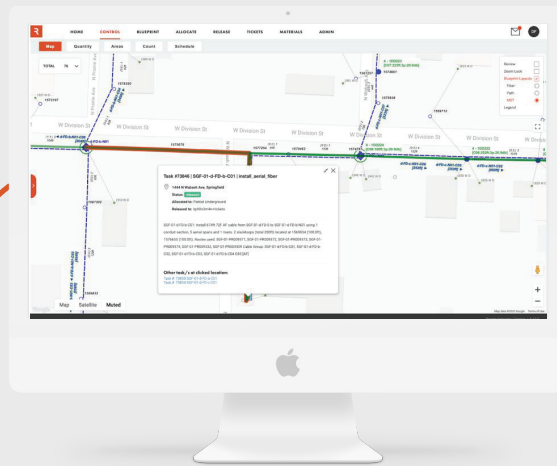
Real-time, geospatial data provides stakeholders with a single, integrated view of progress – increasing visibility and control at all stages of the network delivery lifecycle.

Render's platform is configurable for all telecommunications network architectures and technologies, including FTTx, LTE, 5G, fixed wireless, G-PON, E-PON, TAP, HFC, DOCSIS, and Ethernet.

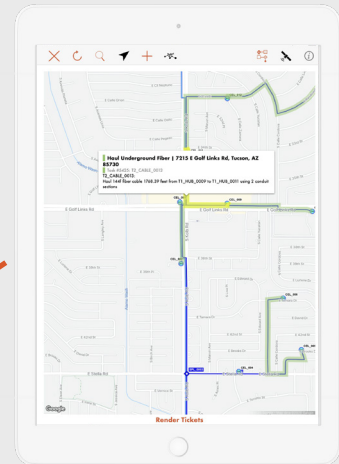


Digital Construction Management Platform

Scale | Web App
Manage Data



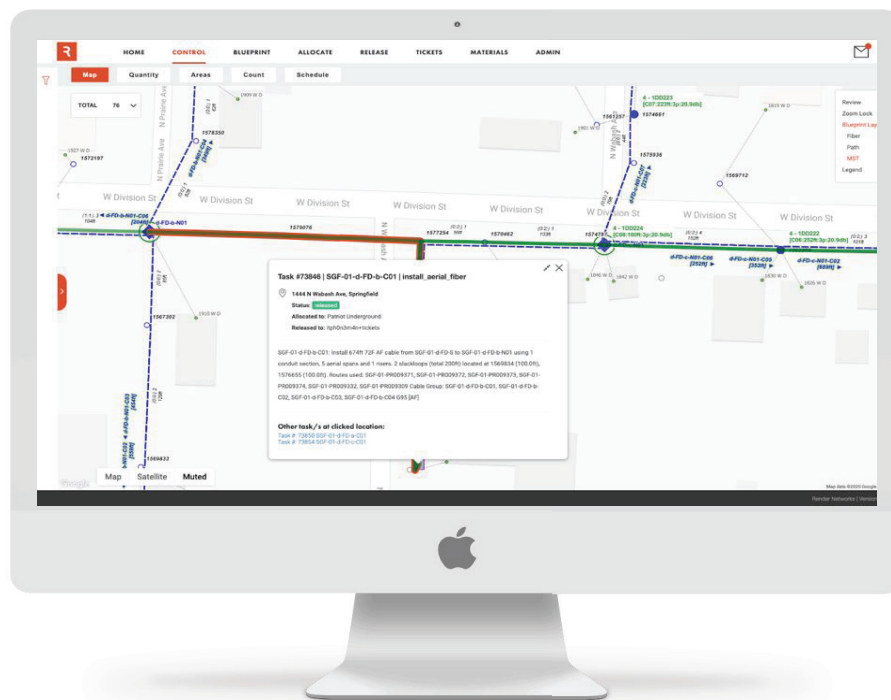
Hub | Web App
View Project-wide Data



Tickets | iOS App
Complete Tasks

Digital Construction Management Platform | Scale

Streamline work allocation with visibility across the entire project, including subcontractors



Optimize project visibility

Keep construction crews productive and dynamically schedule work each day to the most efficient contractors

Data quality and accuracy

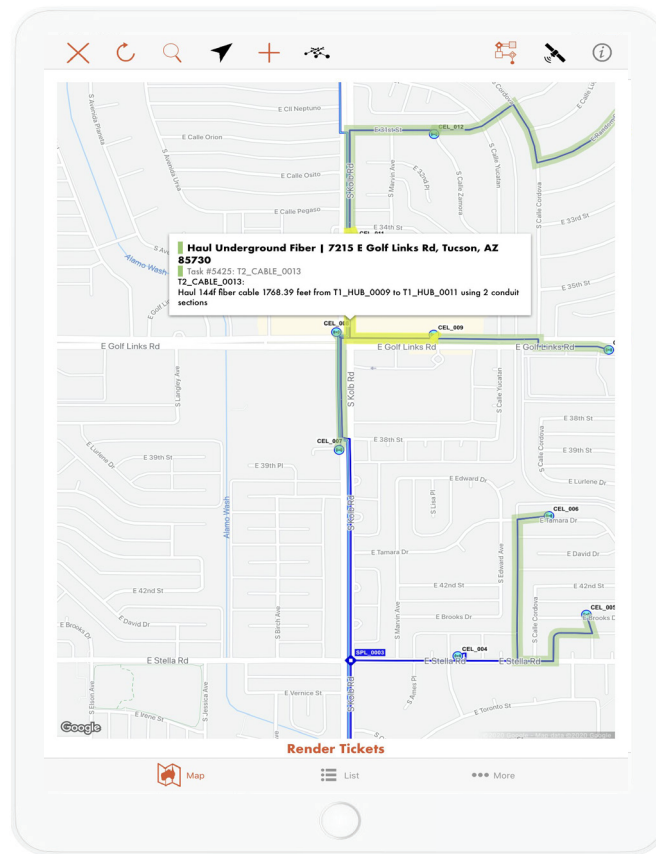
Capture all required data with certainty the first time

Make smarter, faster build decisions

Access real-time progress visibility to make informed decisions on construction and avoid costly delays

Digital Construction Management Platform | Tickets

Streamline data from the field to the office



Improve field productivity

Keep resources busy by only releasing tasks that are ready and sequenced to optimal delivery

Access As-built data in real-time

Keep resources busy by only releasing tasks that are ready and sequenced to optimal delivery

Capture all required As-built data

Build a record of work material data, digital red line and jeopardy data, photos, and other required artefacts

Digital Construction Management Platform | Hub

Leverage a cloud-based platform to predict, plan and optimize progress



Project visibility and control

Identify assets, task completeness and where to allocate more resources to keep projects on track

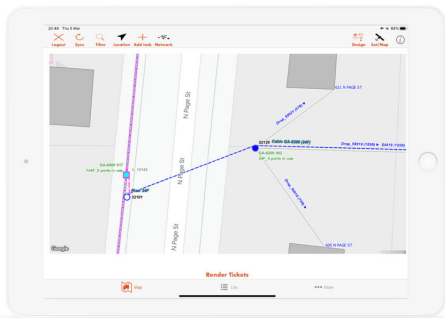
Seamless integration

Integrate work order, material management, field service management and more to harness a centralized view of project data

Actionable insights

Simple and configurable insights and dashboards for all stakeholders

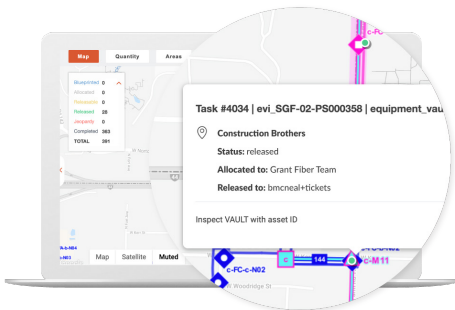
Next-generation capabilities for accelerated fiber and wireless network deployment



Planning and Design

Site Acquisition or Lease Management enabling tracking and managing search ring requests from RF engineering to site acquisition teams.

Permit Management tracks and monitors permit progress and manages releasing relevant work tasks to the field.



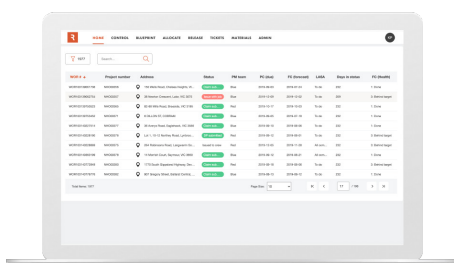
QA and Change Management

Render QA dynamically identifies and rectifies quality defects in parallel with the construction process.

Render Change Management streamlines the end-to-end change and approval process with real-time change management.

Render Digital Redlines maintains an accurate, geospatial record of network changes through construction and delivers this data in real-time to downstream operational systems.

Render RF testing coordinates integration testing, PIM testing, sweep testing, drive testing, and site activations.



Progress Visibility

Render Board provides a dynamic dashboard of progress by cell site, FTTH drop, network node or other priority deliverable.

Progressive Data Export delivers real-time data exports of progress tasks by status, asset by completions, and other customizable report formats.



Digital Network Construction **in** **action**



Unlock the efficiencies of Digital Network Construction

The following cost framework has been developed based on decades of global best-practices and domain expertise. It showcases the potential efficiencies available with an end-to-end digital deployment



Network Design

Network design represents about 6-10% of the overall cost of a network project but has a fundamental impact on the outcome. A digital view of the design evaluates the entire network route and manages the physical inspection of existing poles, vaults, ducts, and infrastructure.

Digital technology requires engineering teams to accurately collect specific field data before closing out survey tasks to ensure final quality designs. The process also provides an assessment of constructability, compliance with local standards, and requirements for wind loading, make-ready, and traffic control.

By reducing the amount of design effort through automation and utilizing technology to convert the design into a paperless geospatial task set, 20% savings are readily achievable.



Project Management

The allocation for project management usually accounts for around 10-15% of the project total and can be a crucial driver of efficiency. Digital technology removes the guesswork from the field by only allocating construction tasks that are ready based on an optimal build sequence with required prerequisite tasks completed. Truck rolls are only initiated when tasks are confirmed and ready for completion by qualified crews.

By simplifying the construction workflow, eliminating administration effort, and introducing productivity gains of a digital, paperless approach, crews increase their efficiency by 20%, and project administration resourcing is reduced by greater than 60%.



Contractor and Materials

The most significant contribution is the cost of contractors and materials, which make up 70% of a project budget, and contain the highest risk elements.

Increasing the transparency and visibility of where materials are used and by whom, utilization rates improve, and wastage reduces considerably. Project material wastage rates are reduced by a factor of five by streamlining material management and accurately tracking material utilization. When teams go faster on the labor side and less field supervision is required, cost efficiencies quickly stack up.

For typical large projects with three-year build forecasts using traditional methods, outside plant speed efficiencies of close to 50% are achievable with a digital approach.



Project Contingency or Margin

Contingency and margin typically represent 5-10% of overall project costs. Savings related to streamlined network delivery, integrated construction, QA and change processes, and reduction in variations all reduce contractor and material costs at completion.

Time-to-market is typically achieved two times faster and these savings contribute directly to increased margin or contingency.



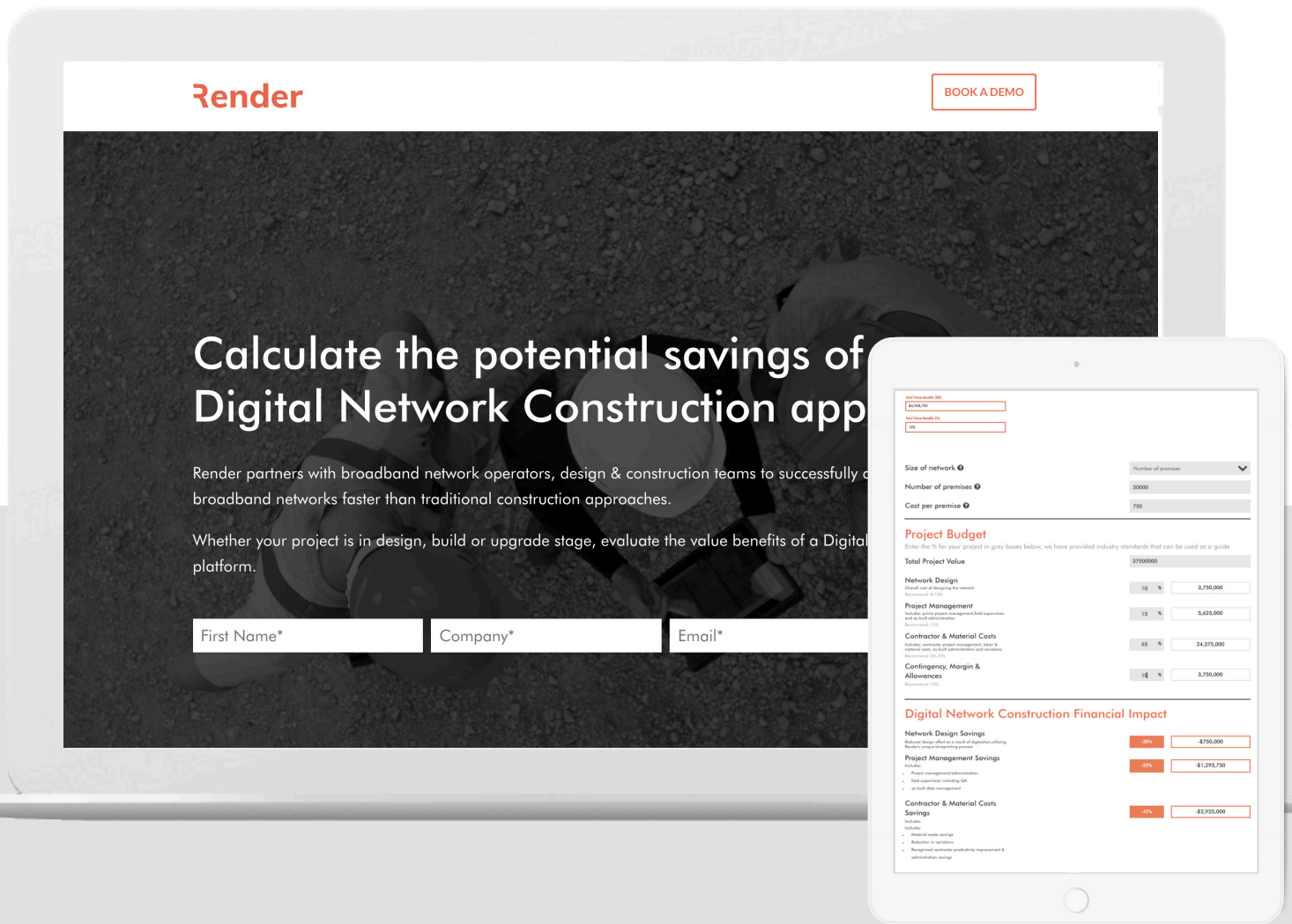
What are the bottom-line benefits?

The benefits outlined here are based on the utilization of an end-to-end geospatial digital deployment process. When these approaches are utilized, the financial benefits flow to network operators and contractors' bottom line.

Financial savings are one thing; however, what is most appealing is how these efficiencies improve the business case for funding. Operators can enable more customers to be connected with a given level of investment and also bring broadband internet services to their communities faster.

The cost and time saving estimates outlined are industry-standard and consistent with our experience deploying fiber in a variety of rural and urban environments. However, costs do vary with technology – so adjust these as necessary for your project.

Calculate your potential savings



Request a project estimate →

A black and white photograph of a windmill in a cornfield under a cloudy sky. The windmill is the central focus, with its large, multi-bladed wheel and a small rectangular sign attached to its side. The cornfield is in the foreground, and the sky is filled with soft, textured clouds.

Funding the future of rural America



Enabling rural network operators to deploy gigabit-capable fiber networks at the lowest possible cost

Render's role in FCC funding programs is to deliver technology-enabled efficiencies and deploy rural networks with significant time, cost, and quality improvements. Real-time project visibility and templated reporting capabilities provide confidence in delivering to census blocks and meeting post-award regulatory and compliance requirements.

Render delivers the following benefits for rural network operators and their trusted partners:



Reduced delivery risk

Access 50+ years of deployment expertise to inform your delivery model. Render's technology has industry best-practices in digital network deployment to yield predictable results. Seamless real-time tracking of progress against census block objectives enable early identification of performance issues or at-risk delivery to avoid post-award penalties



Unmatched real-time project visibility and FCC reporting capabilities

Confidence to cover entire census blocks and avoid penalties for missed milestones. Access customized data capture, reporting and compliance templates with built-in HUBB and DODC requirements to satisfy short and long-term regulatory reporting obligations.



Accelerate network build without increasing costs

Accelerate 'break-even' and positive cash flow while connecting members and your community to high-speed internet faster. Prepare your construction scope and schedule with confidence to enable a highly competitive bid while still maintaining build flexibility and sufficient margin or contingency.



Increased number of HHP

Expand service to meet the needs of additional areas that otherwise would be underserved or unserved.

Learn how Digital Network Construction enables rural network operators to build quality networks faster here [————>](#)

The **Render platform** has enabled CECC to deliver:



55% ahead of deployment schedule and 35% under budget

Outside plant being deployed **84% faster than planned**

75% saving in forecasted admin resource spend

Craighead Electric Cooperative Corporation (CECC) initiated a \$110 million project, in partnership with Irby Utilities, to modernize their grid and bring much needed high-speed broadband to their 30,000 members across rural Arkansas.

With a robust network design and a distributed workforce needing to make informed decisions in the field based on what they encountered, Render helped CECC take the design and flow it seamlessly through to project and task level management.

Render's core capabilities delivered the network design into manageable tasks but more importantly

gave CECC the ability to make informed, data-driven decisions on the infrastructure & deployment whilst continuing to construct. The team no longer needed to devote heavy resource towards status updates and tracking progress, every stakeholder has access to real-time geospatial progress views delivering unequalled visibility and incredible confidence in the project.

CECC's original goal was to cover 50% of its 30,000 members in 3 years. However, this has been achieved in less than 18 months – a testament to the network deployment efficiency that Render enables.



“ With Render productivity is off the charts, data integrity is high, and construction costs are down, all without ever touching a piece of paper. Now I can't imagine trying to implement a large-scale utilities construction project without Render. ”

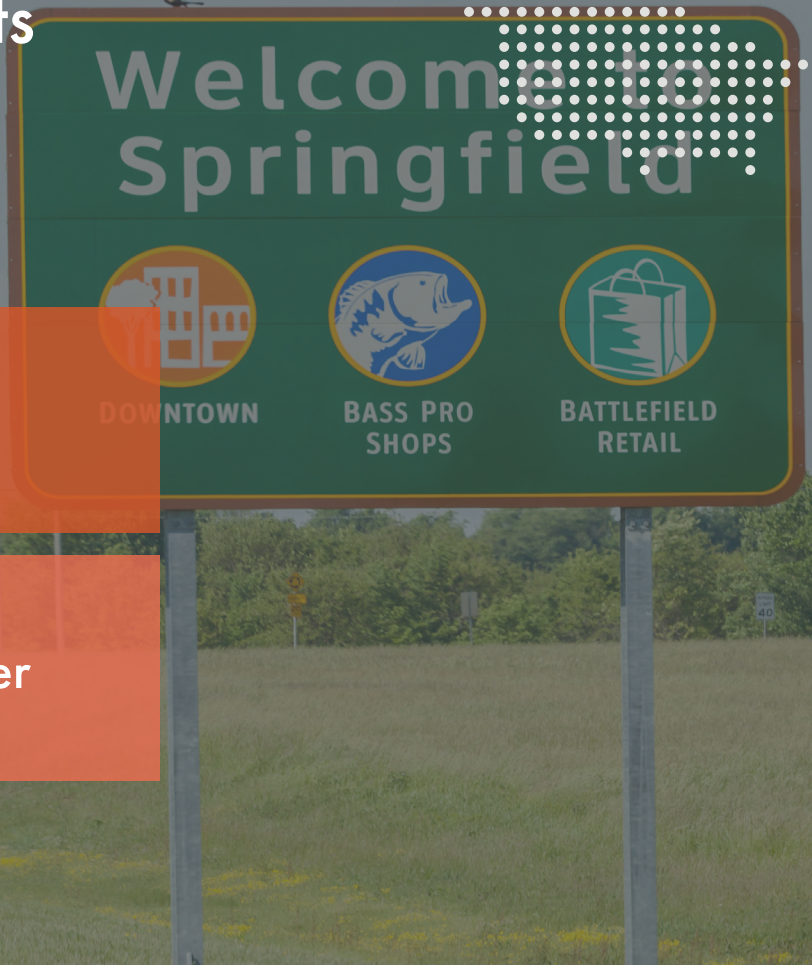
Jeremiah Sloan

Manager Fiber Assets | Craighead Electric Cooperative,
Arkansas USA

Key project highlights for City Utilities of Springfield include:

113,000 homes and businesses

\$120m | 1,000 miles fiber



City Utilities of Springfield and TBG Network Services are pioneering an innovative Utility Lease Model, where utilities invest in fiber infrastructure while leasing fiber capacity to top-tier ISP, CenturyLink.

Construction teams can view production in real-time, including delivery of real-time As-built data and QA as work is completed.

Six months in, digital approaches have been ramped quickly, customer connection experience for the Tier 1 anchor client is 'first class' due to network quality, and construction timelines are being met or exceeded.

"Render introduces valuable operational efficiencies that will complement our overall technology strategy. The Render platform introduces an innovative approach that addresses logistical complexities typically associated with projects of this scale."

Thomas Reiman, President, TBG Network Services



Key project highlights for Decon Technologies include:



Render's technology has been adopted to deliver **23,000 nbn connections** in Victoria

Project Administration cost **64% less than planned**

45% in-field productivity improvements

As nbn closes in on its goal of delivering high-speed broadband to 8.1 million Australian premises, Render formed a strategic partnership with Decon Technologies to ensure the final stages of the large-scale Fiber To The Curb (FTTC) rollout were delivered efficiently.

With nbn's FTTC deployment, the magnitude of the construction data to be managed increased significantly, amplifying the need for construction innovation. To achieve the aggressive delivery timelines, Decon Technologies recognized that a digital network construction strategy was necessary

to automate, optimize and efficiently deliver on targets and connections at scale.

Rollout progress is already demonstrating the power of the partnership to dramatically improve project velocity and outcomes including admin costs savings of over 60% compared to prior nbn Co. fiber projects in Australia.



Conclusion

Today's multi-billion dollar investments in fiber infrastructure should be the ideal incentive to embrace innovation and new technologies to improve data quality, maximize productivity and deliver networks faster and better. However, time and cost-constrained firms have focused on incremental improvements rather than considering broad process and technology adoption to achieve step-improvements in productivity.

At Render, we want to move network owners and construction teams towards a new way of thinking. If innovation does not lead the change, we believe it will result in sub-optimal results and an inability to meet aggressive deadlines. Ultimately, this will compromise the needs and expectations of communities that deserve access to the economic opportunity afforded by reliable and highspeed broadband.

Reimagining the rollout of network projects

To move at pace towards 5G and the economic advantages afforded by unconstrained data connectivity, the prohibitive costs of large-scale fiber and wireless deployments must be managed.

When you look at the challenges of large-scale deployment, you quickly realize that digital practices, automation and technology are what's needed to evolve the industry and remove the inefficiencies of manual handoffs and paper-based construction approaches.

With a proven Digital Network Construction platform, networks can be can be deployed faster than ever before, dramatically lifting in-field productivity and reducing administration effort, whilst increasing data quality and progress visibility.

Now is the time harness the power of today's technology and remove waste from network construction, so collectively we can better meet the needs of our communities.



Get in touch today:

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3. FBA: Paving the Road to 5G with fiber... FBA Paving the Road to 5G with fiber:
4. FCC Market Report here (this also needs to have the number updated in text body)