Streamlining Data Center Construction:
The Case for Early Integration of Tech-Enabled Quality Assurance, Quality Control, and Commissioning Services

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EXECUTIVE SUMMARY

In the high-stakes world of hyperscale data center construction, where projected capital expenditures in North America are set to reach $1 trillion over the next five years, delays, rework, and quality issues can erode budgets, timelines, and client trust. Traditional manual processes for quality assurance and quality control (QA/QC) and commissioning—relying on paper-based documentation, inconsistent inspections, and fragmented oversight—often lead to inefficiencies, safety risks, and costly errors.

By partnering with a technology-driven provider like Cumulus Digital Systems (www.cumulusquality.com) early in the planning phase, developers can embed advanced digital tools into their Quality and Commissioning Plans. This proactive approach not only enhances reliability and efficiency but also sets clear expectations in bid documents and contract negotiations with general contractors (GCs).

The result: faster project delivery, reduced risks, and superior operational readiness for hyperscale tenants demanding 99.999% uptime.

This document outlines the critical importance of early planning for tech-enabled QA/QC and commissioning services, details the comprehensive services Cumulus can provide, and demonstrates how integrating these into project frameworks yields measurable value.

THE IMPERATIVE FOR RELIABILITY

For developers constructing pre-leased data center campuses, ensuring the facility's electrical infrastructure is reliable and free from installation errors is paramount, especially after handover to the hyperscaler tenant. Hyperscalers operate under razor-thin margins for error, relying on uninterrupted power to support mission-critical workloads like cloud computing and AI processing. Installation flaws, particularly in busways within the data hall, can lead to dangerous electrical arc flashes—explosive events caused by loose connections, improper torquing, or faulty joint packs. These incidents not only pose severe safety risks, injuring thousands annually and resulting in 1-2 fatalities per day across industries, but also trigger cascading failures post-turnover, when the developer is no longer on-site but may still bear liability under lease agreements.

Arc flashes in busways often originate from construction-phase mistakes, such as uneven torque application, insufficient inspections, or poor alignment during installation. Once operations start, these hidden issues can appear under load, leading to equipment damage, fires, or outages that breach the developer's service level agreements (SLAs) with end-users.

The impacts go beyond immediate safety hazards: they include OSHA investigations, fines, medical expenses, legal action, and lost business opportunities. For a pre-leased facility, any incident after handover that can be traced to construction might breach lease terms, exposing the developer to penalties, reputational harm, and potential loss of future contracts with hyperscalers.

The financial implications of downtime due to improper installation are staggering. Data center outages disrupt business operations, leading to lost revenue, reduced productivity, and long-term recurring costs. For hyperscalers, even brief downtime can translate to millions in lost revenue per minute, compounded by SLA breaches, customer churn, and regulatory scrutiny. Developers face indirect hits through delayed payments, legal claims, or diminished asset value in a market where reliability is non-negotiable. By prioritizing error-free installations via tech-enabled QA/QC, such as automated torque verification and busway inspections, developers can mitigate these risks, ensuring seamless turnover and safeguarding their investment.

WHY EARLY PLANNING FOR TECH-ENABLED QA/QC AND COMMISSIONING IS ESSENTIAL

Data center construction projects are complex, involving thousands of electrical and mechanical connections, rigorous testing protocols, and multi-layered stakeholder coordination. Hyperscalers require flawless execution to avoid outages, safety incidents, or compliance failures, yet conventional approaches—dependent on manual torque logs, cable test reports, and inspections—create bottlenecks. For an average 80 MW data center building, teams of 20+ QA/QC staff, foremen, GC MEP managers, owner representatives, and third-party inspectors handle thousands of manual documents for cable testing and torque verification alone. This results in lost paperwork, inconsistent standards across contractors, and rework that can consume up to 12% of project costs.

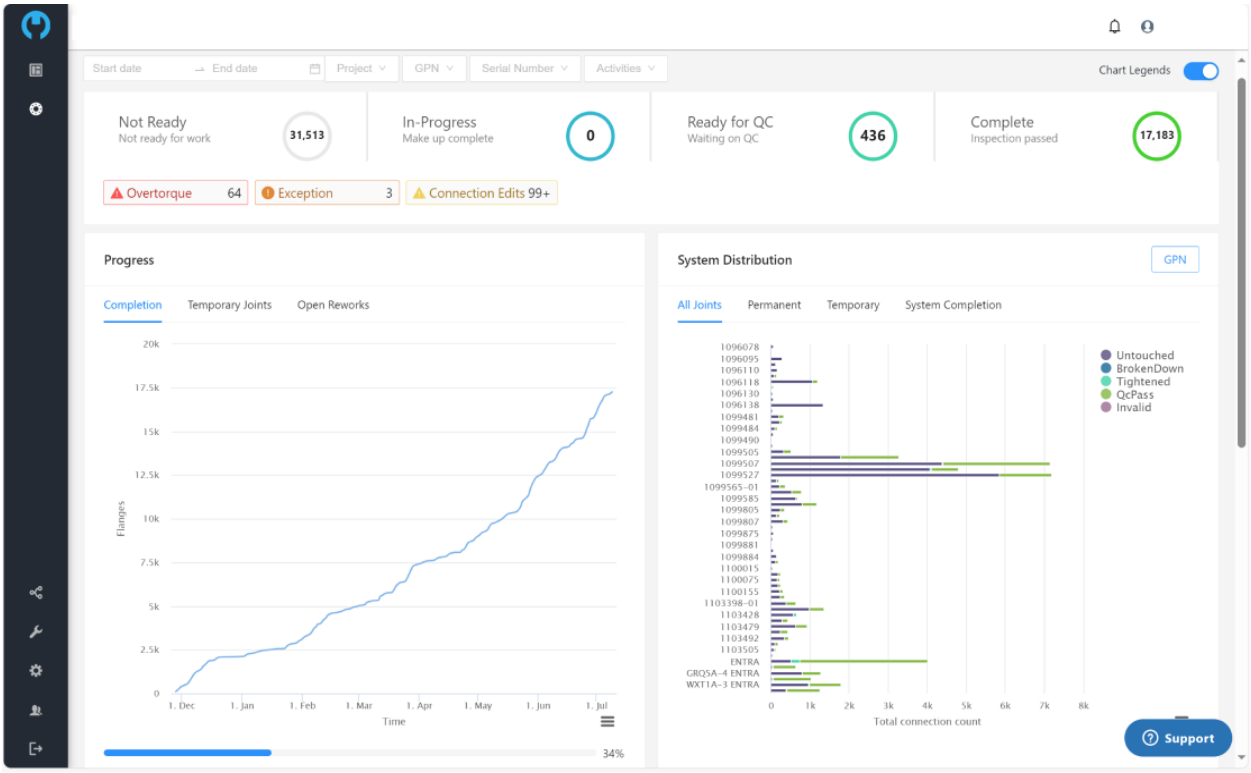
Planning for tech-enabled services early—before hiring a GC—mitigates these challenges by:

- **Embedding Technology from the Outset**: Digital platforms can automate data capture, provide real-time visibility, and standardize processes across all trades. Without early integration, retrofitting technology mid-project leads to resistance, training gaps, and suboptimal adoption.
- **Aligning Stakeholder Expectations**: Incorporating tech requirements into the Quality and Commissioning Plan ensures that bid documents specify digital tools for torque tracking, testing, and inspections. This prevents disputes during contract negotiations and holds GCs accountable for using standardized systems.
- **Reducing Risks and Delays**: Early adoption identifies potential issues in supply chain performance, equipment validation, and training needs. For instance, improper electrical connections risk arc flashes or fires, but digital guidance and automated verification catch errors in real-time, preventing startup delays and enhancing safety.
- **Optimizing Costs and Schedules**: By digitizing workflows, developers can save thousands of man-hours per building (e.g., over 3,000 hours and $300,000 in labor for torque and testing documentation). This accelerates commissioning, supports faster handover to operations, and provides a traceable baseline for long-term maintenance.

Failing to plan early often results in "pencil whipping"—falsified or incomplete records—and audit failures, jeopardizing lease agreements with hyperscalers. In contrast, early partnership with Cumulus positions developers to mandate digital QA/QC across contractors, ensuring consistency and scalability for campus-wide projects.

THE VALUE OF REAL-TIME DAILY PROGRESS TRACKING WITH CUMULUS DIGITAL SYSTEMS

Cumulus Digital Systems software delivers unparalleled real-time visibility into the daily progress of electrical contractors (EC) and mechanical contractors (MC) at granular levels, from individual data halls down to specific electrical busways and mechanical systems. This detailed oversight empowers the developer's owner team—including construction management, owner's representatives, and third-party quality and commissioning resources provided by Cumulus—to monitor contractor activities throughout the construction phase. By implementing Cumulus across all ECs, MCs, and integrators involved in modularized, offsite-optimized components of the data center design, developers gain a comprehensive, unified view of project advancement.



The importance of this real-time tracking cannot be overstated in the fast-paced environment of data center construction, where delays can cascade into multimillion-dollar setbacks. Traditional methods often rely on weekly reports or manual check-ins, leaving blind spots that allow issues to fester until they disrupt timelines.

In contrast, Cumulus' cloud-based dashboards and AI-powered analytics provide instant insights into work completions, such as torque verifications, cable installations, and system integrations, enabling proactive decision-making. This visibility allows the developer and GC to spot potential schedule delays early—whether due to material shortages, workforce inefficiencies, or integration challenges—and intervene swiftly to reallocate resources, adjust sequences, or address bottlenecks before they escalate.

The value extends to substantial cost savings and efficiency gains. Delays in data center projects can cost developers millions per month, driven by lost revenue opportunities, increased financing costs, and penalties from hyperscaler lease agreements. Real-time tracking mitigates these risks by streamlining operations, enhancing accountability among contractors, and improving data accuracy for better forecasting.

For instance, early detection of slippage in busway installations or mechanical system integrations can prevent weeks of overruns, reducing rework (which accounts for up to 30% of construction costs) and ensuring on-time delivery. Additionally, this level of detail supports optimized material flow, fewer surprises on-site, and data-driven adjustments that enhance overall project safety and quality. By fostering a culture of transparency and agility, Cumulus not only prevents costly delays but also positions developers to meet hyperscaler demands for rapid, reliable capacity rollout.

WHY STANDARDIZATION MATTERS ACROSS CONTRACTORS

Delivering data center construction projects at the fastest speed requires consistency. Still, varying contractor processes can lead to "pencil whipping" (inconsistent or falsified records), missing data, or non-compliance, all of which jeopardize project success. Cumulus enforces standardization by:

- **Digitizing SOPs**: AI-powered workflows ensure all contractors follow the same QAQC procedures for activities such as cable testing, torque verification, and installation, reducing variability.
- **Automating Data Capture**: Bluetooth-enabled tools and mobile apps collect granular data, eliminating manual errors and ensuring accuracy.
- **Centralizing Reporting**: Cloud-based reports provide a single source of truth, accessible to all stakeholders, for seamless collaboration and accountability.
- **Scaling Quality**: Cumulus has been used to manage over 7,000,000 work completions, including 2GW of data center construction since 2022, proving its ability to standardize quality at hyperscale.

This standardization not only meets hyperscaler expectations but also streamlines the commissioning process, reducing costs and accelerating handover.

COMPREHENSIVE SERVICES PROVIDED BY CUMULUS DIGITAL SYSTEMS

Cumulus Digital Systems offers a suite of tech-enabled QA/QC and commissioning services tailored for data center construction. Leveraging AI-powered workflows, Bluetooth-enabled tools, and cloud-based dashboards, Cumulus automates critical processes while providing expert oversight. These services draw from industry-leading best practices, including pre-construction phase consulting and planning, systematic validation of electrical systems, inspection and commissioning services, and project management, to deliver error-free operations.

Pre-Construction Phase

In the critical pre-construction planning phase—before engaging a general contractor (GC)—Cumulus Digital Systems acts as a strategic partner to developers, helping to establish robust quality assurance/quality control (QA/QC) and commissioning standards that ensure project success. Cumulus provides tailored consulting services during this phase, drawing on industry-leading best practices in electrical and mechanical validation, digital tooling, and data-driven oversight. Key offerings include:

- Development of Customized Quality and Commissioning Plans
- Integration of Technology Standards
- Training Framework Design
- Risk Assessment and Submittal Guidelines

Project Management

Cumulus provides dedicated oversight for receipt inspections, safety protocols, and coordination efforts. This includes:

- Reviewing asset drawings against as-found conditions to ensure conformance.
- Managing communication between field supervisors, inspectors, and GCs, including attendance at site meetings.
- Developing temporary power plans to minimize impacts on inspections and commissioning.
- Implementing lockout/tagout (LOTO) programs with area coordinators and isolation officers to control hazardous energy.
- Assisting in scheduling, submittal reviews, and troubleshooting to keep construction and commissioning on track.

By integrating digital tracking into these processes, Cumulus offers real-time progress visibility, automated issue logging, and a unified platform for updates, reducing administrative burdens and ensuring timely data accuracy.

Systematic Approach to Validating Electrical Systems

Cumulus employs a comprehensive methodology for electrical validation, including:

- Asset/drawing conformance reviews and current/potential transformer checks to align with power monitoring systems.
- Labeling verification, mechanical checks, and foreign material exclusion (FME) inspections.
- Wire size, breaker function, and lug application reviews.
- Digital low-resistance ohmmeter testing and insulation resistance (megger) verification.

These steps are automated through Cumulus' mobile app, ensuring 100% traceability and reducing commissioning issues.

Sealing, Torquing, and Inspections

Cumulus excels in high-risk areas prone to failures:

- 100% torque witnessing for bus bars, tap boxes, critical bus plugs, and joint packs using Bluetooth wrenches for automated logging.
- Two-pass inspections for bus plugs, maintenance transfer switches (MTS), and non-fused equipment reducers (NFER), including bonding, lug torque, and crossover cable witnessing.
- Joint pack inspections and busway excellence protocols to verify dimensions, torque, and covers.
- Vibration data collection for generators and equipment baselining.

Digital torque logs and IoT data collection eliminate manual entry, provide root cause analysis, and ensure no lost paperwork.

Commissioning Support

Cumulus streamlines Levels 2-5 commissioning:

- Oversight of L2 reviews and checklists for asset readiness.
- Cable insulation resistance testing and pre-energization inspections.

- Execution of Level 4 scripts, issue resolution, and close-out reporting.
- Duct leakage testing, thermography, and current injection for busway validation.
- Final project close-out, including commissioning reports and lessons learned.

Automated documentation accelerates testing, with actionable QA/QC data replacing manual reviews. Cumulus has supported over 2 GW of data center construction since 2022, with a hyperscaler case study showing zero arc flash incidents, 90% fewer torque-related issues, and 80% less rework.

CUMULUS SERVICES IN THE PRE-CONSTRUCTION PLANNING PHASE

By embedding Cumulus' expertise and technology early, developers can define precise, enforceable requirements for GCs and their trade partners (sub-contractors), minimizing risks, standardizing processes, and aligning the entire project team with hyperscaler expectations for reliability and efficiency. This forward-thinking approach not only streamlines bid documents and contract negotiations but also sets the foundation for seamless execution, reducing the likelihood of costly rework or delays during construction.

Cumulus provides tailored consulting services during this phase, drawing on industry-leading best practices in electrical and mechanical validation, digital tooling, and data-driven oversight. Key offerings include:

- **Development of Customized Quality and Commissioning Plans**: Cumulus collaborates with the developer's owner team to create comprehensive plans that outline QA/QC protocols, such as systematic electrical validation (e.g., asset drawing conformance, torque witnessing, and insulation resistance testing) and commissioning levels (L2 through L5). These plans incorporate digital tools like AI-guided workflows and Bluetooth-enabled devices to automate documentation and verification, ensuring standards are tech-enabled from the outset. By defining metrics for success—such as 100% traceability in torque logs and real-time issue resolution—developers can mandate adherence in GC contracts, fostering accountability across sub-contractors.
- **Integration of Technology Standards**: Cumulus advises on embedding digital platforms into the project's core framework, including specifications for IoT data collection, cloud-based dashboards, and mobile apps for real-time progress tracking. This includes recommending standardized operating procedures (SOPs) for high-risk activities like busway installations and joint pack inspections, which are prone to errors if not digitally monitored. Early involvement allows developers to require GCs and trade partners to use Cumulus-compatible tools, preventing inconsistencies and enabling proactive risk mitigation during construction.
- **Training Framework Design**: To build a culture of excellence, Cumulus helps design site-specific training programs for torque application, busway excellence, and ACC or Procore issue management. These frameworks ensure that GCs and subcontractors receive structured, performance-based training aligned with the project's standards, reducing human error and aligning all parties with hyperscaler reliability demands.
- **Risk Assessment and Submittal Guidelines**: Cumulus conducts preliminary risk assessments to identify potential issues in supply chains, equipment validation, and safety protocols (e.g., lockout/tagout programs). This informs submittal review processes and temporary power plans, which are incorporated into bid documents to guide GC selections. By setting these standards early, developers can evaluate bids based on compliance with digital QA/QC requirements, ensuring selected partners are equipped to deliver error-free installations.

Through these services, Cumulus empowers developers to transition smoothly into construction, with predefined standards that enforce consistency, enhance safety, and optimize costs.

INTEGRATING CUMULUS INTO BID DOCUMENTS AND CONTRACT NEGOTIATIONS

To maximize value, developers should include Cumulus' tech-enabled services in the Quality and Commissioning Plan from the planning phase:

- **Quality and Commissioning Plan Guidance**: Cumulus advises on incorporating digital tools for real-time supply chain indicators, standardized documentation, and progress tracking. This includes specifying Bluetooth-enabled torque wrenches, AI-guided SOPs, and cloud dashboards.
- **Bid Documents**: Mandate Cumulus adoption by requiring bidders to demonstrate compatibility with digital QA/QC platforms. Include clauses for automated torque and testing reports, training requirements, and performance metrics (e.g., 100% traceability).
- **Contract Negotiations with GCs**: Negotiate terms that enforce Cumulus use across subcontractors, with penalties for non-compliance and incentives for early adoption. Define KPIs, such as rework rates (<2%) and commissioning durations, and back them with Cumulus dashboards for verification.

Cumulus' turnkey implementation—handling data preload, training, and integration—ensures seamless rollout, with SOC 2, Type 2 certification for data security.

CONCLUSION: PARTNER WITH CUMULUS FOR FUTURE-PROOF DATA CENTERS

Developers who engage with Cumulus pre-GC report faster project ramps, fewer commissioning hurdles, and stronger lease compliance, ultimately protecting their investment in pre-leased hyperscale facilities. Early integration of Cumulus Digital Systems as part of the owner team transforms data center construction from reactive to proactive, delivering safer, faster, and more reliable projects. By planning for tech-enabled QA/QC and commissioning upfront, developers can enforce standards in bids and contracts, avoid costly pitfalls, and meet hyperscaler demands. With proven results—including thousands of saved man-hours and full traceability—Cumulus is the partner to ensure your data center campus is built right the first time.

Contact Cumulus at info@cumulusquality.com to explore how we can support your next project.

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