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# BASIS OF DESIGN - COMMUNICATIONS

## CSI Division 27

### Pryor Data Center - PACHYDERM GLOBAL

**Parent Document:** [[Saga Pryor DC/Basis of Design/Erik\_BOD\_Updated/\_BOD - Exec Summary and TOC]]

## OVERVIEW

Telecommunications infrastructure provides carrier-neutral, diverse, and redundant connectivity supporting 12 MW IT capacity with multiple fiber paths, cloud on-ramps, and structured cabling systems.

**Design Philosophy:** - **Carrier-neutral:** Open access to all telecommunications carriers - **Physical diversity:** Multiple fiber entry points from different directions - **Scalability:** Infrastructure sized for 12 MW (expandable to 24 MW master plan) - **Cloud connectivity:** Direct connections to AWS, Azure, GCP

## FIBER ENTRY & PATH DIVERSITY

### Dual Fiber Entry Points

**Primary Entry (East Side):** - Location: East wall, near electrical yard - Conduits: 4 × 4” PVC/HDPE from property line to MPOE-1 - Vault: Telecommunications manhole at property line (carrier hand-off point) - Purpose: Primary carrier route

**Secondary Entry (West Side - Diversity):** - Location: West wall, opposite side of building - Conduits: 4 × 4” PVC/HDPE from property line to MPOE-2 - Vault: Separate telecommunications manhole - Physical separation: >150 ft from primary entry - Purpose: Geographic diversity (different carrier routes)

**Benefits of Dual Entry:** - Redundancy: If one fiber route is cut, secondary route maintains connectivity - Carrier diversity: Different carriers can use different entry points - Future capacity: 8 total conduits support expansion to 24 MW

### Conduit Infrastructure

**Specifications:** - **Material:** Schedule 40 PVC or HDPE - **Size:** 4” inner diameter (accommodates multiple fiber cables) - **Pull rope:** Installed in all conduits for future cable installation - **Markers:** Conduit route markers every 50 ft (locatable) - **Depth:** 36-48” burial depth per NEC Article 800

**Entry Seal:** - Fire-rated conduit sealing compound at building penetrations - Prevents water intrusion, fire spread, and pest entry

## MAIN POINT OF ENTRY (MPOE) & MEET-ME-ROOMS (MMR)

### Configuration

**2 × MPOE/MMR Facilities (Geographically Diverse):**

**MPOE-1 (Primary):** - **Location:** East side, ground floor - **Size:** 250-300 SF - **Fiber entry:** From east property line conduits - **Purpose:** Primary carrier demarcation and cross-connect

**MPOE-2 (Secondary/Diverse):** - **Location:** West side, ground floor - **Size:** 250-300 SF - **Fiber entry:** From west property line conduits - **Purpose:** Diverse carrier route termination

**Why Two MPOEs:** - Geographic diversity (different fiber routes from different directions) - Redundancy (if one MPOE fails or fiber cut, secondary maintains service) - Carrier preference (some carriers prefer specific entry points)

### MPOE/MMR Specifications

**Each MPOE/MMR Includes:**

**Rack Space:** - 10-15 × 42U four-post racks (carrier equipment) - Capacity: ~10-15 carriers per MMR (adequate for 12 MW facility)

**Power:** - Dual-feed power (A-side + B-side from SWBD-A and SWBD-B) - 200-400A panel per MMR - Redundant UPS-backed circuits for carrier equipment

**Cooling:** - Dedicated split system or precision cooling unit - Capacity: [ROM] 30-50 kW per MMR (carrier equipment heat load) - Redundancy: N+1 or dual units

**Fire Suppression:** - Preaction dry pipe or clean agent (coordinate with data hall system) - VESDA smoke detection

**Grounding:** - Telecommunications main grounding busbar (TMGB) per TIA-607-C - Bonded to building grounding system

**Security:** - Card reader + biometric (two-factor authentication) - CCTV coverage (entry monitoring) - Access restricted to facility staff and authorized carriers

### Cross-Connect Infrastructure

**Fiber Cross-Connect Panels:** - LC duplex or MTP/MPO high-density panels - Capacity: 288-576 fibers per panel (adequate for 12 MW) - Labeling: Customer ID, circuit ID, carrier name

**Cable Management:** - Overhead ladder rack or wire basket tray - Vertical cable managers on racks - Minimum bend radius: 1.5” for single-mode fiber

**Patch Cords:** - Single-mode fiber (OS2) for long-distance/carrier circuits - Multi-mode fiber (OM4) for short in-building connections - Quality: Low insertion loss (<0.5 dB), tested and certified

## MAIN DISTRIBUTION AREA (MDA)

### Purpose

Central location for facility network equipment (not customer equipment). Houses core switches, firewalls, and BMS/DCIM infrastructure.

### MDA Specifications

**Location:** Adjacent to data halls (central position)

**Size:** 300-400 SF

**Rack Space:** - 4-6 × 42U four-post racks - Equipment: Core switches, firewalls, BMS/DCIM servers, NOC workstation switches

**Power:** - Dual-feed UPS-backed circuits (A-side + B-side) - 100-200A panel

**Cooling:** - Shared with data hall HVAC or dedicated mini-split - Capacity: [ROM] 20-30 kW

**Structured Cabling:** - Fiber backbone from MDA to each data hall zone - Fiber: 24-48 strands single-mode + 24-48 strands multi-mode - Copper: Cat6A for management network (if needed)

## FACILITY BACKBONE ARCHITECTURE

### Network Segmentation

**Physical Networks:**

**1. IT Network (Customer):** - Customer servers, applications, internet gateway - Isolated from facility networks (firewall, VLAN segmentation) - No direct connection to facility BMS/DCIM

**2. Facility Network (BMS/DCIM):** - Building management system (HVAC, lighting) - EPMS (electrical power monitoring) - DCIM (rack power/cooling monitoring) - Access control, CCTV

**3. Management Network (NOC/Admin):** - NOC workstations - Remote access (VPN gateway) - Administrative access to facility systems

**Firewall:** Between IT and Facility networks (strict access control rules)

### Backbone Topology

**Redundant Fiber Ring:** - Fiber backbone connects MDA → Data Hall 1 → Data Hall 2 → MPOE-1 → MPOE-2 → MDA (ring) - Dual fiber paths (A-side + B-side) - Automatic failover if one fiber path cut

**Core Switches:** - 2 × redundant core switches in MDA (A/B) - 10 Gbps or 40 Gbps uplinks - Layer 3 routing, VLANs for network segmentation

## STRUCTURED CABLING (DATA HALLS)

### Horizontal Cabling

**Configuration:** - Overhead ladder rack or wire basket tray - Route: MDA → Data hall zone distribution frames → Cabinets - No raised floor (slab-on-grade with overhead cable distribution)

**Cabling Types:** - **Fiber:** OM4 multi-mode (850 nm, 100 Gbps capable) for cabinet connections - **Copper:** Cat6A (10 Gbps) for management/IPMI connections (if needed)

**Cabinet Connectivity:** - 2 × fiber pairs per cabinet (A-side + B-side for redundancy) - Terminates at cabinet top-of-rack (ToR) switches or directly to customer equipment

### Labeling & Documentation

**Cable Labels:** - Source/destination, circuit ID, installation date - Attached at both ends and every 10 ft along route

**As-Built Documentation:** - CAD drawings showing all fiber routes, patch panel assignments - Cable schedule (Excel or database) with circuit IDs, customer assignments - Updated whenever changes are made

## CLOUD CONNECTIVITY

### Cloud On-Ramp Strategy

**Direct connections to major cloud providers:**

**AWS Direct Connect:** - Via carrier partners (Equinix, Megaport, etc.) - Bandwidth: 1 Gbps, 10 Gbps, or 100 Gbps - Latency: <5 ms to nearest AWS region (likely Dallas or Kansas City)

**Microsoft Azure ExpressRoute:** - Via carrier partners - Bandwidth: 50 Mbps to 100 Gbps - Private connection to Azure services

**Google Cloud Platform (GCP):** - **Proximity advantage:** Pryor is ~20 miles from Google’s Mayes County data center campus - **Potential for low-latency interconnect:** <2 ms if direct fiber route available - **Interconnection options:** - Partner Interconnect (via carrier in MMR) - Dedicated Interconnect (if direct fiber to Google facility negotiated)

### Implementation

**Carrier Partners:** - Carriers present in MMR offer cloud on-ramps as a service - Customer orders cross-connect from MMR to their cabinet - Carrier provides cloud connectivity (AWS, Azure, GCP)

**Customer Value:** - Low-latency hybrid cloud deployments - Reduced data egress costs (bypass internet) - Secure private connectivity to cloud services

## TELECOMMUNICATIONS GROUNDING & BONDING

### TIA-942 Compliance

**Telecommunications Main Grounding Busbar (TMGB):** - Located in MDA - 1/4” × 2” copper busbar, minimum 10 ft long - Bonded to building grounding electrode system

**Telecommunications Bonding Backbone (TBB):** - 6 AWG bare copper conductor - Connects TMGB to grounding busbars in each MPOE/MMR, data hall zone

**Equipment Grounding:** - All racks bonded to TBB via 6 AWG copper - All carrier equipment chassis bonded to rack - Fiber cable shields bonded at entry point only (avoid ground loops)

**Standards:** - TIA-607-C (Telecommunications Bonding and Grounding) - J-STD-607-B (Commercial Building Grounding/Bonding)

## CARRIER ONBOARDING PROCESS

### New Carrier Installation

**Step 1: Carrier Requests Space** - Carrier submits application (equipment list, power requirements, fiber route) - Facility approves based on MMR capacity

**Step 2: Carrier Installation** - Carrier pulls fiber from property line vault to assigned MMR - Carrier installs equipment in assigned rack space - Carrier terminates fiber on designated cross-connect panel

**Step 3: Cross-Connect Activation** - Customer orders cross-connect from carrier panel to customer cabinet - Facility staff install fiber patch cord (MMR → customer cabinet) - Circuit tested and activated

**Step 4: Ongoing Maintenance** - Carrier responsible for their equipment maintenance - Facility provides rack space, power, cooling, security

## COST SUMMARY

| System | Cost Estimate |
| --- | --- |
| **Fiber Conduit Infrastructure (Dual Entry)** | $200-400K |
| **MPOE-1 Fit-Out (Racks, Power, Cooling)** | $150-300K |
| **MPOE-2 Fit-Out (Racks, Power, Cooling)** | $150-300K |
| **MDA Fit-Out (Core Switches, Racks)** | $100-200K |
| **Fiber Backbone (MDA to Data Halls, MPOEs)** | $100-200K |
| **Structured Cabling (Overhead, Cabinets)** | $200-400K |
| **Grounding & Bonding (TMGB, TBB)** | $50-100K |
| **Cross-Connect Infrastructure** | $50-100K |
| **Total Communications Infrastructure** | **$1.0-2.0M** |

**Recurring Costs (OPEX):** - Carrier circuits: Varies by customer (customer-paid) - Cloud on-ramps: $500-5,000/month per connection (customer-paid)

## CODES AND STANDARDS

* **TIA-942-B** (Telecommunications Infrastructure Standard for Data Centers)
* **TIA-568-D** (Commercial Building Telecommunications Cabling Standard)
* **TIA-607-C** (Telecommunications Bonding and Grounding)
* **NEC 2023 Article 800** (Communications Circuits)
* **BICSI DCIM** (Data Center Infrastructure Management Best Practices)

**Tags:** #pryor-dc #communications #fiber #mpoe #mmr #carrier-neutral #cloud-connectivity

**Next Steps:** 1. Confirm fiber routes and carrier availability in Pryor, OK area 2. Negotiate carrier on-ramp agreements (AWS, Azure, GCP partners) 3. Design fiber backbone routing (overhead tray layout) 4. Develop cross-connect pricing and procedures for customers 5. Coordinate TMGB/TBB installation with electrical grounding system

**Document Control:** - **Source:** Pryor\_Bod\_EVS\_Rev01.md and Erik\_BOD reference - **Date Updated:** October 29, 2025 - **Prepared by:** EVS / PGCIS Team - **Key Updates:** Dual MPOE/MMR for geographic diversity, cloud connectivity strategy