

Decoding Commercial Plans

Interactive Blueprint Reading & Estimating Strategies

Ryan Byrne • Air Quality Systems • Atlanta, GA
NADCA Fall Technical Conference • 2026



Copyright © 2021 NADCA, All Rights Reserved

No part of this publication may be reproduced or distributed by any means, electronic or mechanical, including photocopy, recording, or any other information storage and retrieval system, without prior written consent from the publisher.



Presenter



Ryan Byrne

Vice President

Air Quality Systems — Atlanta, GA

- NADCA ASCS and CVI
- ICRA certified
- ASHRAE — Atlanta Chapter
- NADCA Fall Technical Conference Committee
- Regional Coordinators Committee, U.S. Southeast



Disclaimer

This presentation is not intended to be a comprehensive program covering all aspects of this topic. All technicians are encouraged to read and follow all applicable standards, codes and regulations related to this topic.

- 1 It is the responsibility of each individual contractor to follow local building codes and licensing requirements and to work safely in accordance with OSHA guidelines.
- 1 It is the contractor's responsibility to take proper precautions on each project to prevent cross contamination. Always take the health and safety of the building occupants into consideration before you conduct any cleaning procedures.
- 1 All of the following tips are only general tips. They do not cover every situation and it is your responsibility to adapt these tips to the individual system you are working on.
- 1 The Instructor is not responsible in any way for the work you perform after viewing this slide show. You are responsible for your own work.
- 1 The views and opinions following are the instructors opinions and not necessarily the official position of the National Air Duct



What We'll Learn

- 1 Read the plan set with purpose
- 2 Trace systems and zoning
- 3 Build an accurate takeoff
- 4 Bid to protect your margin



Decoding Commercial Plans

Why the Plans Matter

1 The Square-Foot Guess

- Prices floor area, not system density
- A 40,000 sf warehouse and a 40,000 sf patient tower are not the same job
- Fast — and wrong in both directions

2 The Walkthrough Alone

- You see what hangs below the ceiling
- Above the lid, you are estimating from memory
- No defensible quantity to point at six months later

3 The Plan-Based Takeoff

- Quantities you can show, defend, and repeat
- Assumptions become written scope
- Turns field surprises into change orders



Decoding Commercial Plans

Anatomy of a Commercial Plan Set

- **G — General** Sheet index, symbol legends, code and life-safety summaries. Start here every time.
- **A — Architectural** Floor plans, reflected ceiling plans, partition types. Your access and containment picture.
- **M — Mechanical** Duct plans, equipment schedules, details, riser diagrams, control sequences.
- **E, P, FP** Everything else competing for the same plenum space. Coordination sets your real production rate.
- **Specifications** Division 23 for materials and methods. Division 01 for site rules, hours, and submittals.



Decoding Commercial Plans

The Sheets That Drive Your Number

- 1 **Mechanical floor plans** Duct routing, sizes, device locations, rise and drop.
- 2 **Equipment schedules** AHU, RTU, VAV, and exhaust fan data — CFM, filters, coils, cabinet size.
- 3 **Mechanical details** Liner, insulation, access door construction, and support spacing.
- 4 **Reflected ceiling plans** Ceiling type and height. Grid versus hard ceiling - not a small detail to overlook.
- 5 **Life-safety plans** Tells you where fire and smoke dampers live.
- 6 **Division 23 specs** Liner material, cleaning and verification requirements, allowable work hours.



Decoding Commercial Plans

Before You Read a Single Duct Run

- 1 **Title block** Sheet number, discipline, issue date, revision, seal. Confirm you are on the current set.
- 2 **Scale** Verify against a known dimension before you measure. Never trust a scaled PDF at face value.
- 3 **North arrow and matchlines** Matchlines are where quantities get double-counted or dropped entirely.
- 4 **Revision clouds and deltas** The deltas tell you what changed — and what your competitors may have missed.
- 5 **General notes and keynotes** The scope-changing sentence almost always hides here, not on the plan.
- 6 **Legend and abbreviations** Every set defines its own symbols. Assume nothing carries over from the last job.

GENERAL HOSPITAL — TOWER B MECHANICAL RENOVATION LEVELS 1–2 PROJECT NO. 2024-118	REVISIONS 1 05.14.26ADDENDUM 2 — DUCT REROUTE, LEVEL 2 2 06.02.26ASI 004 — AHU-3 FILTER BANK REVISED <i>Bidding off the old set? You just missed both of these.</i>	SCALE: 1/8" = 1'-0" DATE: 06.02.2026 DRAWN: RB / CHK: JM SHEET M-201
--	--	---



Decoding Commercial Plans

Decoding the Mechanical Symbols

Airstreams and Line Work

- SA, RA, OA, EA, RL, TA — know which airstream you are actually pricing
- Dashed or solid: new, demo'd or existing — check the legend, not your habit
- Rise and drop symbols mark elevation changes and added fittings

Devices and Dampers

- Diffusers, return and exhaust grilles — each one is an access point and a task
- VD, FD, SD, FSD, BDD — damper type tells you where barriers and required access are
- VAV boxes, fan-powered boxes
- Turning vanes, taps, and offsets — fitting density is a production-rate driver



Decoding Commercial Plans

Symbols in Context

LINE WORK



Solid-line duct
New ductwork.



Dashed / hidden
Existing or ductwork being demo'd



Single-line duct
Not to scale. Never take width off it.



Rise / drop
Elevation change. Adds fittings and access.

AIR DEVICES



Supply diffuser
Remove, clean, reinstall.



Return grille
Count separately from supply.



Linear diffuser
Do not forget the boot!



Round takeoff
Where branch duct leaves the trunk.

DAMPERS & TERMINALS



Volume damper
Balancing point. Usually not an access point.



Fire damper
Marks a rated barrier. Access required.



Fire / smoke damper
Rated barrier plus controls.



Terminal unit
Each one is an access and a cleaning item.



Decoding Commercial Plans

Duct Callouts: Size, Shape, Material

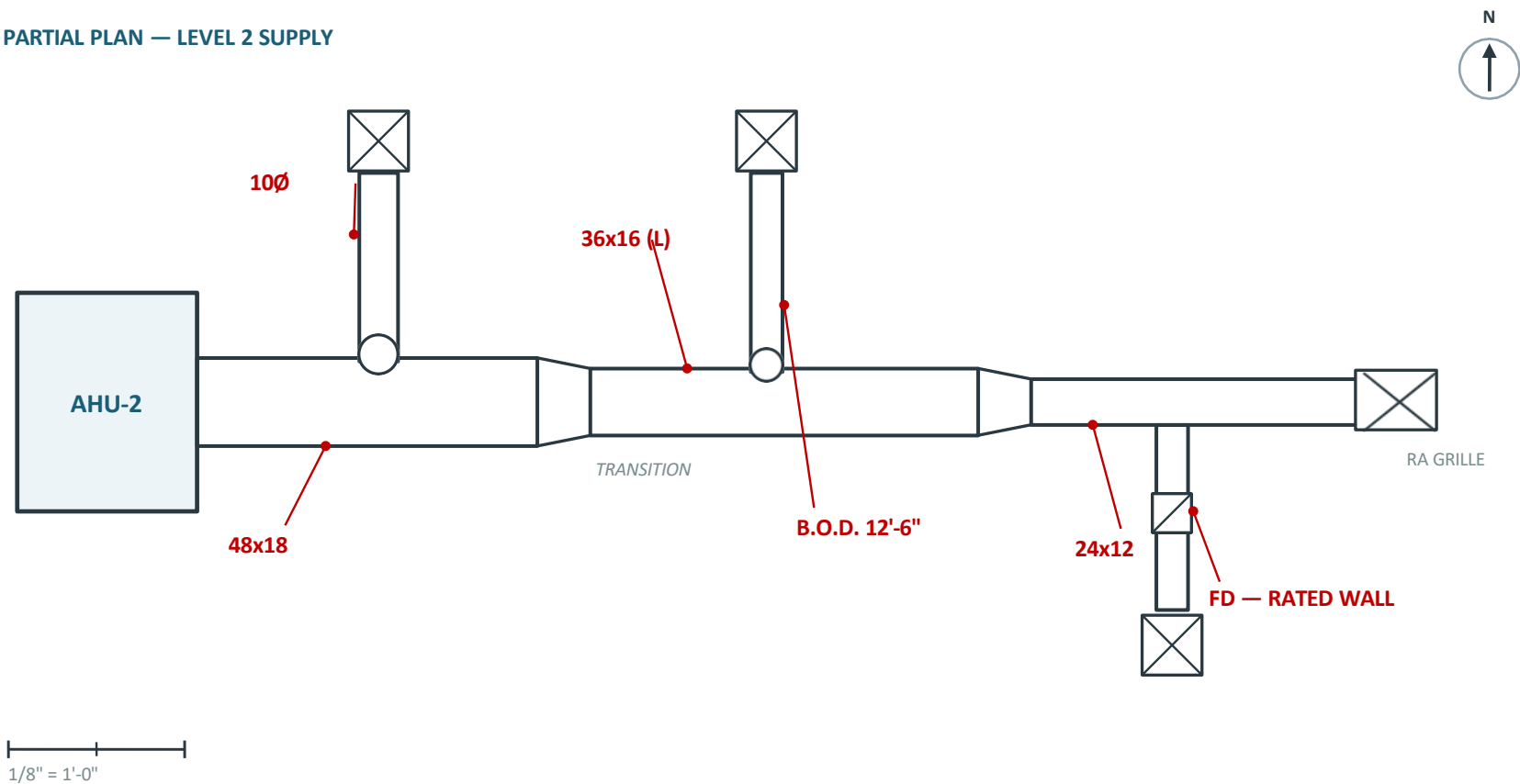
Callout	What it tells you
24x12	Rectangular. First figure is the dimension shown in plan; second is depth.
14Ø or 14" DIA	Round. Spiral versus snaplock changes method and production rate.
34x12 FO	Flat oval. The perimeter math is not rectangular math — do not shortcut it.
(L) or "lined"	Internal liner. Different method, different rate, different risk. Price it separately.
B.O.D. 12'-6"	Bottom of duct elevation. Your lift, scaffold, and fall-protection driver.
Transitions	Every size change starts a new takeoff segment. This is where LF counts go wrong.



Decoding Commercial Plans

Callouts on a Real Plan

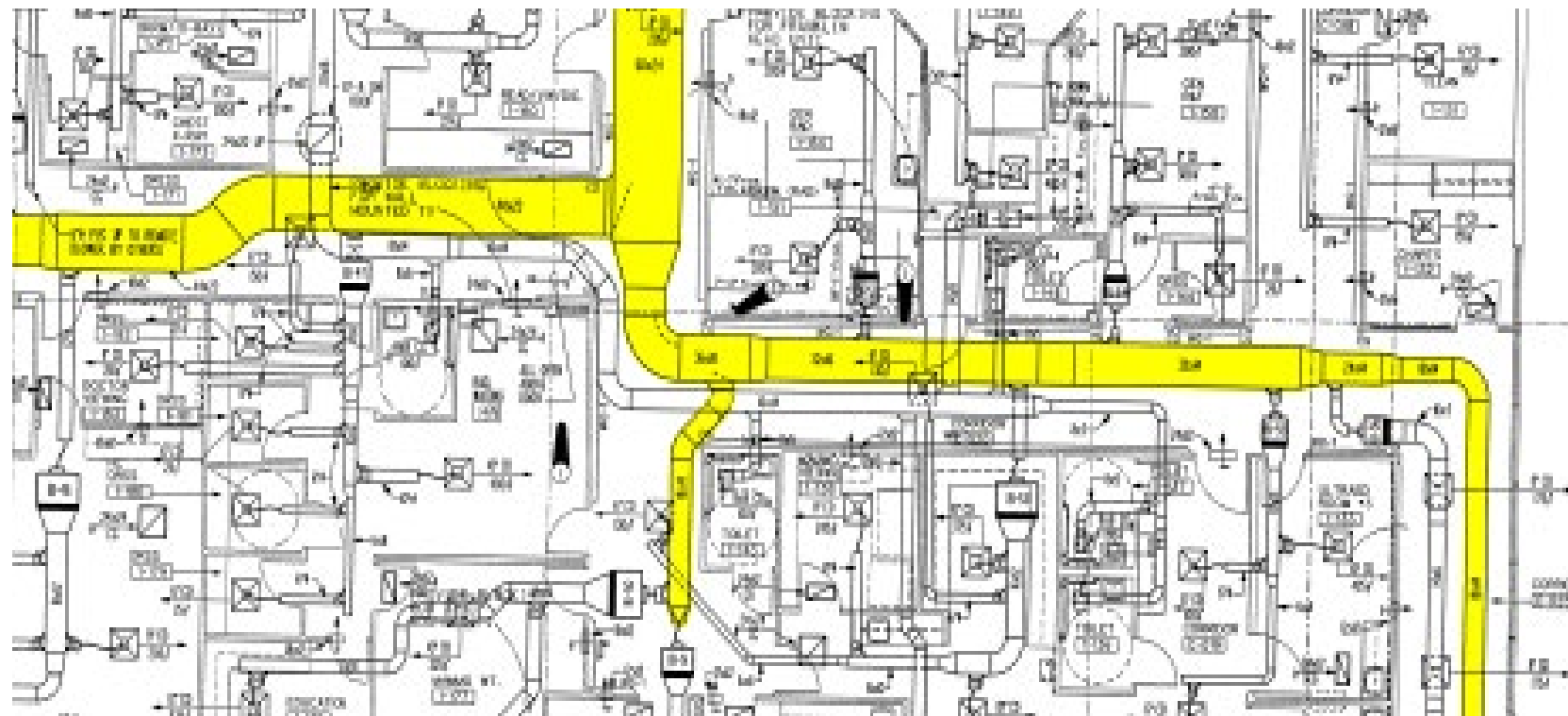
PARTIAL PLAN — LEVEL 2 SUPPLY





Decoding Commercial Plans

Callouts on a Real Plan





Decoding Commercial Plans

Equipment Schedules: Bid-Grade Data

What you read	Why it changes your price
Unit tag and area served	Ties equipment to zone, and zone to available shutdown windows.
Design CFM	Sanity-checks your duct quantities. A large mismatch means you missed something.
Filter bank and MERV	Filter access, replacement count, and disposal volume.
Coil rows and fin spacing	Cleaning method, labor hours per coil.
Cabinet dimensions	Internal access, confined-space classification, and how many bodies fit inside.
Remarks column	Where the outlier lives. Read every line of it, every time.



Reading an Equipment Schedule

MECHANICAL EQUIPMENT SCHEDULE

MARK	AREA SERVED	TOTAL CFM	O.A. CFM	FILTER BANK	COIL	REMARKS
AHU-1	Level 1 East — OR Suites 1–4	12,000	3,600	(2) 24x24x12 MERV 14 (4) 24x24x2 MERV 8 pre	6 row 12 FPI	Supply duct internally lined first 20'-0"
AHU-2	Level 1 West — Pre / Post-Op	9,500	2,850	(4) 24x24x2 MERV 8	4 row 10 FPI	Access doors both sides of coil section
AHU-3	Level 2 — Patient Rooms	16,000	4,000	(6) 24x24x2 MERV 8	6 row 11 FPI	Return air via ceiling plenum — no ducted return
AHU-4	Level 2 — Administration	7,200	1,500	(3) 24x24x2 MERV 8	4 row 10 FPI	Existing unit to remain — verify in field
EF-1	Soiled Utility, Levels 1–2	1,800	—	—	—	Ducted to roof. No access openings provided.

Read the remarks column last — and never skip it.

Decoding
Commercial Plans



Decoding Commercial Plans

Zoning: Tracing One System End to End

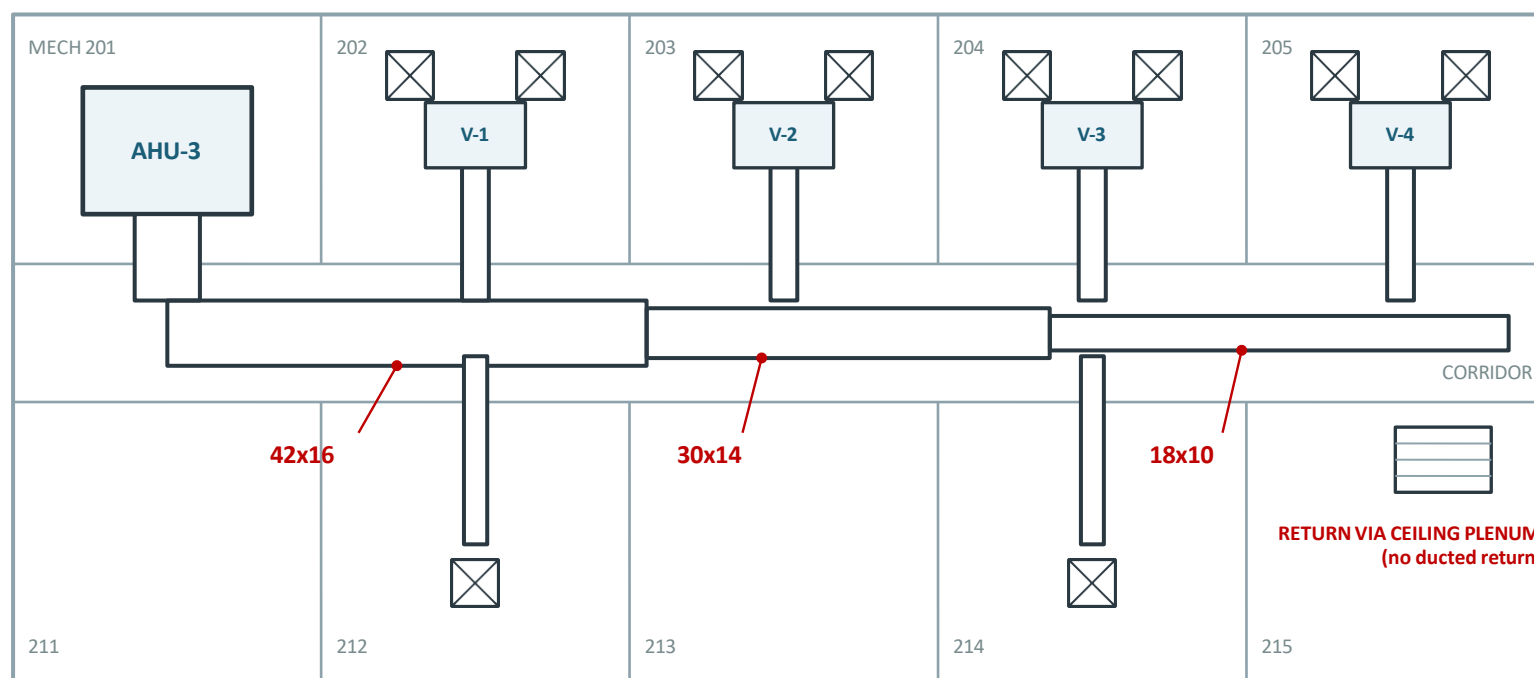
- 1 Start at the unit** Find the air handler on the plan, not just in the schedule.
- 2 Follow the trunk** Main, then branch, then runout — all the way to the last device on the system.
- 3 Color-code as you go** One color per system. Anything left uncolored is either out of scope or missed.
- 4 Count devices as a check** Your device count should reconcile against the schedule terminal count.
- 5 Ducted or plenum return?** Plenum return removes an entire scope — or hides one. Confirm it on the sections.
- 6 Note every crossing** Matchlines, floor levels, and rated barriers each add access and coordination.



Decoding Commercial Plans

Trace It: One System, End to End

PARTIAL FLOOR PLAN — AHU-3, LEVEL 2



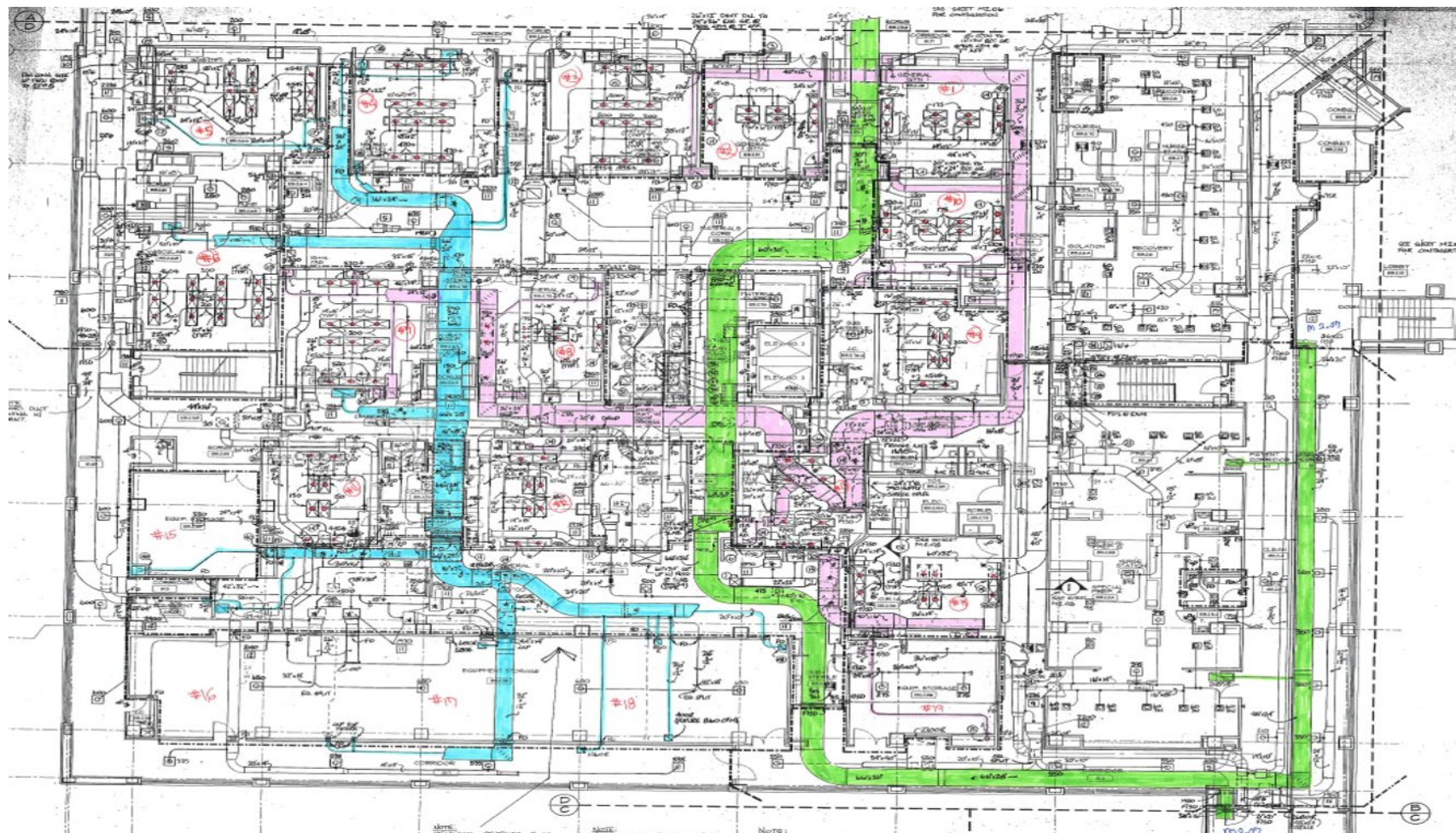
1/8" = 1'-0"

Trace it: unit → trunk → branch → terminal → last device.



Decoding Commercial Plans

Trace It: One System, End to End

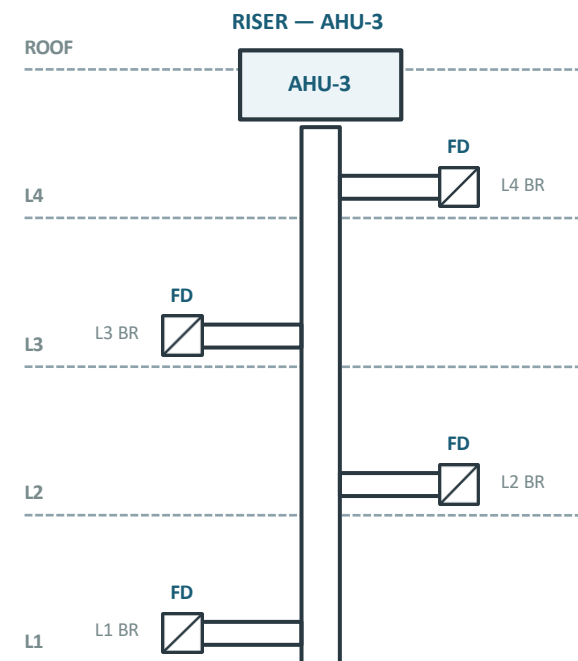




Decoding Commercial Plans

Riser Diagrams and Vertical Systems

- 1 **Not to scale — ever** Risers show connectivity and sequence, not length. Take length off the plans.
- 2 **Catch what the plan hides** Shafts, multi-floor risers, and equipment on levels you were not looking at.
- 3 **Vertical duct is a different job** Rigging, fall protection, and access from both ends of the run.
- 4 **Shaft access is schedule risk** Often the largest single unknown in a high-rise. Qualify it in writing.
- 5 **Reconcile against the schedule** Every unit on the riser should appear in your takeoff. Every one.



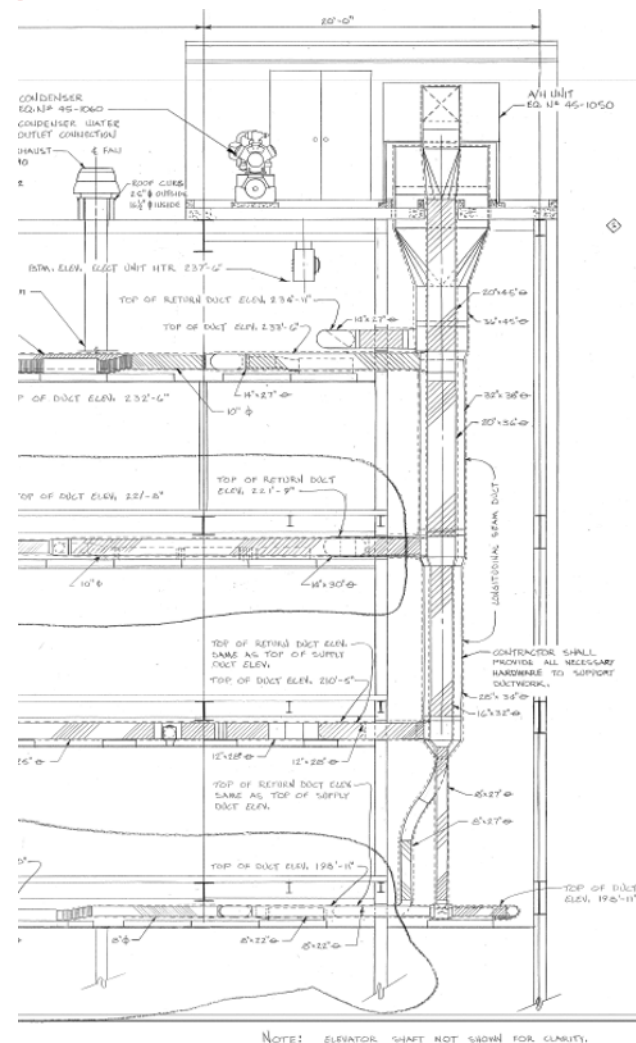
Shaft access at L1 and roof only

Not to scale



Decoding Commercial Plans

Riser Diagrams and Vertical Systems





Decoding Commercial Plans

From Plans to Takeoff: The Workflow

- 1 **Set the boundary** Which systems, which floors, which airstreams. Write it down before you measure.
- 2 **Mark up by system** Color-code trunk, branch, and runout on a printed or digital set.
- 3 **Measure by size** Linear feet segmented by duct size — never one lump figure.
- 4 **Convert to surface area** Interior surface area is what labor tracks. Linear feet alone will mislead you.
- 5 **Count discrete items** Devices, terminal units, dampers, coils, plenums, filter racks.
- 6 **Estimate access openings** Apply a spacing rule, then state the resulting count as an assumption.
- 7 **Overlay the conditions** Ceiling type, height, occupancy, infection-control level, allowable hours.
- 8 **Rate it, then sanity-check** Compare against a completed job of similar type before you send it.



Decoding Commercial Plans

The Core Math: Linear Feet to Area

Rectangular

$$2 \times (W + H) \div 12$$

24x12 duct $\rightarrow 2 \times 36 = 72 \div 12 = 6.00$ sq ft per linear foot

Round

$$\pi \times D \div 12$$

14Ø duct $\rightarrow 3.1416 \times 14 = 43.98 \div 12 = 3.67$ sq ft per linear foot

Flat oval

$$[2(W - H) + \pi H] \div 12$$

34x12 FO $\rightarrow 44.0 + 37.7 = 81.7 \div 12 = 6.81$ sq ft per linear foot

One linear foot is not one linear foot.

A 60x24 trunk carries 14.0 sq ft per foot. An 8Ø branch carries 2.1.
Nearly seven to one — and your bid has to know the difference.



Decoding Commercial Plans

Beyond Duct: What Else You Count

1 Air Devices

- Supply diffusers, return and exhaust grilles
- Remove, clean, reinstall — and rebalance if the spec requires it
- Count from the plan, verify a sample in the field

2 In-Line Equipment

- VAV boxes and fan-powered terminal units
- Fire, smoke, and combination fire/smoke dampers
- Coils, drain pans, mixing boxes, filter racks

3 Fittings and Access

- Elbows, offsets, taps, turning vanes
- Fitting density slows production more than length does
- New and existing access openings



Decoding Commercial Plans

What the Plans Won't Tell You

The Plans Give You

- Duct size, routing, and elevation
- Ceiling type and mounting height
- Equipment data and system boundaries
- Rated barrier and damper locations
- Design intent and specified materials

The Plans Do Not Give You

- As-built reality — what actually got installed
- Existing contamination level and condition
- Twenty years of undocumented modifications
- Who else is above that ceiling right now
- When the owner will actually let you work



Decoding Commercial Plans

Conditions That Move the Number

- 1 Ceiling construction** Ceiling grid/tile versus hard ceiling can add considerable labor to your job.
- 2 Working height** Ladder, scissor lift, or boom — each a different rate, crew size, and setup time.
- 3 Occupancy and shutdown** Occupied space could mean containment, phasing, and short productive windows.
- 4 Infection control level** ICRA class drives containment barriers, negative air, monitoring, and documentation.
- 5 Allowable hours** Nights, weekends, and escorted access carry premium labor and lost mobilization.
- 6 Wage determination** Public and federal work may carry prevailing wage. Confirm before you rate labor.



Decoding Commercial Plans

Unit Rates: Build Them From Your Data

- 1 Published rates are a start** They are not your rates. Your crews, equipment, and market are not average.
- 2 Measure what you produce** Square feet of interior surface cleaned per crew-hour, captured job by job.
- 3 Segment the rate** Ceiling grid vs hard ceiling. Lined versus unlined. Occupied versus shutdown.
- 4 Convert honestly** $\text{Area} \div \text{rate} = \text{crew-hours}$. $\text{Crew-hours} \times \text{burdened cost} = \text{labor}$. No optimism between.
- 5 Re-baseline on a schedule** A rate you have not validated in two years is a guess wearing a spreadsheet.
- 6 Close the loop** Feed actual job costs back into the rate table, or the estimate never improves.



Decoding Commercial Plans

Assembling the Bid

Cost element	What it has to cover
Direct labor	Crew-hours by classification and shift, at fully burdened rates.
Equipment	Negative air machines, HEPA vacuums, compressors, brushes, lifts, containment.
Consumables	Filters, poly, tape, sealant, access doors, coil cleaner, encapsulant.
Mobilization and travel	Trucks, fuel, lodging, per diem — and demobilization at the end.
Project management	Supervision, safety, submittals, and the reporting the specification requires.
Subcontracts	Lift rental, electrical, damper testing, third-party verification.
Overhead and contingency	Contingency sized to the specific unknowns — not a flat percentage on everything.



Decoding Commercial Plans

Scope, Exclusions, and Qualifications

- 1 **Publish your quantities** Linear feet, square feet, device count, opening count. The numbers you bid.
- 2 **Name systems by tag** AHU-3 and AHU-4, second floor — not "the HVAC system."
- 3 **State access assumptions** Existing openings usable, ceiling tile removal by others, lift access provided.
- 4 **State schedule assumptions** Shift, shutdown windows, floors per night, escort availability.
- 5 **Exclude what you cannot see** Asbestos, remediation beyond stated scope, structural repair, damper replacement.
- 6 **Price the overage up front** Unit prices for additional openings, additional devices, additional footage.



Decoding Commercial Plans

Hands-On Exercise: Your Assignment

The Set You'll Receive

- One floor of a partial mechanical set
- A single air handler serving mixed rectangular and round duct
- Reflected ceiling plan and equipment schedule included
- Tables of four to six people
- 10(ish) minutes on the clock

What You'll Produce

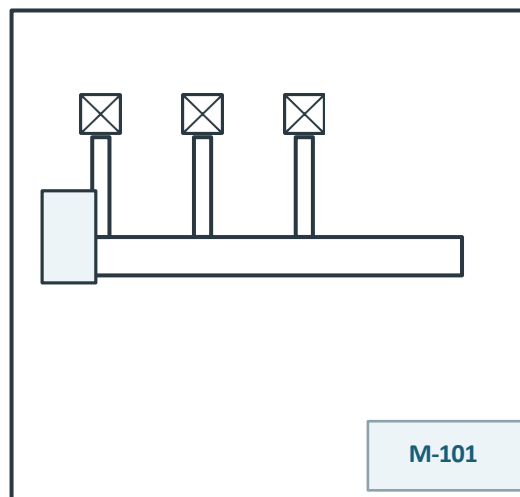
- The system boundary you are pricing
- Total interior surface area
- Device and terminal unit counts
- Assumed access opening count
- Three questions you would ask before bidding



Decoding Commercial Plans

Your Exercise Set

AT YOUR TABLE — Sets of Mechanical drawings



M-101

PARTIAL MECHANICAL PLAN

One AHU, trunk and branches,
mixed rectangular and round.

A schematic diagram of an equipment schedule. It consists of a table with a dark blue header row and several empty rows below it. The table is enclosed in a black rectangular border.

M-501

EQUIPMENT SCHEDULES

Unit data, filter banks, coils,
and the remarks column.



Decoding Commercial Plans

Debrief: Where the Numbers Diverge

- 1 Branch runs above corridors** The most commonly missed footage in any commercial takeoff.
- 2 Centerline versus routed length** Offsets and drops add length a straight-line measure never captures.
- 3 The return path** Ducted or plenum. This call moves the number more than any other single decision.
- 4 Access opening count** Almost always under-estimated, and almost never written into the proposal.
- 5 The general note nobody read** One sentence on sheet M-001 can reprice the entire job.
- 6 What "clean" was assumed to mean** Two bidders can be far apart and both be right, given their assumptions.



Decoding Commercial Plans

What to Take Back to the Office

- 1 **A plan-based number is defensible** A walkthrough number is hopeful. Only one survives a dispute.
- 2 **Three quantities move the price** Interior surface area, device count, and access openings.
- 3 **Your rates are the advantage** Own them, segment them, and re-baseline them on a schedule.
- 4 **Write the assumptions down** Scope, exclusions, and unit prices are where margin is actually protected.

Decoding
Commercial Plans





Decoding Commercial Plans

Presenter Contact Information

Ryan Byrne

Vice President, Commercial

Air Quality Systems

Ryan.Byrne@airqualitysystems.com

470-662-9629

Norcross, Georgia

**Thank you
for
Participating!**

