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DOE 2024 CAIS Meeting

23 October 2024
Las Vegas, Nevada

Joe Kelble, Principal Engineer

Data Operations

Research Team

- MLE Price Collection
- CCI, MP Research

Engineering Team

- MLE QA/QC
- Crews
- Task/Unit Cost
- Assemblies
- Square Foot Models

CTC Data Team

- Development of CTCs
- DMAP Enhancements

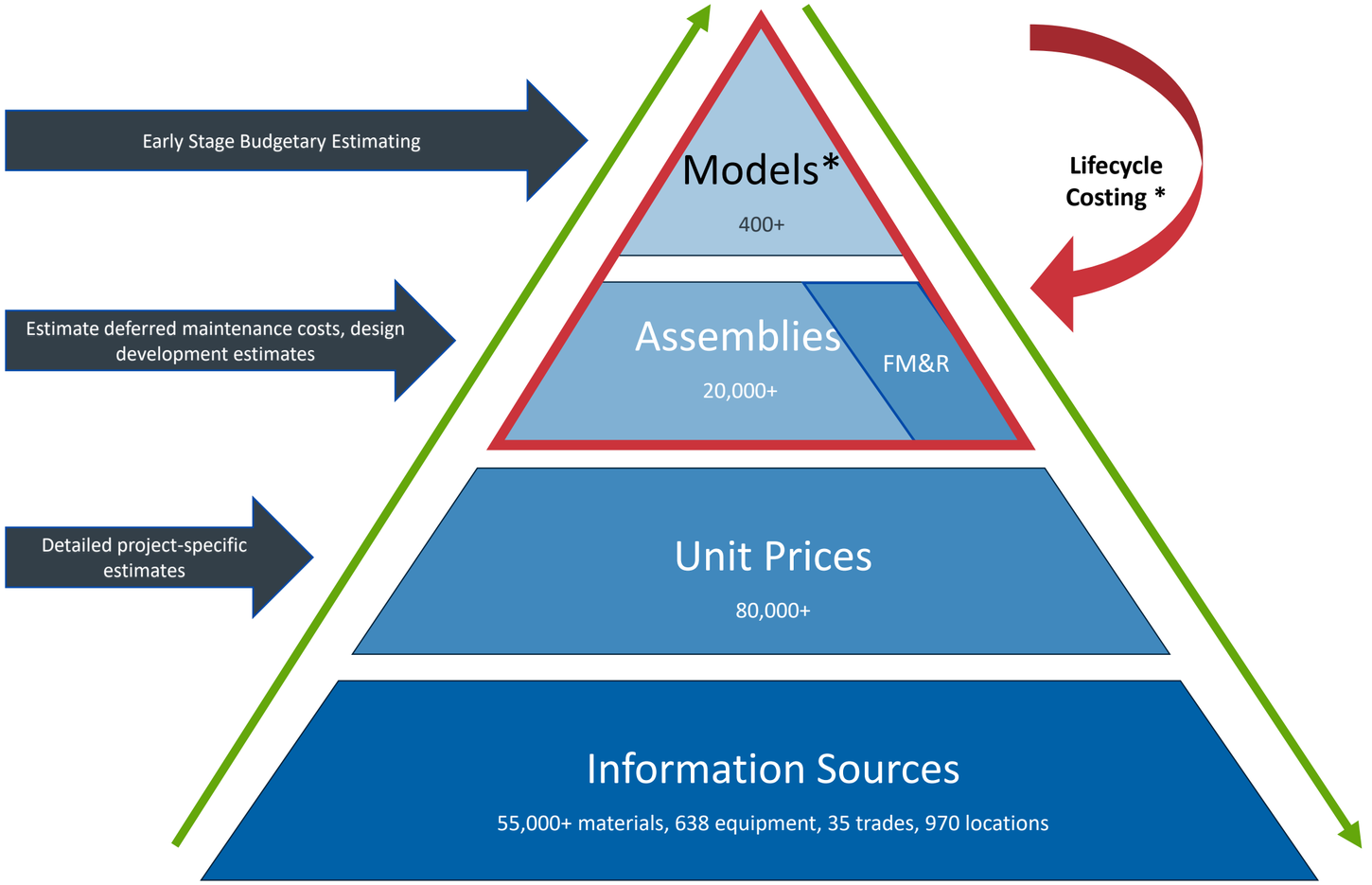
Cost Modeling Team

- Custom Modeling Projects
- Special Projects

Construction Formats

- MasterFormat® 2022
  - The current industry-standard fifty divisional format for construction specifications
- UniFormat II (ASTM E-1557-9)
  - Originally set up by the General Services Administration and the American Institute of Architects
  - Utilized by RS Means to format assembly pricing

RS Means Database Structure



Costs - Materials

- Average of all sources
- Includes:
  - Quantity sufficient for commercial construction project
  - Delivery to the job-site
  - Fasteners for a normal installation
- Does not include:
  - Sales tax

Costs - Labor

- Combination of wages and daily output
- Includes:
  - Union wages (30 major cities average)
  - Fringe benefits

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Daily Output

- How many units of work the crew can install/perform in one eight-hour day
  - Based upon actual working conditions
  - Developed over an extended period to eliminate abnormal variations
- Includes time spent during a normal workday on tasks other than actual installation, such as……

Costs – Equipment

- Combination of rental rate, hourly operating cost and daily output
- Includes:
  - Equipment rental, fuel, lubrication, maintenance
- Does not include:
  - Operator
  - Mobilization/demobilization

Costs – Including O&P

- Combination of bare costs plus burdens and mark-ups
- Includes:
  - Installing contractor’s overhead and profit
- Does not include:
  - General Conditions
  - General Contractor’s overhead and profit
  - Permits, Fees (architectural, engineering)

Types of Costs

- **Direct Costs:**
  - Materials
  - Labor (Fringes)
  - Equipment
- **Indirect Costs:**
  - Workers Compensation
  - FUTA, SUTA, FICA
  - Insurances
  - Office Overhead
  - Profit

Office Overhead

- Owner
- Principals/Manager
- Estimator(s)
- Clerks/Administrators
- Bookkeeper
- Office (Rent and Utilities)
- Accountant Fees
- Legal Fees

Office Overhead

- Medical & Workers’ Compensation
- Advertising
- Auto/Truck Expenses
- Association Dues
- Training and Travel
- Entertainment
- Bad Debts

Markups

- Material + 10%
- Labor Direct Costs + Indirect Costs (50% or more)
- Equipment + 10%

Types of Estimates

- Unit Price
- Assemblies
- Square Foot Models

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Unit Cost/Price

All costs are based upon the Unit of Measure

- The Total Cost per UOM
  - Labor hours per unit = [total crew L.H. per day]/daily output
  - Material price = Material delivered to 20 miles (no sales tax)
  - Labor price = [total daily bare labor cost/daily output]
  - Equipment cost = [total daily bare equipment cost/daily output]
  - Crew equipment cost = [weekly rentals/5] + [hourly operating cost × 8]

What are Assemblies

- Groups of Unit Cost Lines that make up major components of a structure
- Composed of:
  - Unit Cost Line
  - Quantity
- Based on a convenient unit of measure

Assemblies Structure

- UniFormat II Organization Structure
- 8 Elements
  - A Substructure
  - B Shell
  - C Interiors
  - D Services
  - E Equipment & Furnishings
  - F Special Construction & Demolition
  - G Building Sitework
  - H General Conditions

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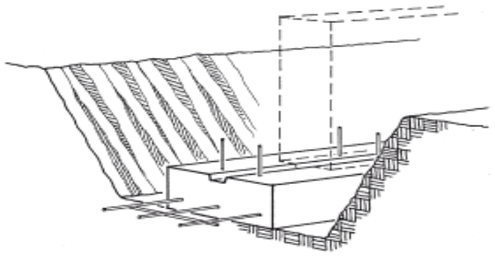
Assemblies

A10 Foundations

A1010 Standard Foundations



The Strip Footing System includes: excavation; hand trim; all forms needed for footing placement; forms for 2″ x 6″ keyway (four uses); dowels; and 3,000 p.s.i. concrete.

The footing size required varies for different soils. Soil bearing capacities are listed for 3 KSF and 6 KSF. Depths of the system range from 8″ and deeper. Widths range from 16″ and wider. Smaller strip footings may not require reinforcement.

Please see the reference section for further design and cost information.

System Components	QUANTITY	UNIT	COST PER L.F. MAT.	INST.	TOTAL
SYSTEM A1010 110 2500					
STRIP FOOTING, LOAD 5.1 KLF, SOIL CAP. 3 KSF, 24″ WIDE X 12″ DEEP, REINF.					
Trench excavation	.148	C.Y.		1.60	1.60
Hand trim	2.000	S.F.		2.40	2.40
Compacted backfill	.074	C.Y.		.33	.33
Formwork, 4 uses	2.000	S.F.	5.64	10.50	16.14
Keyway form, 4 uses	1.000	L.F.	.53	1.34	1.87
Reinforcing, fy = 60000 psi	3.000	Lb.	2.49	2.07	4.56
Dowels	2.000	Ea.	2.34	6.04	8.38
Concrete, f'c = 3000 psi	.074	C.Y.	12.95		12.95
Place concrete, direct chute	.074	C.Y.		2.11	2.11
Screed finish	2.000	S.F.		.90	.90
TOTAL			23.95	27.29	51.24

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Models

- UNIFORMAT II Organization Structure
- Groups of Assemblies
  - Components of the specific building type
  - Quantified by mathematical algorithms
- Included:
  - All costs and all mark-ups except Sitework
- Not Included For DOE:
  - Contingencies
  - Architectural Fees
  - Engineering Fees
  - Contractor Fees

Models

- What does E and N reference in the Model Description
  - E (DOE E01) are Existing Models and are based on RSMeans Standard Commercial Models
  - N (DOE N01) are New Models developed specifically for DOE

- Based on the DOE /FIMS Usage Codes
- Prior to 2015 – 76 Building Models
- 2024 – 400 Building Models

Caution When Selecting a Model

- Check the model range
- Check the number of stories in the model
- 55 Unique Models have been created for NNSA

Model Scaling

Exterior Wall Type and Structural System	SF Area	500	2500	5000	8000	12500	15000	18500	21000	25000
Brick Veneer/CMU	$ Per SF	$638.00	$276.00	$219.00	$186.00	$166.00	$158.00	$152.50	$149.00	$145.50
Precast Concrete Panel	$ Per SF	$439.00	$228.00	$195.00	$176.00	$164.50	$160.50	$157.00	$151.50	$147.50

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Models and Updates for 2024

- 52 New Models
- Updated 50 Models
  - Increased range of 43 Models
  - Added Wall types to 7 Models

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DOE New Models for 2025

DOE N304 Modular Training Building, 2,500 to 5,000 SF

DOE N389 Office Building, 3 story 200,000 SF to 500,000 SF

DOE N392 Warehouse 1 Story 90,000 SF to 125,000 SF

DOE N396 Modular Office, 2 Story, 2,500 SF to 80,000 SF

DOE N405 Research Lab with Clean Rooms, 2 Story, 15,000 SF to 60,000 SF

DOE N411 Airport Terminal

DOE N412 Airport Control Tower

DOE N413 Research Lab with Clean Rooms, 1,000 to 49,000 SF

DOE N417 Warehouse 2 Story 80,000 SF to 250,000 SF

DOE N418 Lab with Clean Room, 5 Story, 75,000 SF to 250,000 SF

DOE N432 Bunker, Galvanized Culvert style (NNSS)

DOE N462 Access Tunnel

DOE N463 Classroom, 1,500 SF to 30,000 SF

DOE N464 Office, 7 Story 100,000 SF to 300,000 SF

DOE N465 Office, 2 Story 75,000 SF to 300,000 SF

DOE N466 Emergency Services / Fire Station, 3 Story

DOE N467 Animal Care Buildings

DOE N469 Premanufactured Shed (Handi Hut)

DOE New Models for 2025

DOE N471 Nuclear Waste, 2 Story

DOE N472 Utility Building, 2 Story

DOE N473 Gas Station

DOE N474 Conex Style Indoor Firing Range, 10 Lanes

DOE N475 Conex Style Indoor Firing Range, 5 Lanes

DOE N476 General Lab 5 Story

DOE N477 Neutron Generator Production Facility, 3 Story

DOE N478 MESA Microfab East 3 Story

DOE N479 Radiation Hardened Integrated Circuits, 3 Story

DOE N480 MESA Microfab East 5 Story

DOE N481 Microelectronics Lab 3 Story

DOE N482 Explosive Component Facility 3 Story

DOE N483 Advanced Manufacturing Process Lab 3 Story

DOE N484 Environmental Test Lab 2 Story

DOE N485 Production & Assembly, 16 Story, 15,000 to 45,000 SF

DOE N486 Z Administration Shops, 100,000 to 120,000 SF

DOE N487 Solar Power Tower, 4 Story, 10,000 to 20,000 SF

DOE N488 Warehouse, 3 Story, 2,000 to 10,000 SF

DOE New Models for 2025

DOE N489 Office, 5 Story, 90,000 to 200,000 SF

DOE N491 Live Shoot House, 10,000 SF to 25,000 SF

DOE N492 Warehouse 100,000 SF to 250,000 SF

DOE N493 Office, 50,000 to 175,000 SF

DOE N494 Office, 4 story 60,000 SF to 200,000 SF

DOE N495 Office, 4 story 10,000 SF to 50,000 SF

DOE N496 Fire Stations 5,000 SF to 30,000 SF

DOE N496 Fire Stations 5,000 SF to 30,000 SF

DOE N497 Guard Headquarters, 15,000 to 50,000

DOE N498 Security Operations, 1,000 to 12,000 SF

DOE N502 Storm Shelter, 1,000 to 5,000 SF

DOE N504 Nuclear Waste, 2 story, 1,000 SF to 10,000 SF

DOE N505 Utility Building 3 story, 2,000 SF to 30,000 SF

DOE N506 Accelerator Building, 7 Story, (ION Beam)

DOE N509 Warehouse, 3 story 10,000 SF to 50,000 SF

DOE N510 Nuclear Material Storage 500 SF to 9,000 SF

City Cost Index / Area Cost Factor

- Geographical Adjustment Factor
- The City Cost Index is a measurement of the differences in the cost of construction in a specific location as measured from a baseline (National Average)
- The City Cost Index contains the average construction cost for 731 U.S. and Canadian cities covering over 930 three-digit zip code locations
- The baseline does not change during a **given year;** it is based on January 1st.

City Cost Index / Area Cost Factor

- The index is based on the material and installation cost from the 30 major city average

- Exceptions:

  An example would be Lawrence Livermore Labs. The three-digit zip code is based in Oakland. However, for Livermore, we use San Jose which is economically equivalent to Livermore

QA/QC

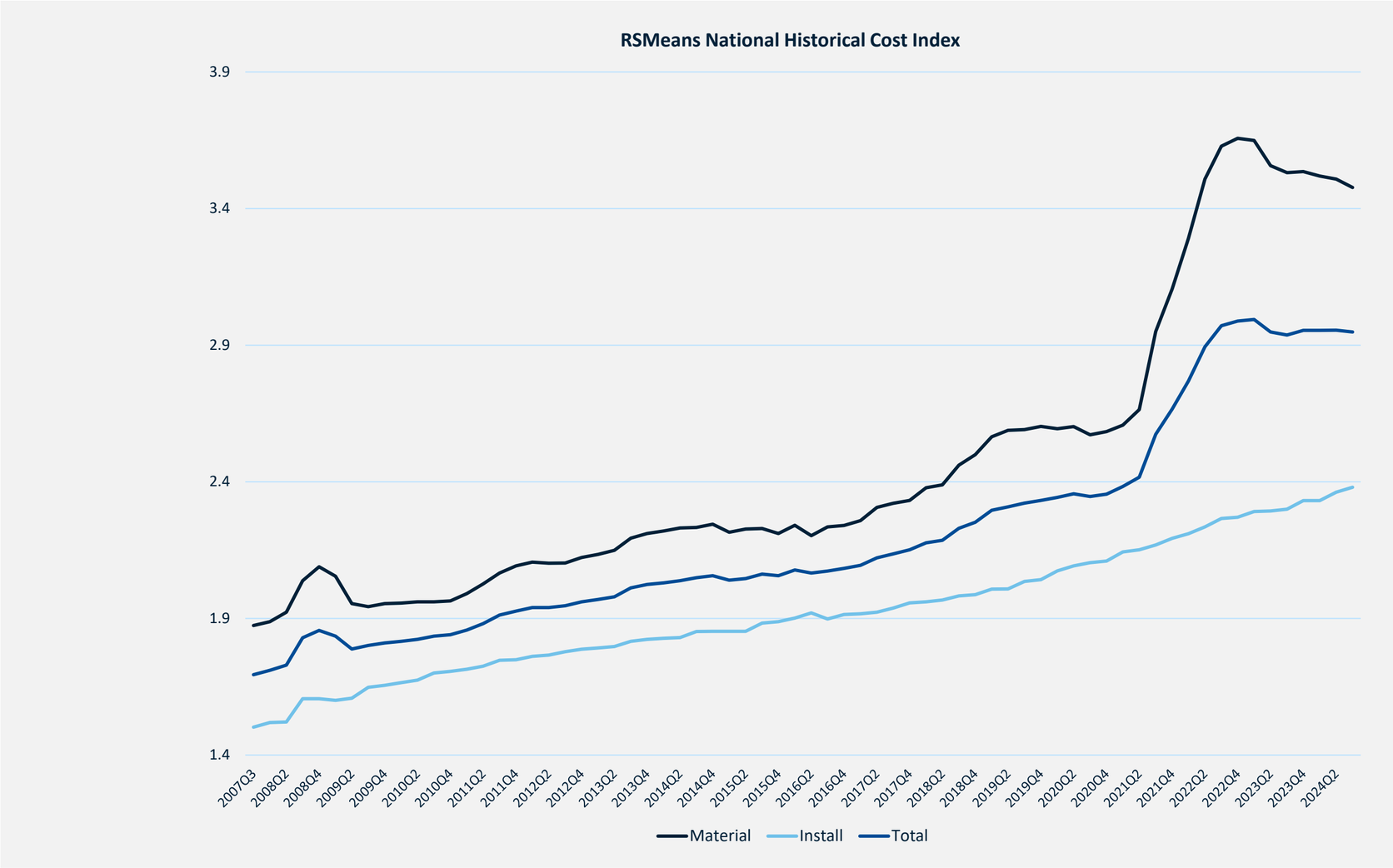
- Core Data research is built in an agile data workflow, with dedicated QA/QC throughout the research cycle. Material, labor, and equipment prices are validated at the point of entry into our research database by experienced engineers.
- After the data is input, machine learning models and statistical algorithms are used to identify outliers and anomalies, which are returned to the senior engineers and managers for validation.
    - No research prices that are flagged are used in our final database without validation from a qualified cost engineer
- Tasks (unit costs) and Assemblies receive a further set of QA/QC at the point of release, where engineers review all published cost exceptions (variance over time) and all cost progressions (trending relationships with similar costs).
  Included in the point of release QA/QC is a review of UOM changes and supplier changes since the last release
- After the database is deployed to customers, our engineering team monitors a feedback loop that flows through our professional services team, our retail CS/CS team, and our sales team. If defects are uncovered, these are delivered to an internal change control board and assigned to our engineers with the greatest experience in that division to fix

Feedback Loop

- Regional Trends
  - Labor Availability
  - Material Shortage
- Need for additional material selections
  - The database has a line 2” and 4” black iron pipe, I need a 2-1/2”
- Questions on pricing
  - Low
  - High
  - Progression
- Questions on what is included or not in a task (unit cost) or assembly

National Historical Pricing Trends

- Material costs continue to decline relative to their peaks in 2022.
- Install costs continue to increase due to labor pool degradation.



National costs shown for reference purposes only.

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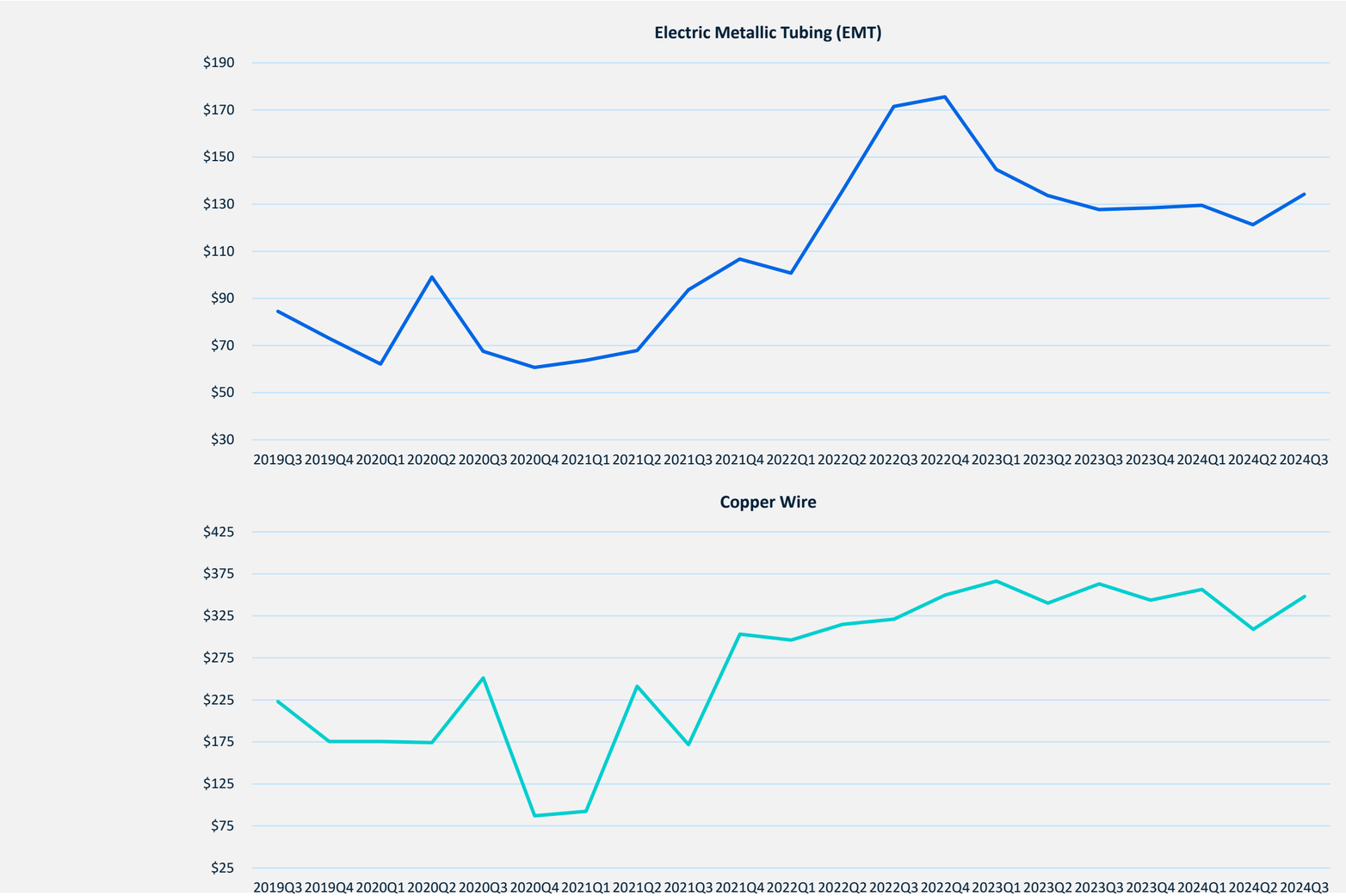
National Conduit/Electrical Trends

- Copper wire continues seasonal trends, with a surge in 2024Q3 mirroring the last 3 years.
- EMT increased significantly as well, spiking an average 10% from 2024Q2 to 2024Q3.



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National Concrete & Masonry Cost Trends

- Input prices have continued to climb for these materials, driving costs higher through 2024.
- Simultaneously, increased demand has sharpened price surges in many areas during the summer of 2024.

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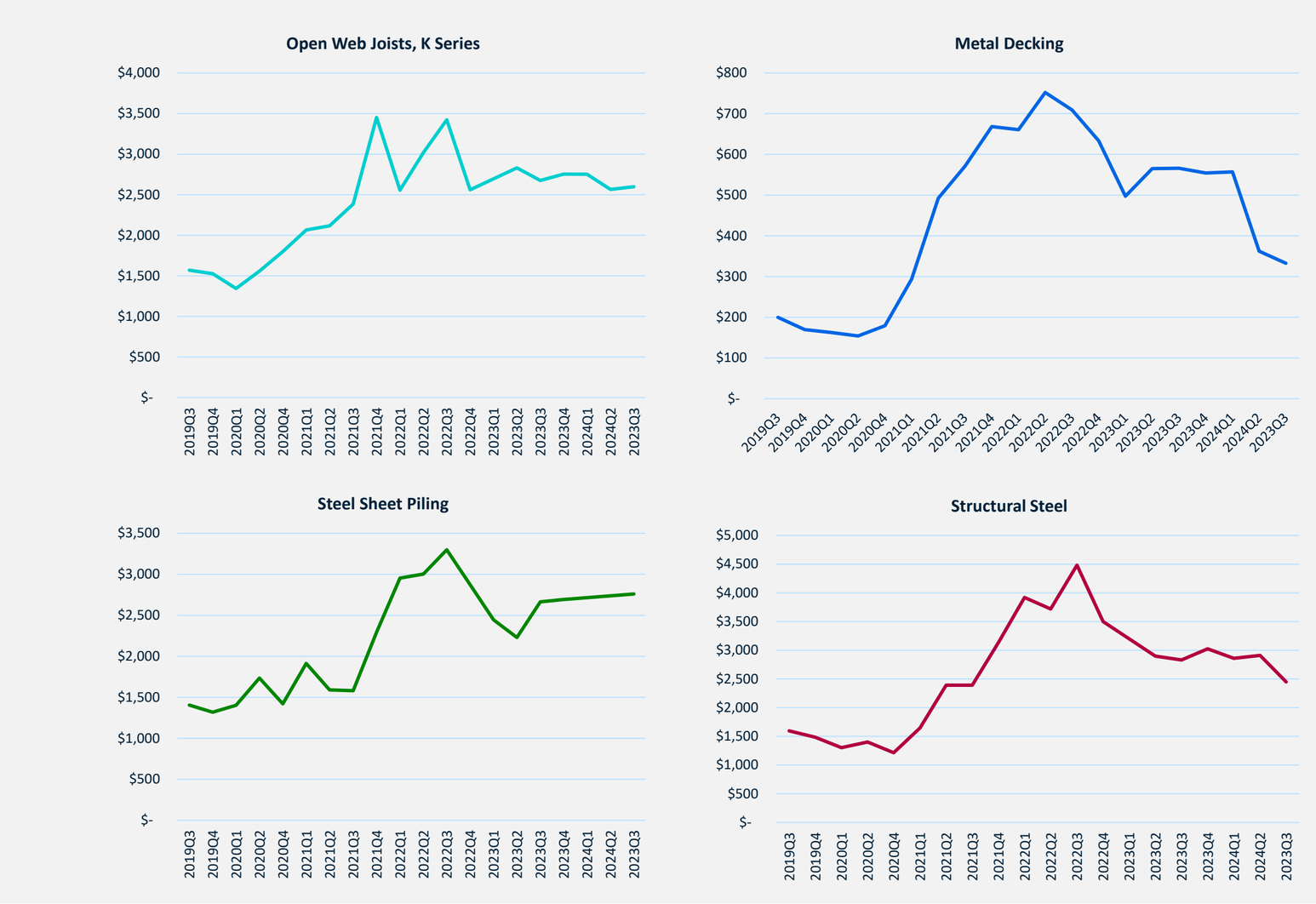
National Steel Cost Trends

- Structural steel continued its multi-quarter decline, although we anticipate it to flatten out by 2025Q1.
- With the manufacturing sector lightly contracting, we anticipate lower demand leading to lower prices in 2024Q4.



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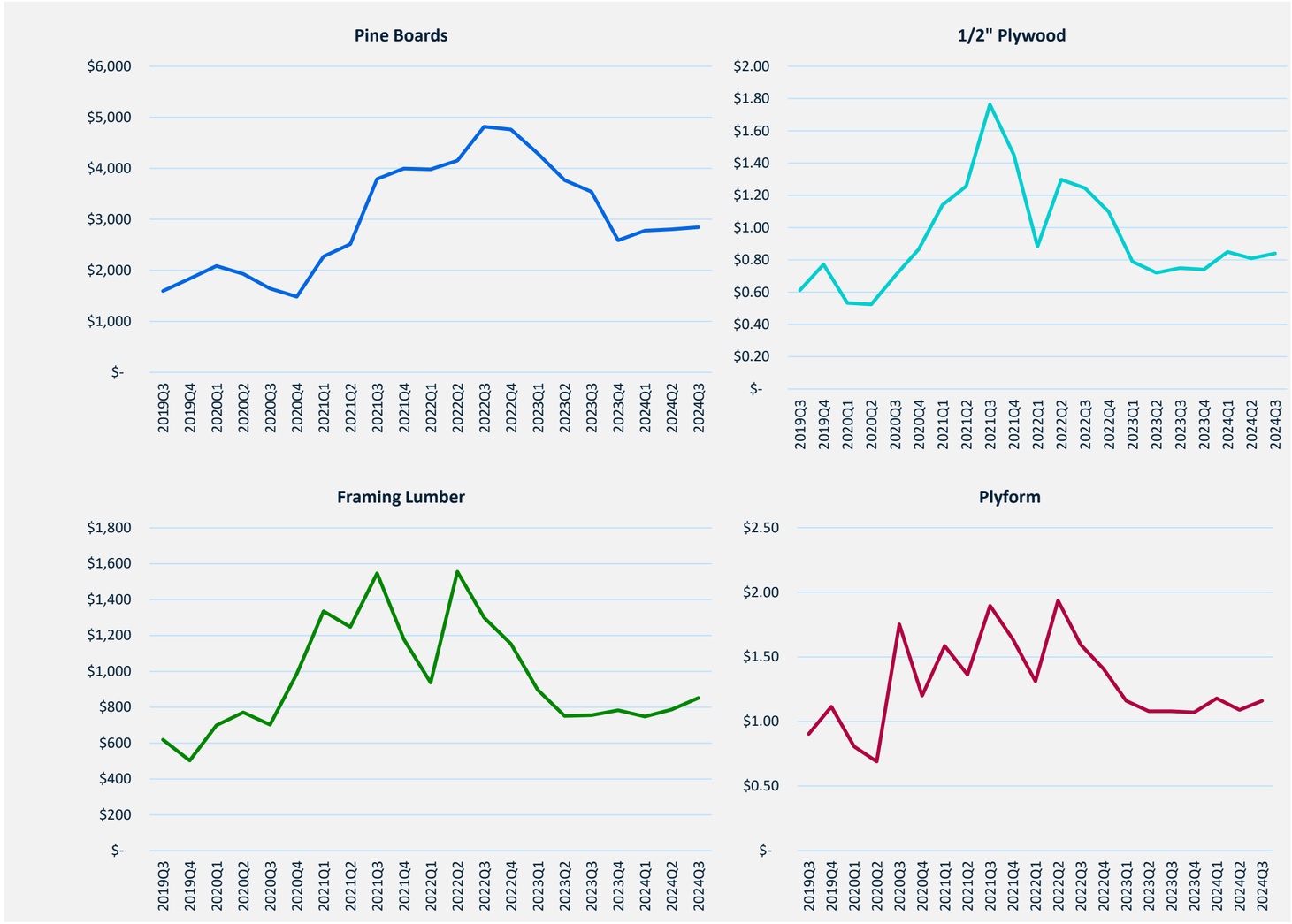
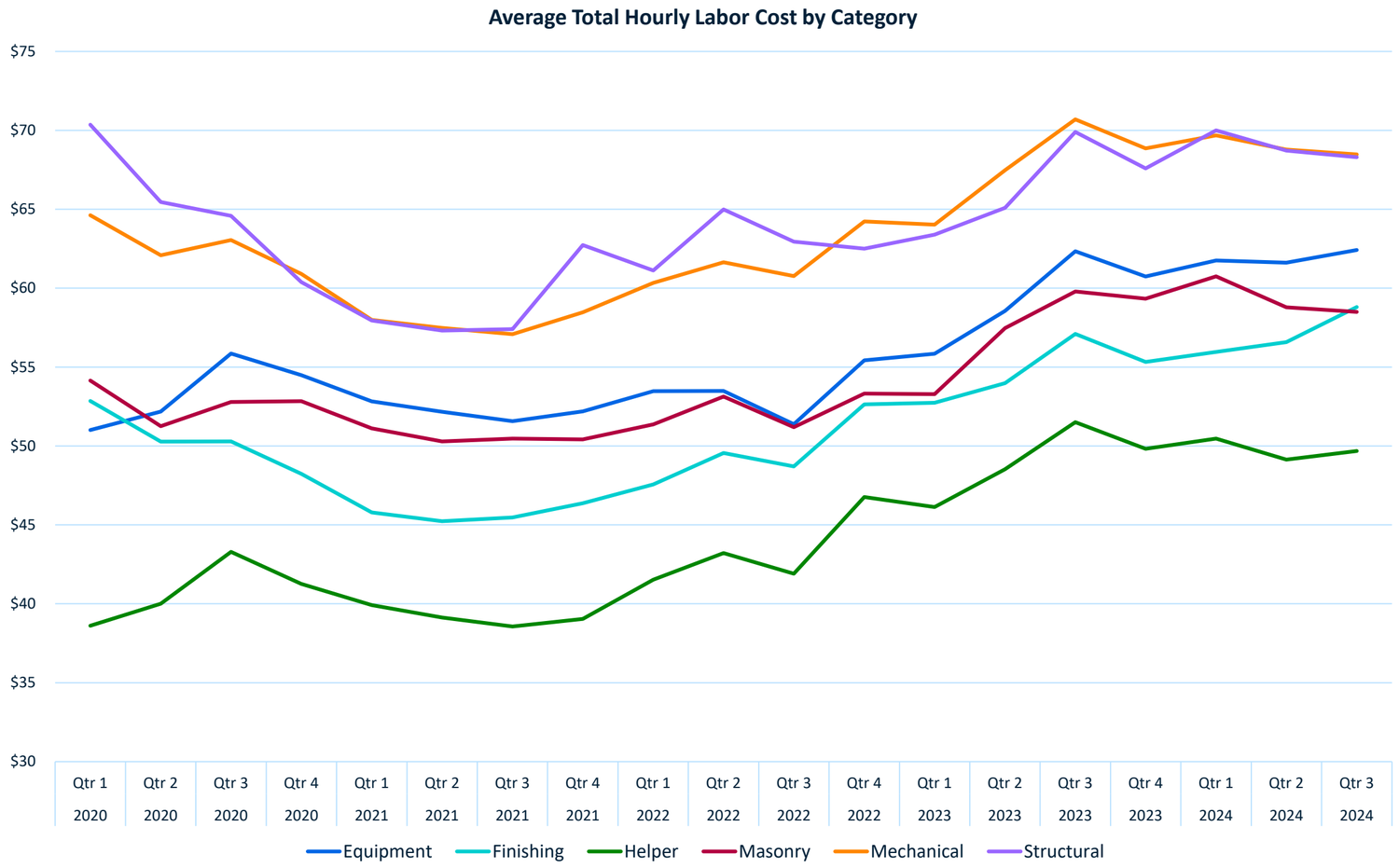
National Lumber Cost Trends

- Overall lumber costs are increasing slightly in 2024Q3.
- Although costs remain high nominally, in real terms lumber costs have nearly returned to pre-pandemic levels.



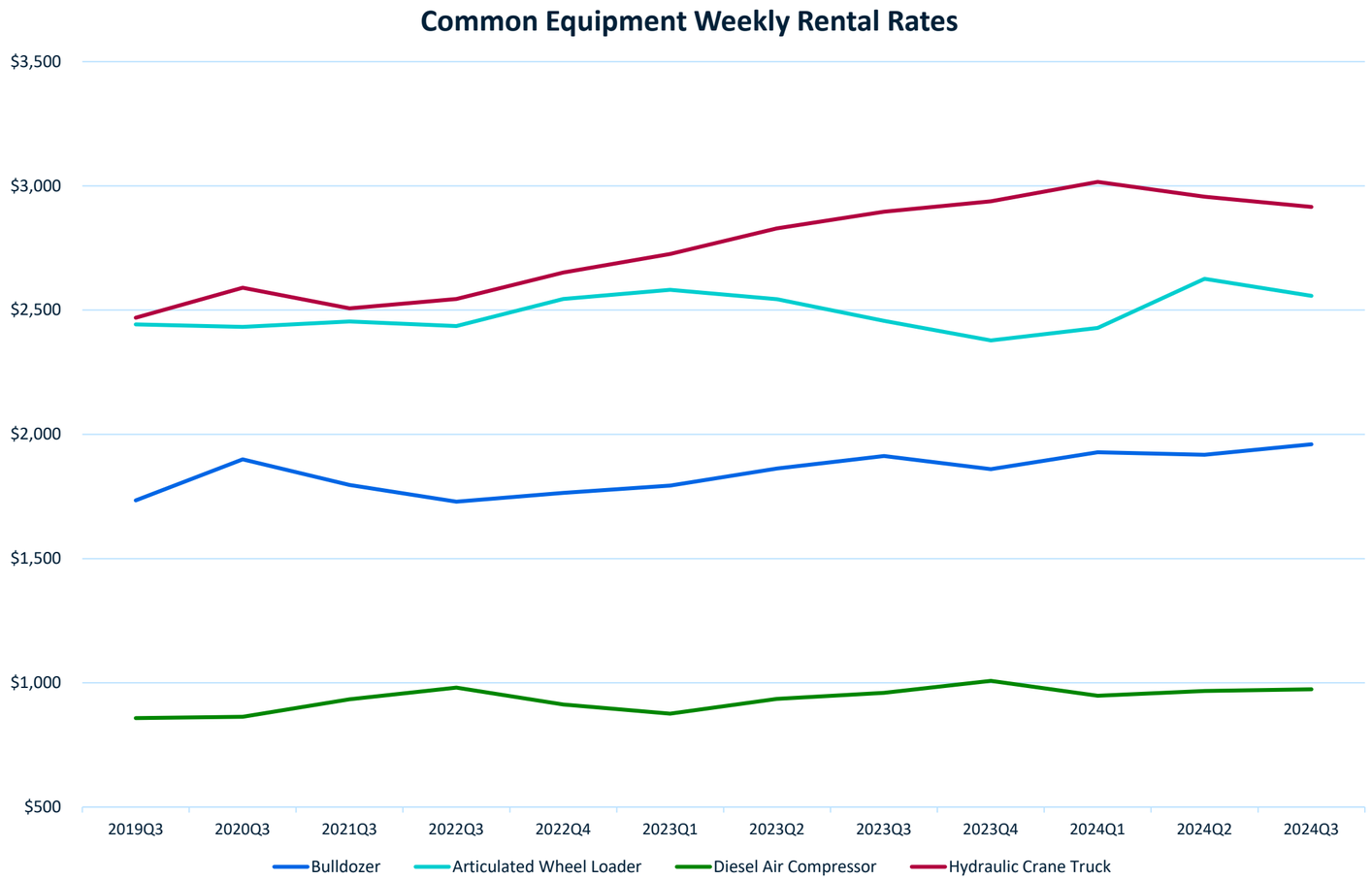
National Labor Cost Trends

- 2024Q2 and Q3 trends show some alleviation to the wage growth of the last 2 years
- Average wages flattened in 2024Q3 for the first time in the post-COVID era



National Equipment Cost Trends

- Wheel loaders and Dozers continue to show moderate volatility through 2024Q3
- Sustained financial pressure likely to offset increased rental demand through 2024Q4



2025 Cost Data

Although we see many materials, labor, and equipment prices stabilizing the following materials are still increasing:

- Copper pipe – an increase of up to 11% for October 2024
- Copper fittings – an increase of 4% for October 2024
- Plastic pipe and fittings – varied
- Metal tanks – an increase of 4% to 10%
- Plumbing and heating products – up to 6%
- Concrete products - varied

Preparing a Unit Price Estimate - Example

Installing a self-contained single package A.C., air-cooled, for free blow or duct, constant volume, 3-ton cooling, with remote condenser.

Preparing a Unit Price Estimate - Solution

Self-contained single package A.C., air-cooled, for free blow or duct, constant volume, 3-ton cooling, excludes remote condenser

CSI = 238119200200

Qty	Crew	Daily Output	Labor Hours	Unit	Bare Mat.	Bare Labor	Bare Equip.	Total	Total Incl. O&P
1	Q5	1	16	Ea.	$4,425.00	$1,100.00	$0.00	$1,100.00	$6,475.00

Condenser, ratings are for air-cooled, direct drive, propeller fan, 3 ton

CSI = 236313101630

Qty	Crew	Daily Output	Labor Hours	Unit	Bare Mat.	Bare Labor	Bare Equip.	Total	Total Incl. O&P
1	Q5	2.4	6.667	Ea.	$4,000.00	$455.00	$0.00	$4,455.00	$5,075.00

Total = $6,475 (AC Unit) + $5,075 (Condenser) = $11,550

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Preparing a Custom Estimate - Example

Installing Relays that are not in the Cost Book

Information that we know:

Material

- Relay at $1,500.00 each
- 4 anchor bolts are needed for each Relay at $8.00 each

Crew

- 2 Electricians are required to install a Relay

Crew Daily Output

- 5 hours per Relay

Preparing a Custom Estimate - Solution

- **Material Cost** = ($1,500.00 Relay) + (4 Anchor Bolts at $8.00 = $32.00) = $1,532 Each.

  $1,532.00 (Bare Material x 10% Markup) = $1,685.20

- **Labor Hours** = (Crew Labor Hours/Day) / (Daily Output) = (2 Electricians x 8 Hours/Day) / (5 Relays/Day) = 16/5 Each = 3.2 Labor Hours Each.
- **Labor Cost** = (Labor Hours /Unit) x (Average Hourly Rate Per Person) = (3.2 Labor Hours/Unit) x ($71.7/Hour) = 3.2 Labor Hours x $71.7 Per Hour =$229.44

  ($229.44 Bare Labor) x (1.483 O&P) = $340

- Installed Cost = $1,685.20 (Material) + $340 (Labor) = $2,205.20

Q&A