



Product-Oriented Work Breakdown Structure

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Agenda

- Objectives
- Obstacles
- Definitions & References
- Best Practices
- Examples
- Questions

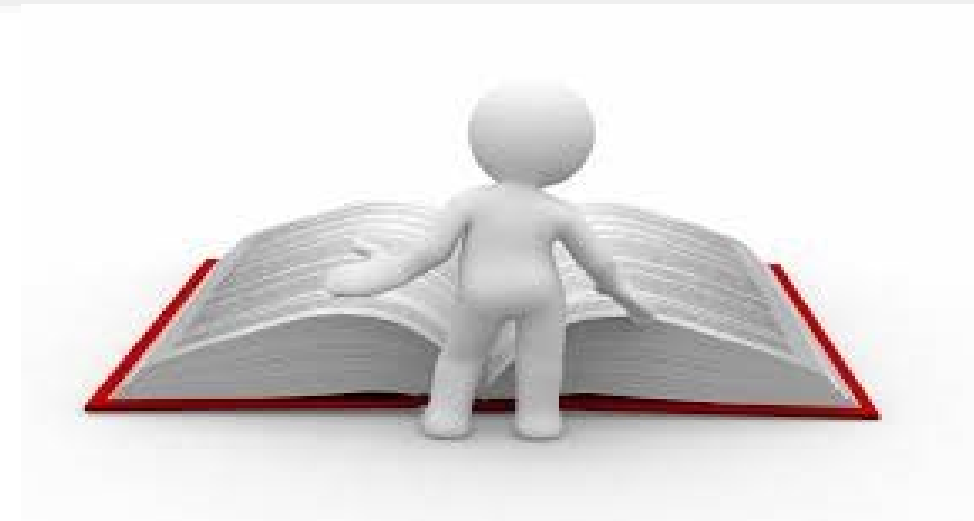
AGENDA





Objectives

- Obstacles
- Definitions
 - Product-Oriented WBS
 - WBS Dictionary
- WBS Guidance
- GAO Cost Estimating Best Practice
- EIA-748 Earned Value Management Systems Requirement
- Importance to estimating, planning, scheduling, EVMS
- Examples





What are the obstacles?

- Awareness of WBS guidance / best practices
 - DOE, GAO, NDIA guidance
- Various types of WBS orientations
 - Product
 - Funds (TEC vs. OPC)
 - Process/Functional
 - Service
- DOE customers requiring use of a specific WBS orientation
 - Example: Directing use of a funds-oriented WBS (i.e. TEC, OPC, fee)



What is a WBS?

- **GAO Cost Estimating and Assessment Guide (March 2020)**: A WBS deconstructs a program's end product into smaller specific elements that are suitable for management control. It is the cornerstone of every project because it defines in detail the work necessary to accomplish a project's objectives. It provides a consistent framework for planning and assigning responsibility for the work, and is an essential element for identifying activities in a project's IMS. **Establishing a product-oriented WBS is a best practice because it allows a program to track cost and schedule by defined deliverables.**
 - **BEST PRACTICE**: The WBS is product-oriented, traceable to the statement of work, and at an appropriate level of detail to ensure that elements (i.e. scope) are neither omitted nor double-counted.
- **EIA-748D**: A product-oriented division of program tasks depicting the breakdown of work scope for work authorization, tracking, and reporting purposes.
- **DRAFT DOE G 413.3-X Project Scope Guide**: A product-oriented work breakdown structure (WBS) deconstructs a program's end product into smaller specific deliverables and elements that are traceable to the statement of work and suitable for management control. It provides a consistent framework for developing the IMP and IMS, assigning responsibility and identifying resources, estimating costs, and determining where risks may occur. **It provides the outline to develop a schedule and cost plan that can easily track technical accomplishments by defined products and deliverables** in terms of resources spent in relation to the plan and completion of activities, enabling quick identification of cost and schedule variances.



What is a WBS Dictionary?

- **EIA-748D**: A listing of work breakdown structure elements with a description of the work scope content in each element. The work descriptions are normally summary level and provide for clear segregation of work for work authorization and accounting purposes.
 - Includes a description of the discrete work scope for the element in the context of its parent element work scope, forming an integrated whole.
 - Lists the elements included at a given level and notes those important for the parent element functional capability but not included at that level.
 - Describes the element deliverables and scope that constitute the element resources and cost.
 - References important or unique aspects of the element if they are particular to a specific phase of the project.
 - Provides a link to detailed technical definition documents, where applicable.
 - **Is updated as required on the basis of the contract and internal project changes and reflects the current scope** of each of the elements throughout the project's life.
 - **Follows the project's change control and work authorization processes before any changes are made to the WBS dictionary.**
 - Includes a current WBS index, listing the hierarchical relationship of elements throughout the project.



Sources for WBS Guidance

- **GAO Cost Estimating and Assessment Guide; March 2020**
 - Chapter 7: Step 4: Determine the Estimating Structure – Work Breakdown Structure
- **DOE G 413.3-10B IPM Using The EVMS; April 20, 2022**
 - Section 6.2.3: IPM Principle 3 – Establish a Project Strategy and Organization Structure
- **DOE-PM-HBK-02-2012 Work Breakdown Structure (WBS); August 16, 2012**
 - NOTE: The WBS Handbook will be absorbed into the new DOE G 413.3-2X Scope Guide
- **DOE PM Compliance Assessment Governance (CAG) 2.0; June 1, 2022**
 - Attribute A.1: Product-Oriented Work Breakdown Structure (WBS)
 - Attribute A.2: Work Breakdown Structure (WBS) Hierarchy
- **NDIA Earned Value Management Systems EIA-748-D Intent Guide; August 28, 2018**
 - Section 2.1 Organization: Guideline 1 – Define Work Scope (WBS)



GAO Cost Estimating and Assessment Guide

- Step 4: Determine the Estimating Structure – Work Breakdown Structure
- **Establishing a product-oriented WBS is a best practice** because it allows a program to track cost and schedule by defined deliverables, such as a facility, work area, hardware, or software component.
- A WBS breaks down product-oriented elements into a hierarchical parent-child structure that shows how elements relate to one another and the overall end-product.
- **Failing to include all scope for all deliverables can lead to schedule delays and cost increases.**
- The **WBS is the common link** integrating the planning, scheduling, cost estimating, budgeting, contracting, CM, and performance reporting disciplines.

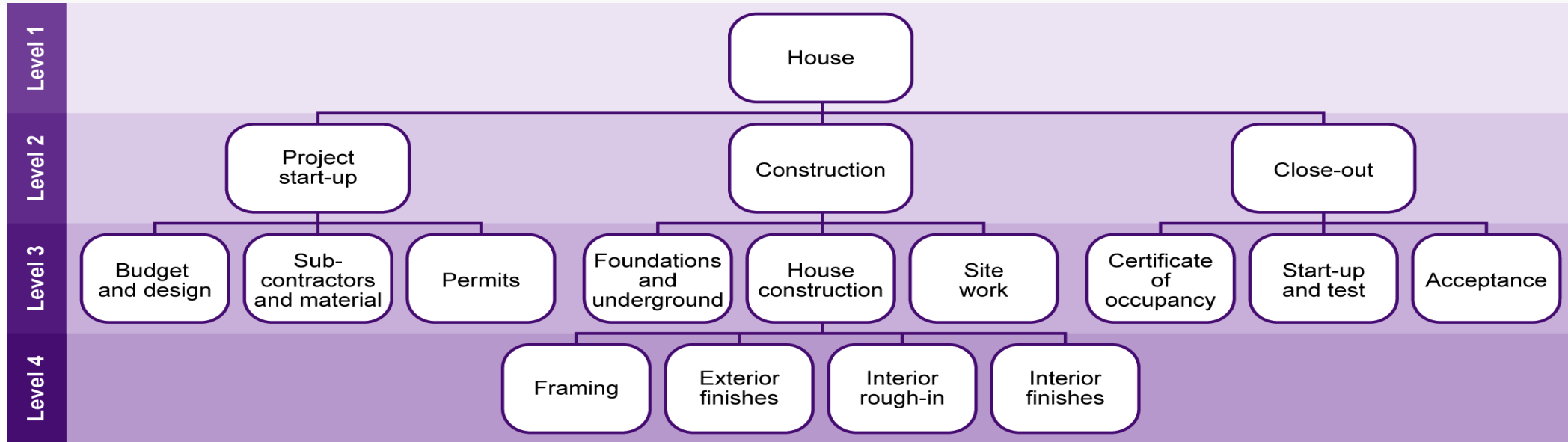


GAO Cost Estimating and Assessment Guide

- **The WBS is the organizing structure used to summarize performance data** (cost, schedule, technical) for successive levels of management and provide accurate information on projected, actual, and current status of the individual elements.
- The number of levels to include in a WBS depends on a project's complexity and risk. It should be expanded to a level of detail that is sufficient for planning and successfully managing the full scope of work.
- **In addition to the product-oriented elements, every WBS includes common elements** such as project management, system design and engineering, commissioning and start-up, support equipment and facilities, system test and evaluation, operations/site activation, and project closeout.
 - For additional examples of Common Elements see:
 - GAO Cost Estimating and Assessment Guide, Table 6 Common Elements in WBSs
 - DOE-PM WBS Handbook, Section 3.3 Use of Common Elements



GAO Cost Estimating and Assessment Guide

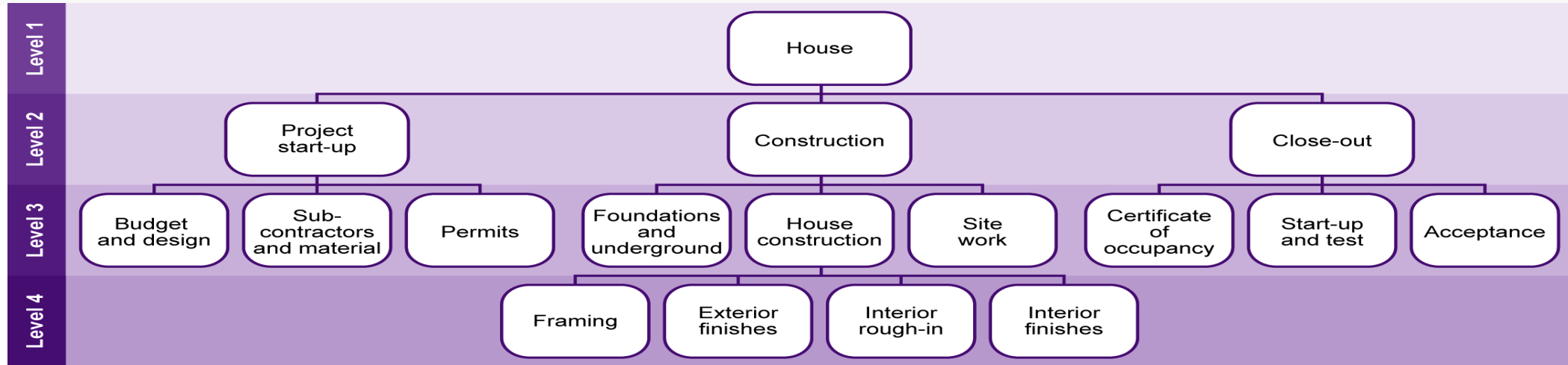


Source: GAO. | GAO-20-195G

- In this example, the ‘Construction’ element (Level 2) is the child of the ‘House’ product but is also the parent of multiple children.
- In a WBS, the sum of the parent’s children (i.e. budget) must equal that of the parent.
- A product-oriented WBS ensures that each element is defined and related to only one work effort.
- A well-defined product-oriented WBS clearly delineates the logical relationship of all project elements (i.e. scope).
 - Recall GAO’s BEST PRACTICE: The WBS is product-oriented, traceable to the statement of work, and at an appropriate level of detail to ensure that elements (i.e. scope) are neither omitted nor double-counted.



GAO Cost Estimating and Assessment Guide



Source: GAO. | GAO-20-195G

- **A functionally-oriented WBS** is organized by activities or processes (i.e. manufacturing, engineering, or quality control), but **is not a cost estimating best practice** because it does not reflect cost, schedule, or technical performance by specific deliverable.
- Functional activities are necessary for supporting a product's development, but the WBS should not be organized around them.
- Functionally-oriented WBS's are similar in construct to an Organizational Breakdown Structure (OBS). An OBS is a separate construct that is required in addition to the WBS.
- Using the above example, in a product-oriented WBS, a cost overrun for a specific item (i.e. framing) enables project management to change a specification, shift funds, or modify the design. In a functionally-oriented WBS (i.e. by carpenters vice framing), management would not have the right information to get to the root cause of the problem. WBS elements should be structured by products or deliverables.



GAO Cost Estimating and Assessment Guide

- **Examples of WBS elements that are not products include:**
 - design engineering, requirements analysis, logistics, risk, quality assurance, and test engineering (all functional engineering efforts), aluminum stock (a material resource), and direct costs (an accounting classification);
 - types of funds used in program acquisition phases (for example, PED, construction, OPCs, TEC, research, development, test and evaluation);
 - rework, retesting, and refurbishing, which should be treated as activities of the WBS element;
 - nonrecurring and recurring classifications, for which reporting requirements should be structured to ensure that they are segregated;
 - cost saving efforts—such as total quality management initiatives and acquisition reform initiatives—included in the elements they affect, not captured separately;
 - the organizational structure of the program office or contractor;
 - the program schedule—instead the WBS will drive the necessary schedule activities;
 - meetings, travel, and computer support, which should be included in the WBS elements they are associated with;
 - generic terms (terms for WBS elements should be as specific as possible); and
 - tooling—that is, special equipment needed to produce, handle, or assemble an item—which should be included with the equipment being produced.
- **Best Practice: The cost estimate WBS is product-oriented, traceable to the statement of work, and at an appropriate level of detail to ensure that cost elements are neither omitted nor double-counted.**
 - A WBS dictionary exists that defines what is included in each element and how it relates to others in the hierarchy.



DOE G 413.3-10B IPM Using The EVMS

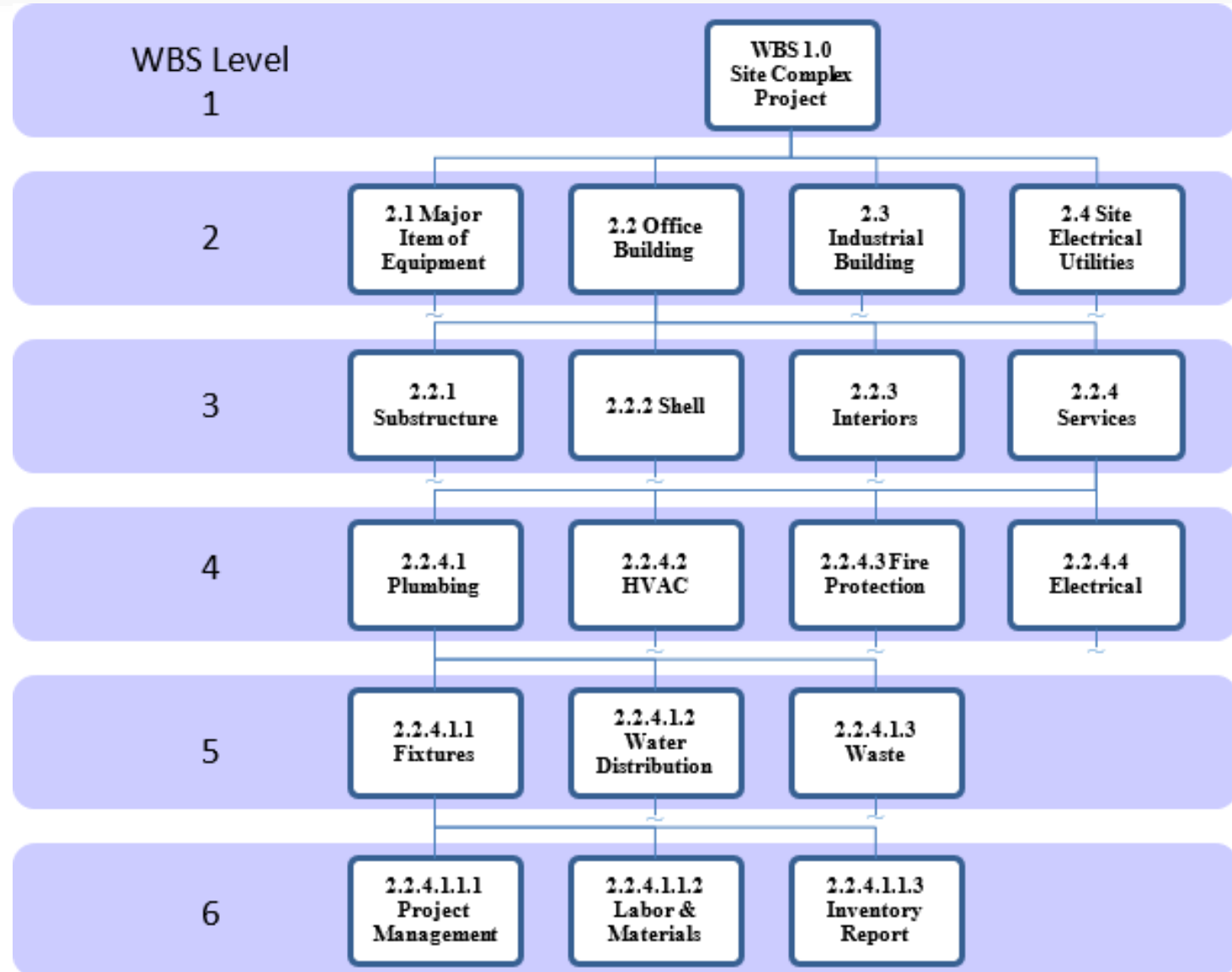
- IPM Principle 3 – Establish a Project Strategy and Organization Structure
- **A product-oriented WBS, required by EIA-748 and a best practice in the GAO Cost Estimating and Assessment Guide**, organizes the total work scope of the project through elements grouped on descending levels that increasingly detail the project work and is extended down to at least the CA level.
- A product-oriented WBS decomposes elements into a hierarchical structure that relates elements to one another as well as to the overall product.
 - The elements in each decomposition (child) level represent 100 percent of work applicable to the next higher (parent) element.
- The WBS gives the IPT the necessary framework of elements for creating cost estimates and scheduling resources at the most detailed and accurate level possible
- It breaks down all authorized work scope into elements used to formulate the project baseline and is used for planning, responsibility assignment, work authorization, scheduling and budgeting, cost accumulation, performance analysis, and baseline planning revisions.
- The WBS provides a framework for data collection and reporting.





DOE G 413.3-10B IPM Using The EVMS

- This example shows a WBS for a program of capital asset projects.
- WBS Level 2 is comprised exclusively of individual capital asset projects.
- The Office Building capital asset project is progressively decomposed to lower levels, depicting the parent to child relationship through successive WBS levels.





DOE Compliance Assessment Governance (CAG) 2.0

- **Maturity Attribute A.1: Product-Oriented Work Breakdown Structure (WBS)**
- **Objective:** A single, product-oriented WBS is extended to the level of detail necessary for effective management control. The WBS is integrated with other management processes.
- **Take away points:**
 - Product-oriented WBS with WBS Dictionary
 - WBS encompasses all authorized work scope
 - WBS is maintained through change control process
 - Integrated w/ project management processes





DOE Compliance Assessment Governance (CAG) 2.0

- **Maturity Attribute A.2 – Work Breakdown Structure (WBS) Hierarchy**
- **Objective:** The WBS is complete, logical and aligns with the PEP.
- See CAG 2.0 Figure 7 (pg. 31) for a sample product-oriented WBS.
- **Take away points:**
 - WBS hierarchy is logical, consistent, and contains all work scope
 - WBS dictionary fully explains the WBS
 - Complete and proper identification of all “products” are in the WBS





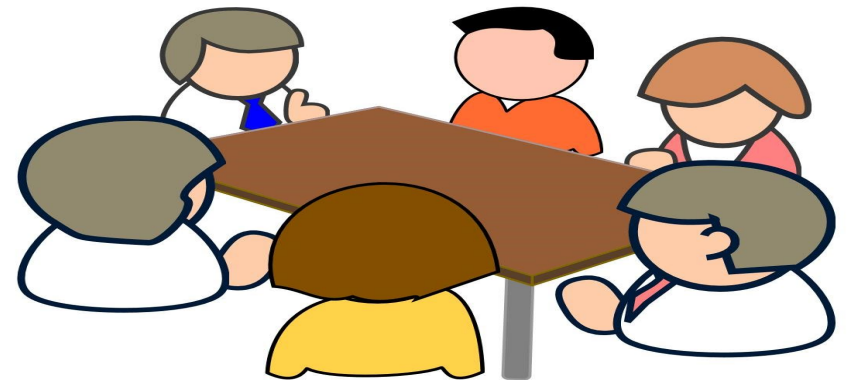
How Do We Test? DOE EVMS Metrics

- **Attribute A.1 Product-Oriented WBS**
 - A.01.01 – Checks for product-oriented groupings in WBS Dictionary (WBSD) of all contractual work scope elements
 - A.01.02 – Checks that the WBSD extends to CA (minimum) and that WBSD and work authorization document (WAD) scope statement are consistent
 - A.01.04 – Checks that the WBS includes all authorized work scope, including revisions from authorized changes, by comparing WBS budget at completion (BAC) values in the RAM and IPMR F1
 - A.01.05 – Checks that the WBS includes all authorized work scope, including revisions from authorized changes, by comparing WBS identifiers in the WBSD and BL IMS
- **Attribute A.2 WBS Hierarchy**
 - A.02.01 – Checks that WBS is decomposed into smaller components that provide hierarchical relationships of scope/resources consistent with analysis and reporting requirements, by comparing dollarized WBSs and BACs.
 - A.02.02 – Checks that products/deliverables have been appropriately decomposed into logical parent and child relationships using explanations provided by CAMs.



Why use a product-oriented WBS?

- The WBS (and WBS Dictionary) is the cornerstone of every project because it defines in detail the complete scope of work necessary to accomplish a project's objectives.
- A product-oriented WBS is a best practice because it ensures that elements (i.e. scope) are neither omitted nor double-counted and are traceable to the statement of work.
- A product-oriented WBS allows for the tracking of cost and schedule by defined deliverables.
- Cost Estimating
 - The WBS should be extended to an appropriate level of detail to ensure cost elements are neither omitted nor double-counted.
 - The hierarchical parent-child structure relates WBS elements to each other and the overall end product (i.e. facility).



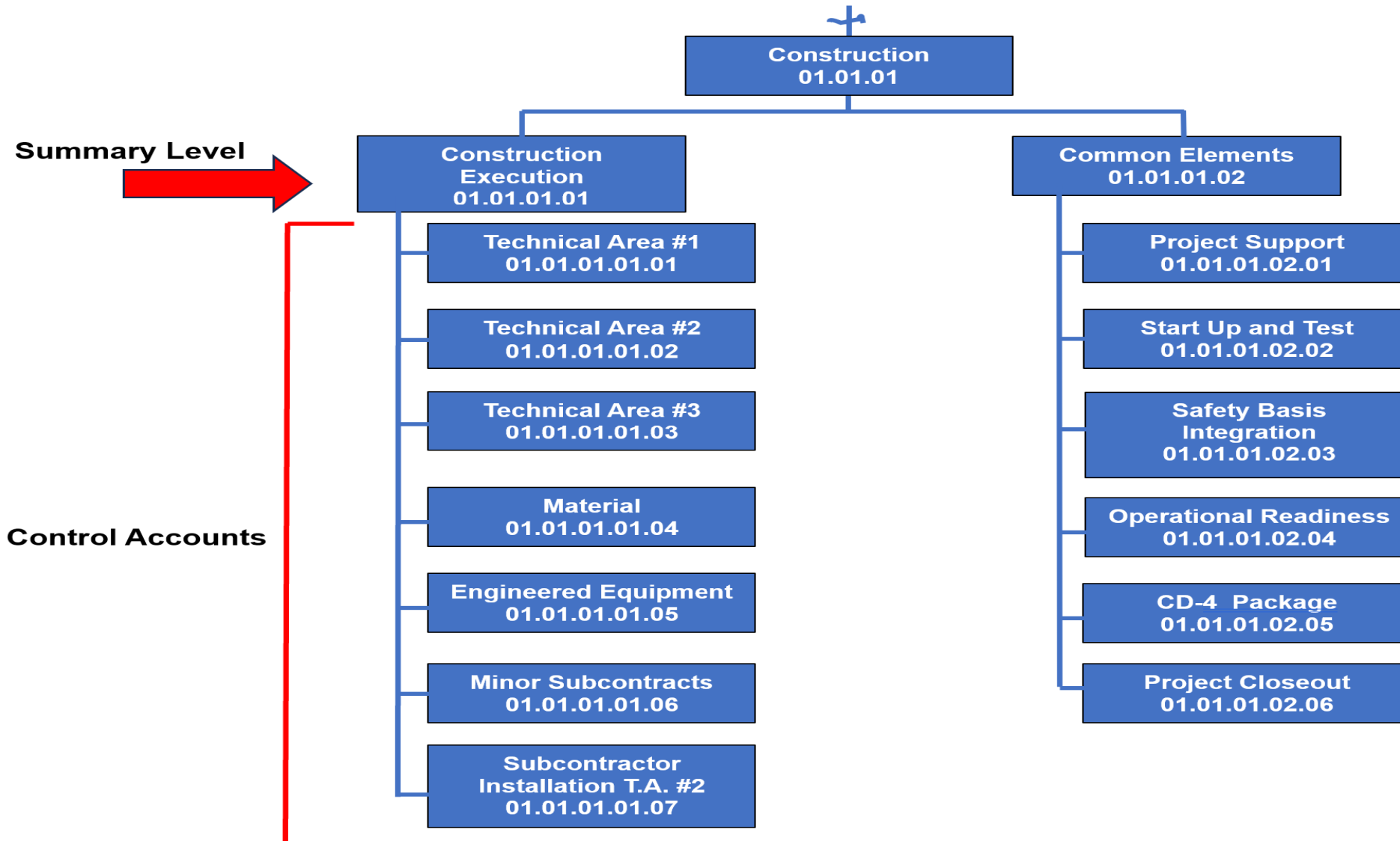


Why use a product-oriented WBS?

- Planning & Scheduling
 - The IMS – the focal point of project management – details the activities necessary to accomplish the project’s scope statement, PEP, WBS, and the events contained in the IMP.
 - The IMS reflects all activities as defined in the WBS (GAO Schedule Guide Best Practice 1) and defines the activities necessary to deliver the lowest-level deliverable.
 - A product-oriented WBS allows project managers to more precisely identify which elements are causing cost/schedule overruns and more effectively mitigate overruns by addressing their root causes.
- Earned Value Management
 - By breaking the work into smaller and more manageable work elements, a product-oriented WBS is used to integrate the scheduled activities and costs for accomplishing each work package at the lowest level of the WBS – **essential for developing the resource-loaded schedule that forms the foundation of the PMB.**
 - Provides the framework for monitoring and measuring cost, schedule, and technical performance.
 - Because the performance data is organized in a product-oriented hierarchical structure, data can be summarized (i.e. rolled up) by product to provide managers valuable information at any phase of the project.
 - Allows for current and visible project status so that risks can be managed or mitigated quickly.
 - Permits root cause analysis of cost, schedule, and technical problems and identification of effective solutions.

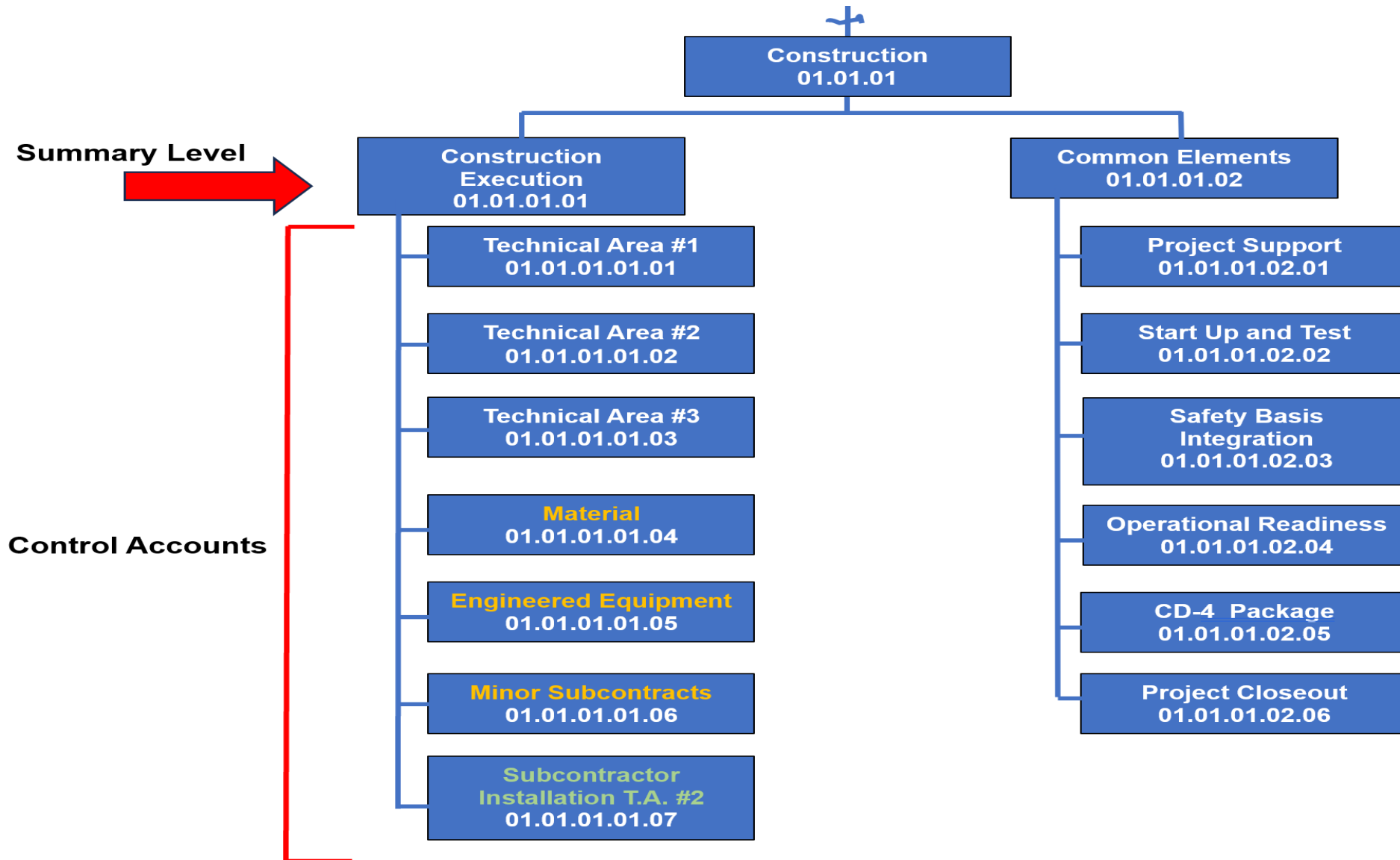


WBS Example: Project 1 – Current WBS



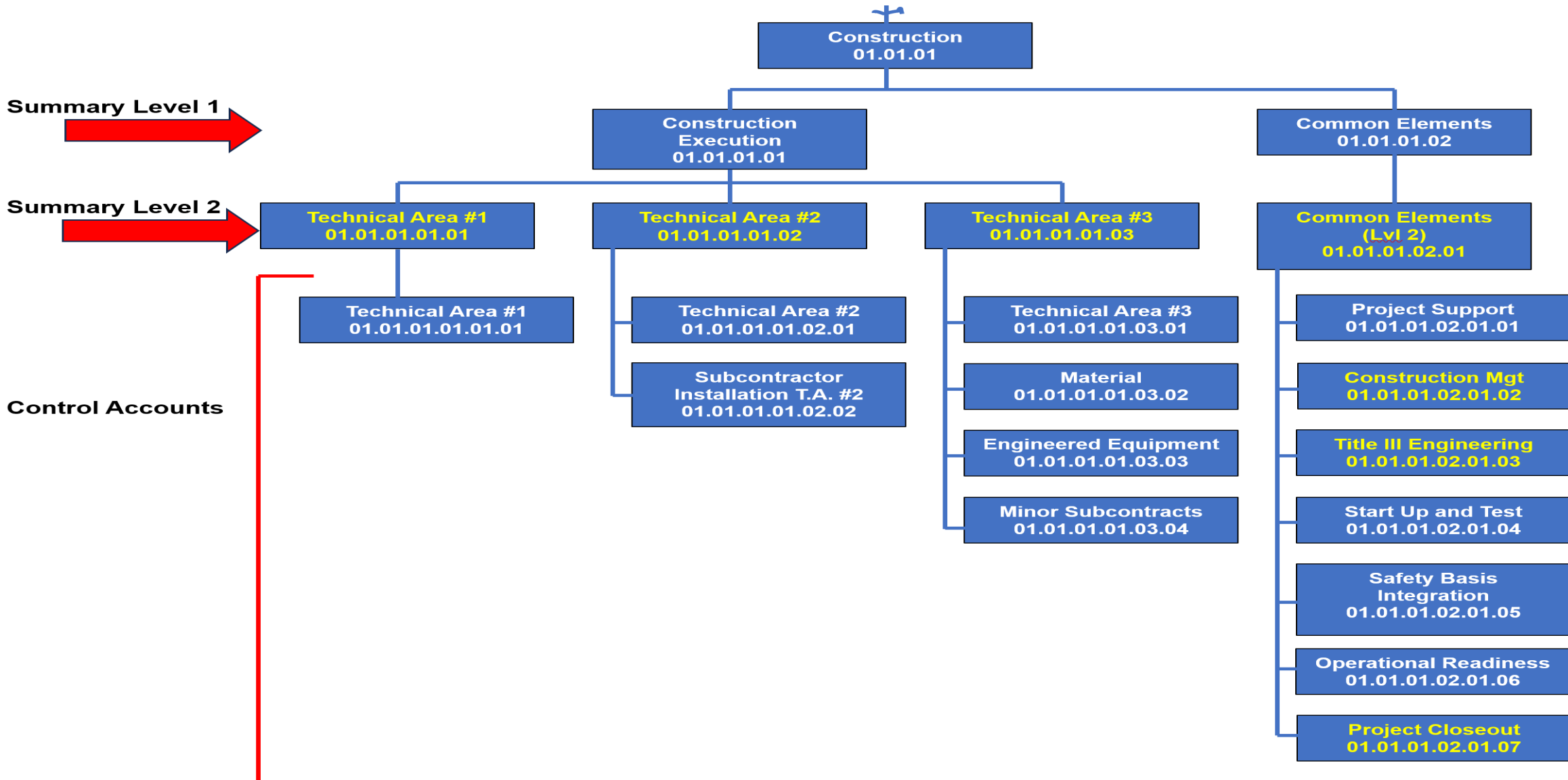


WBS Example: Project 1 – Current WBS



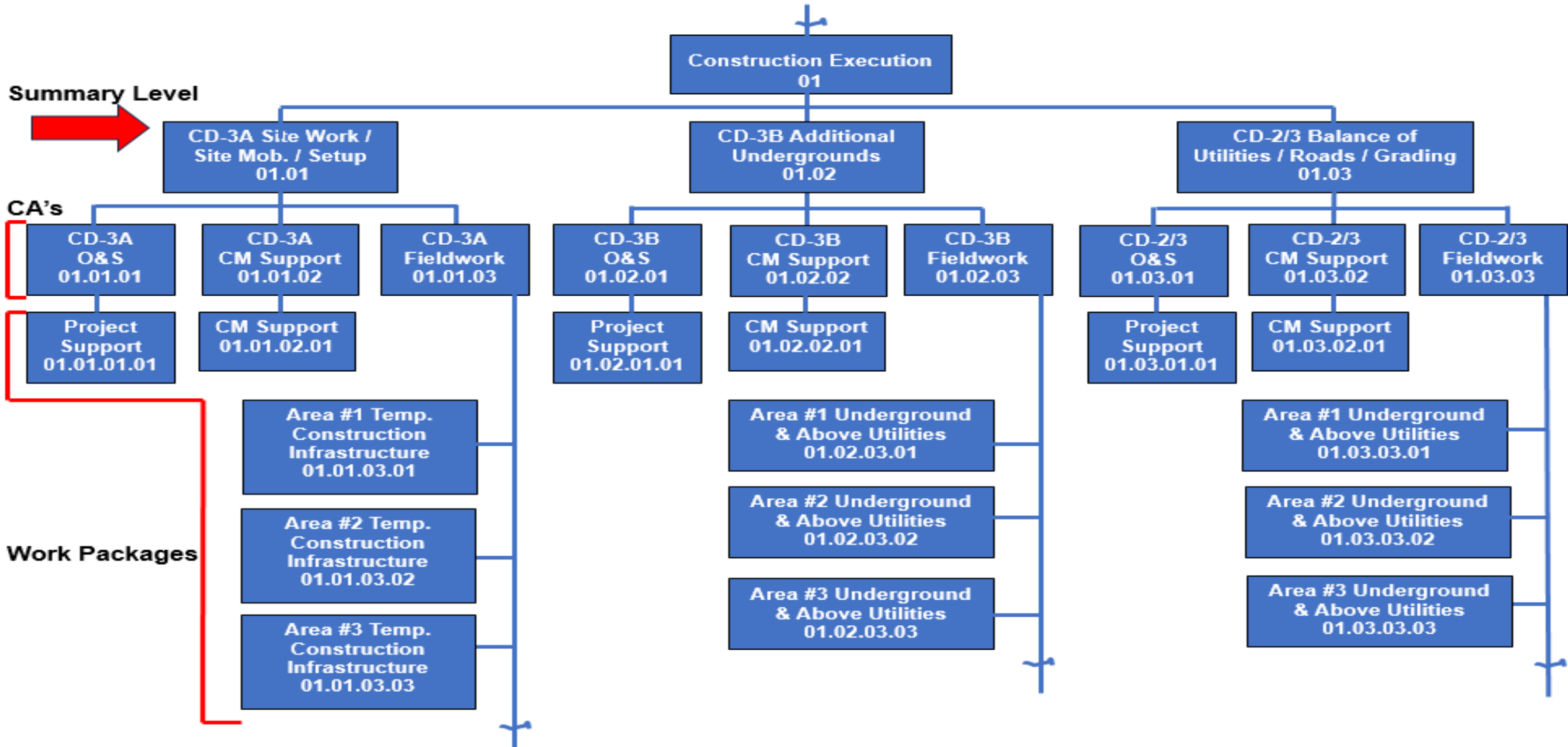


WBS Example: Project 1 – Proposed WBS



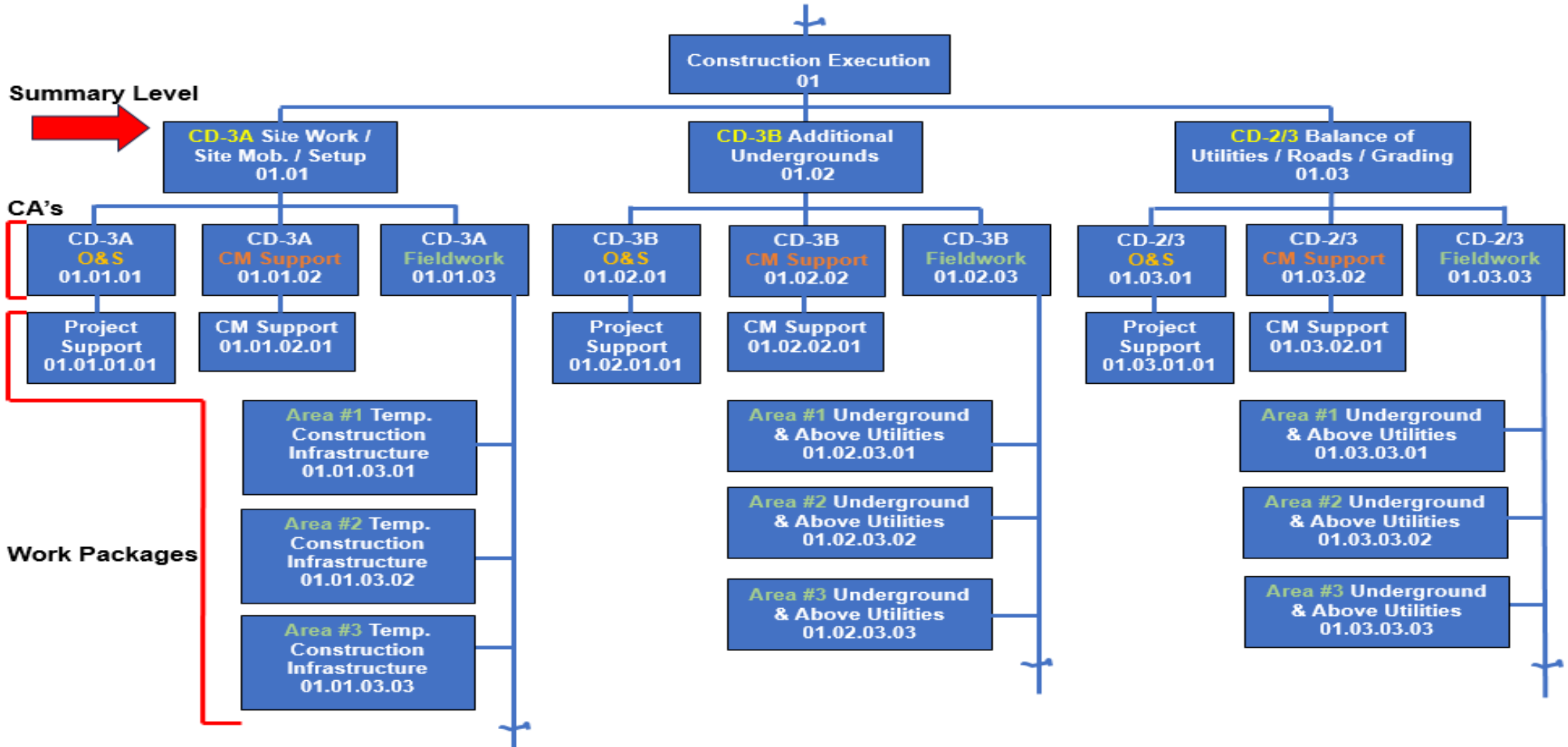


WBS Example: Project 2 – Current WBS



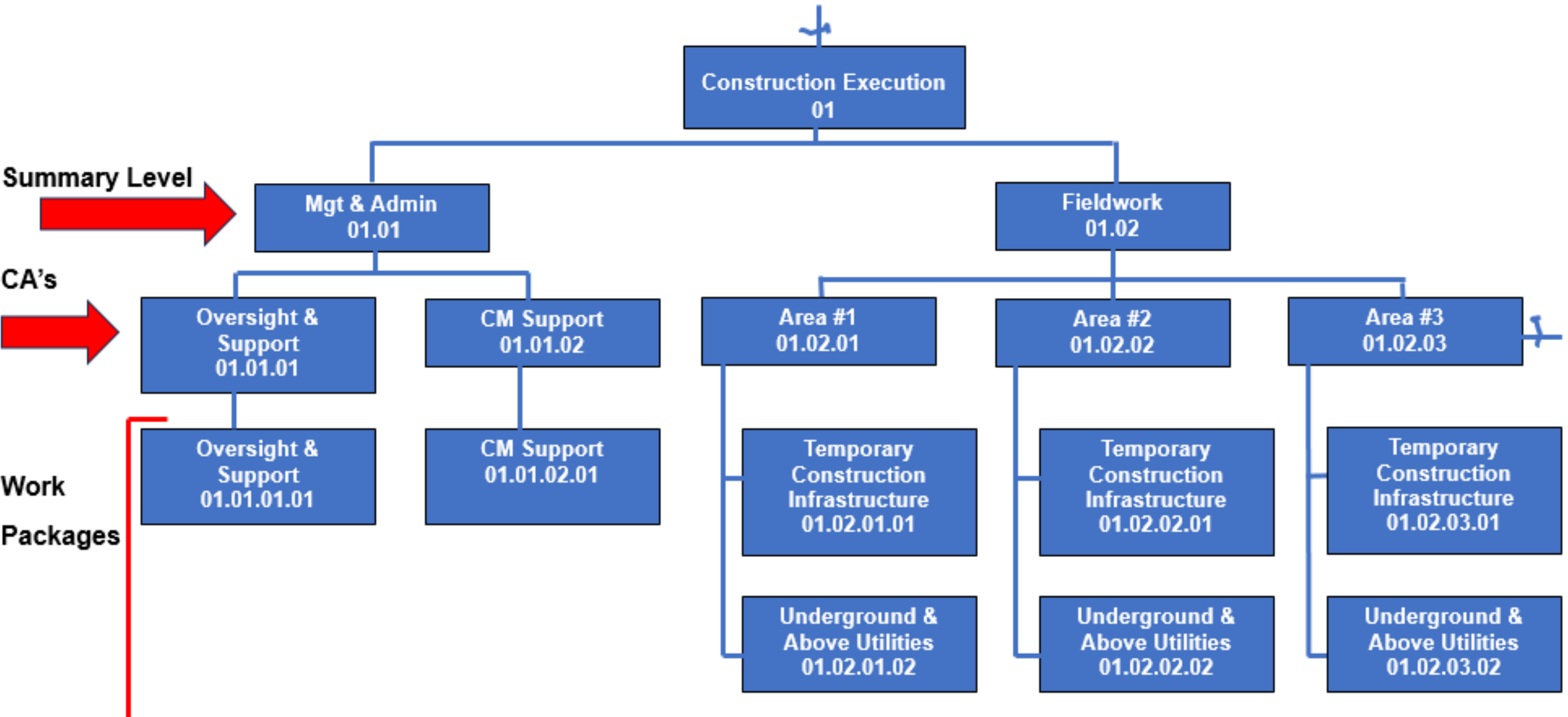


WBS Example: Project 2 – Current WBS





WBS Example: Project 2 – Reorganized WBS





Questions?

