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PRACTICE

33R-15

**DEVELOPING THE PROJECT
WORK BREAKDOWN STRUCTURE**

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DEVELOPING THE PROJECT WORK BREAKDOWN STRUCTURE

TCM Framework: 7.1 – Project Scope and Execution Strategy Development
8.1 – Project Control Plan Implementation

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INTRODUCTION

This recommended practice (RP) describes the purpose, development, and management of a work breakdown structure (WBS). This RP provides guidance regarding the use of a WBS on projects and demonstrates typical examples for a WBS. Additional project coding structures (e.g. organizational breakdown structures, risk breakdown structures) are covered in other recommended practices.

This recommended practice is intended to provide guidelines (i.e., not a standard) for development of a work breakdown structure based on the decomposition of the scope of the project statement of work (SOW). The intent of the RP is to document what most practitioners would consider to be good practices that can be relied upon and considered for use. The intended audience is project team members including project managers, project controls professionals, and earned value practitioners who develop and use the work breakdown structure as a part of the project planning process. This RP applies to owner/operator firms as well as to contractor firms.

At times, a program or portfolio WBS may contain additional hierarchical levels to indicate the relationship of projects within the program or portfolio.

This RP is aligned with the *Total Cost Management Framework*, as well as the *Electronics Industries Alliance (EIA) - 748 Earned Value Management Systems (EVMS)* guidelines (Guidelines 1 and 3).

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RECOMMENDED PRACTICE**What is a Work Breakdown Structure?**

The work breakdown structure is a hierarchical framework for organizing and ordering the activities that make up the entire project scope. It should cover all project scope and be broken down into “unique and manageable parts that correspond to key deliverables, phases of work, or milestones.”^[4] They are product (deliverable-based) or process oriented structures that provide a common frame of reference for managing and reporting project elements (e.g. estimating, scheduling, etc.) to stakeholders. A general description of the qualities of a WBS can be summarized in Table 1, below.

The WBS <u>Should</u> :	The WBS <u>Should Not</u> :
<ul style="list-style-type: none"> • Be unique - there can only be one WBS for each project. • Contain all of the project work scope and be updated to include revisions for authorized changes and modifications throughout the project’s life cycle. • Establish the project baseline for performance measurement and control. • Be the common reference for both internal and/or external project reporting. 	<ul style="list-style-type: none"> • Be a comprehensive list of all work activities. • Contain a chronological listing - it specifies what will be done, not when. • Contain planned activities- it specifies what will be done, not how. • Be used to describe an organizational hierarchy.

Table 1 – Qualities of a WBS

There are 2 types of WBSs:

1. PROJECT WORK BREAKDOWN STRUCTURE (PWBS) – A summary WBS tailored by project management to the specific project with the addition of the elements unique to the project. ^[1] (Also called the WBS)
2. CONTRACT WORK BREAKDOWN STRUCTURE (CWBS) – A work breakdown structure of the products or services to be furnished under contract. It is comprised of selected PWBS (program / project WBS) elements specified in the contractual document and the contractor’s lower level extensions of those elements. (6/07) ^[1]

Understanding the Work Breakdown Structure

Development of a WBS begins with decomposition of the project scope of work. This process breaks down the entire scope into discrete elements for which work can be planned and managed effectively.

For example, construction of a warehouse facility may be decomposed into site, foundation, superstructure, wall cladding, electrical and other mechanical systems, and other physical components. These components may not establish a manageable level of project control, or meet other project requirements. As such, the foundation may be further decomposed into greater detail that may include grade walls and concrete spread footers. This decomposition, when organized in a logical hierarchical manner, is called the WBS.

All costs and resources for a project should be mapped to a WBS element.

Scope decomposition and WBS development is a collaborative effort by the project team that may include the project manager, project control personnel, technical, and other stakeholders.

Two common ways of representing a WBS are:

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- As a tree hierarchy (shown in Figure 1).
- As a list hierarchy (shown in Table 2).

The WBS typically consists of two components:

- *Levels* - These establish the hierarchical structure of the work breakdown structure. Typically the highest level of the WBS is identified as level 0 or level 1 (see Figure 1).
- *Elements* - A discrete member of the WBS at each level of the hierarchy. It may be referred to as a node. At this level it represents the scope of work or task to be performed.

The WBS hierarchy establishes the ordered relationship between the various elements of the WBS. The lowest level of any branch of the WBS is defined by the project requirements including estimating and control.

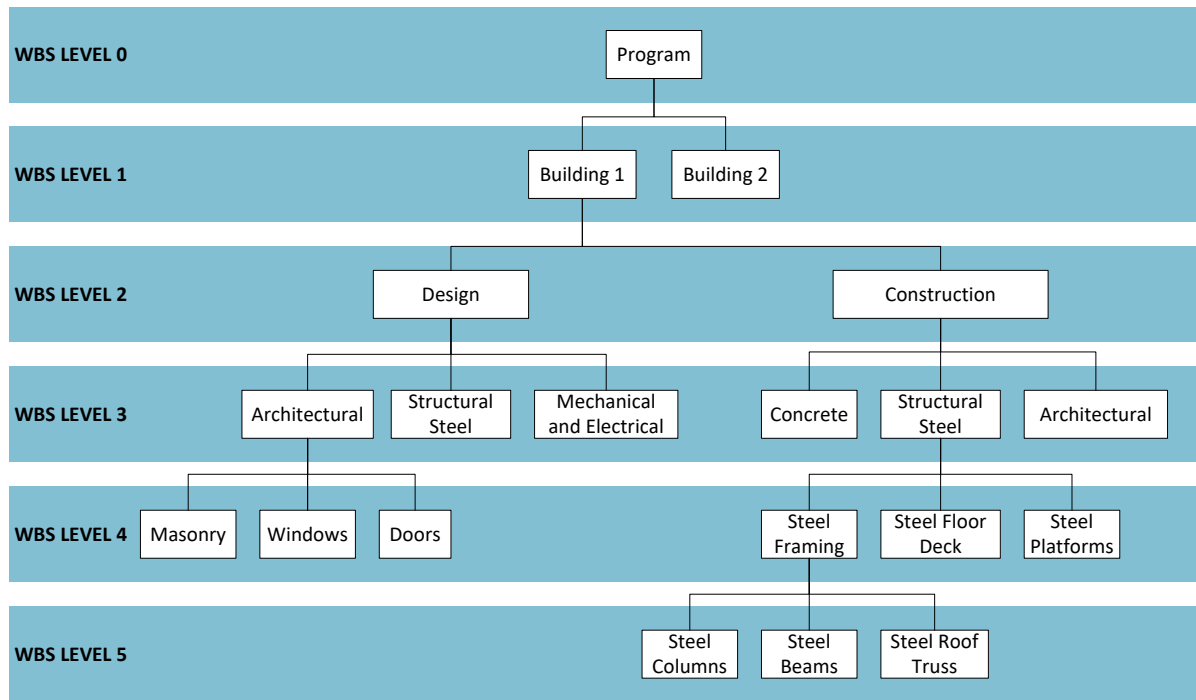


Figure 1 – Sample WBS as a Tree Hierarchy

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Table 2 illustrates decomposition of the scope of work in a list format.

LEVEL	WBS CODE	WBS ELEMENT DESCRIPTION
0	00.	Program
1	00.01	Building 1
2	00.01.01	Building 1 – Design
3	00.01.01.01	Building 1 – Design – Architectural
4	00.01.01.01.01	Building 1 – Design – Architectural – Masonry
4	00.01.01.01.02	Building 1 – Design – Architectural – Windows
4	00.01.01.01.03	Building 1 – Design – Architectural – Doors
3	00.01.01.02	Building 1 – Design – Structural Steel
3	00.01.01.03	Building 1 – Design – Mechanical and Electrical
2	00.01.02	Building 1 – Construction
3	00.01.02.01	Building 1 – Construction – Concrete
3	00.01.02.02	Building 1 – Construction – Structural Steel
4	00.01.02.02.01	Building 1 – Construction – Structural Steel – Steel Framing
5	00.01.02.02.01.01	Building 1 – Construction – Structural Steel – Steel Framing – Columns
5	00.01.02.02.01.02	Building 1 – Construction – Structural Steel – Steel Framing – Beams
5	00.01.02.02.01.03	Building 1 – Construction – Structural Steel – Steel Framing – Roof Truss
4	00.01.02.02.02	Building 1 – Construction – Structural Steel – Steel Floor Deck
4	00.01.02.02.03	Building 1 – Construction – Structural Steel – Steel Roof Truss
3	00.01.02.03	Building 1 – Construction – Architectural
1	00.02	Building 2

Table 2 – Sample WBS as a List Hierarchy

In the examples shown in Figure 1 and Table 2, note that not all sub-levels have been expanded upon in the hierarchy. Also note that not every branch of the hierarchy needs to reach the most detailed sub-level.

While all work breakdown structures contain the same basic elements, they can vary by industry.

WBS Dictionary

The WBS dictionary describes each of the work elements. It may include milestones, deliverables, activities, scope, dates, resources, costs, and quality requirements. Attributes that may be found in a WBS dictionary include:

- End result or expected work product.
- Relationships and dependencies between elements of work.
- Optional Elements:
 - Risk factors.
 - Assumptions or limitations.
 - Technical specifications.
 - Other supporting documents.

A dictionary may be shown in many forms; however they should contain the same information for all WBS elements. An example of a WBS dictionary is shown in Figure 2, below.

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WBS Code	WBS Element Description	Date	Revision
00.01.01	Phase 1 – Site Preparation	3/1/2016	1
WBS Element Description			
<p><i>Work product:</i> This shall include the initial clearing, grubbing, mass excavation, and rough grading of the site per specifications.</p> <p><i>Relationships:</i> Dependent on obtaining site permits.</p> <p><i>Risk Factors:</i> Unknown underground conditions (boulders, utilities).</p> <p><i>Assumptions:</i> Will be constructed on a 5 day 40 hour workweek.</p> <p><i>Specifications:</i> Civil specification 31.10.00</p>			

Figure 2 – Sample WBS Dictionary

It is important that the WBS dictionary provides concise, relevant, and sufficient information.

Conclusion

Once the WBS and associated dictionary are developed and approved, they should be placed under revision control. The following are some key points of the work breakdown structure:

- It established the basic building blocks for the planning of all authorized work scope.
- It is product (deliverable-based) or process oriented.
- It provides a decomposition of the scope of work.
- It establishes a common frame of reference for aligning cost estimating, scope control, project control, reporting, etc.

Repeatable and similar projects may benefit from standardization of work breakdown structures, and WBS dictionary formats.

REFERENCES

1. AACE International, Recommended Practice No. 10S-90, *Cost Engineering Terminology*, AACE International, Morgantown, WV, (latest revision).
2. Stephenson, H. Lance, Editor. *Total Cost Management Framework: An Integrated Approach to Portfolio, Program and Project Management, Second Edition*, AACE International, Morgantown, WV, 2015.
3. AACE International, Recommended Practice No. 20R-98, *Project Code of Accounts*, AACE International, Morgantown, WV, (latest revision).
4. NDIA PMSC Earned Value Management Systems Intent Guide April 29, 2014 Edition, National Defense Industrial Association.
5. *Earned Value Management Systems*, EIA-748-C, GEIA, March 2013
6. AACE International, Recommended Practice No. 60R-10, *Developing the Project Controls Plan*, AACE International, Morgantown, WV, (latest revision).
7. AACE International, Recommended Practice No. 83R-13, *Organizational Breakdown Structure and Responsibility Matrix*, AACE International, Morgantown, WV, (latest revision).
8. Department of Defense Earned Value Management System Interpretation Guide Dated Feb 18, 2015.
9. MIL-STD-881C (3 Oct 2011), Department of Defense Standard Practice, Work Breakdown Structures for Defense Material Items.
10. Work Breakdown Structure Handbook (August 16, 2012) United States Department of Energy, downloaded January 23, 2016 from: <http://energy.gov/projectmanagement/downloads/doe-work-breakdown-structure-handbook>

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APPENDIX. WBS EXAMPLES

Below are examples of WBS listings for a variety of industries and applications.

Building Construction Example ^[10]:

LEVEL	WBS CODE	WBS ELEMENT DESCRIPTION
1	A	Buildings
2	A1	Structure
3	A1.1	Foundation
3	A1.2	Basement
3	A1.3	Superstructure
3	A1.4	Exterior Enclosure
3	A1.5	Roofing
3	A1.6	Interior Construction
3	A1.7	Stairs
3	A1.8	Interior Finishes
2	A2	Utilities
3	A2.1	Electrical Systems
3	A2.2	Heating, Ventilating, and Air Conditioning (HVAC)
3	A2.3	Plumbing
3	A2.4	Conveying
3	A2.5	Fire Protection
3	A2.6	Communication Systems
2	A3	Furniture, Fixtures, & Office Equipment
3	A3.1	General Equipment
3	A3.2	Furnishings
3	A3.3	Process / Scientific / Technical Equipment
2	A4	Demolition
3	A4.1	Building Element Demolition
3	A4.2	Hazardous Component Abatement

Table 3 – Sample WBS for Buildings as a List Hierarchy

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Aircraft Systems Example^[9]:

LEVEL	WBS CODE	WBS ELEMENT DESCRIPTION
1	1	Aircraft System
2	1.1	Air Vehicle
3	1.1.1	Airframe
4	1.1.1.1	Airframe Integration, Assembly, Test and Checkout
4	1.1.1.2	Fuselage
4	1.1.1.3	Wing
3	1.1.2	Propulsion
3	1.1.3	Vehicle Subsystems
2	1.2	System Engineering
2	1.3	Program Management
2	1.4	System Test and Evaluation
2	1.5	Training
3	1.5.1	Equipment
3	1.5.2	Services
3	1.5.3	Facilities
2	1.6	Data
3	1.6.1	Technical Publications
3	1.6.2	Engineering Data
3	1.6.3	Management Data
3	1.6.4	Support Data
3	1.6.5	Data Depository

Table 4 – Sample WBS for Aircraft Systems as a List Hierarchy

Electronic Systems for Weapons Platforms Example^[9]:

LEVEL	WBS CODE	WBS ELEMENT DESCRIPTION
1	1	Electronic System
2	1.1	Prime Mission Product (PMP)
3	1.1.1	PMP Subsystem 1...n (Specify)
4	1.1.1.1	PMP Subsystem Hardware 1...n
4	1.1.1.2	PMP Subsystem Software Release 1...n
4	1.1.1.3	Subsystem Integration, Assembly, Test and Checkout
2	1.2	Platform Integration, Assembly, Test and Checkout
2	1.3	System Engineering
2	1.4	Program Management
2	1.5	System Test and Evaluation
3	1.5.1	Development Test and Evaluation
3	1.5.2	Operational Test and Evaluation
3	1.5.3	Mock-ups / System Integration Labs (SILs)

Table 5 – Sample WBS for Electronic Systems as a List Hierarchy