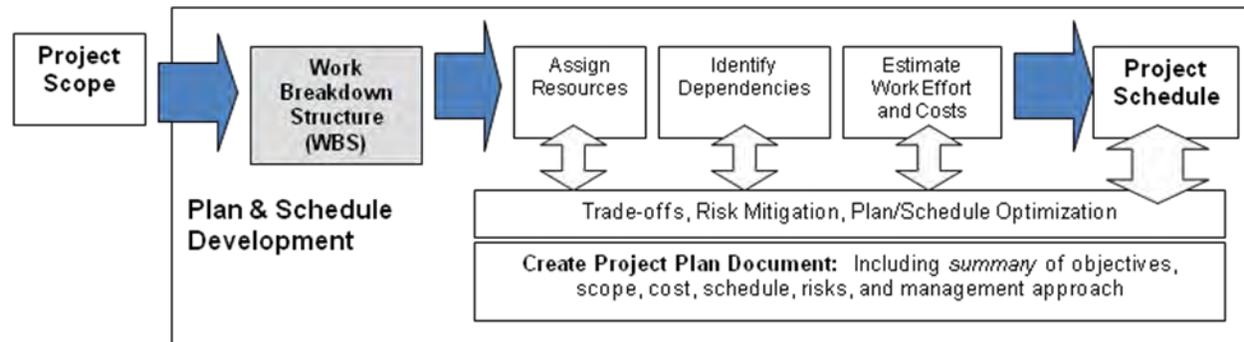


INTRODUCTION: Plan and Schedule Development – Create a Work Breakdown Structure (WBS)

The detailed guidelines and examples start on the following page.

What This Is

First of a series of guidelines for project plan and schedule development. This guideline covers **the steps for developing a Work Breakdown Structure (WBS)** to identify all the activities that must be executed to fulfill the objectives of the project. Several WBS examples are provided.



Content in this guideline was contributed by:

ProjectConnections staff, IPSolutions - www.ipsassociates.com, and ICS Group www.icsgrp.com

Why It's Useful

A key to successful project scheduling is to identify all the work of the project *before* you consider delivery dates and resource constraints. This helps a team objectively identify everything that needs to be done without subconsciously leaving out real work in order to fit pre-determined dates.

The WBS step helps accomplish the following key objectives:

- Develops an objective, rational view of the amount of work required.
- Provides a basis for next identifying the skills and resources required for the project.
- Provides a framework for clearly defining pieces of the work and delegating responsibility.
- Lays a foundation for analyzing dependencies and for isolating and managing risks.
- Lays a foundation for developing a bottom-up estimate for the project schedule.

How to Use It

1. Review the overview and steps for creating a Work Breakdown Structure starting on the next page.
2. Identify how team members will be involved in creating the WBS and educate them on their role. The primary objective is to get all of the team participants to contribute to the definition of the work.
3. Decide how you'll record the items in your WBS (e.g., worksheet, spreadsheet, scheduling tool). See the table on the last page of this file for one example of a worksheet. This format can be carried forward into the next few steps of scheduling to systematically build the pieces of the schedule (resource assignments, estimates, etc.) onto the foundation of the WBS items.
4. Determine an appropriate organization for your WBS and begin identifying major work efforts. See the detailed guidelines that begin on the following page for ways your WBS can be organized.
5. Break the top level of your WBS further into a hierarchical set of activities. Use the guidelines starting on the next page to decide how far your WBS must be broken down to ensure that you've defined enough detail for scheduling your project.
6. The WBS is the basis for all the next steps in the planning and scheduling process.

The guideline and template content for creating a WBS starts on the following page.

Plan and Schedule Development – Create a Work Breakdown Structure

Overview of WBS Creation

The WBS is the first step in developing a detailed work plan for the project. It bridges from the early Scope definition to creation of a detailed project schedule.

1) Start with the Scope

Defines at the highest level what must be created and delivered to the project's customers to satisfy the objectives of the project.



2) Create the Work Breakdown Structure (WBS)

A top-down hierarchical description of the work required to *produce* what is called for in the Project Scope and *achieve the mission*, satisfy stakeholders.

- Provides approach for 'decomposing' the work into measurable units, which allows easier and more accurate estimates of duration, needed resources, and time required.
- Helps ensure that the scope is completely defined and the team has not forgotten any work.
- Allows breakdown of work to deliverables and activities that can be assigned to an owner.



3) Based on the WBS, develop the Project Schedule

Created by adding resource assignments, identifying dependencies among activities and tasks, and estimating work effort for all items in the WBS.

Overview of the Work Breakdown Process: From the Top Down

Use the following top-down approach to iteratively create your WBS:

1. Identify the major components of work to be accomplished.

Identify 5-10 major work groups to form the top level of your WBS. Select these based on the best way to organize the work for this project given the project complexity, how the work is spread across your organization, and how the work will be tracked and managed. Here are seven possible approaches for your overall WBS organization. (Reference: *Effective Project Management*, Wysoki et al, pg. 120)

Noun-Type

- Physical Decomposition – The pieces of a product
- Functional Decomposition – Areas of system functionality

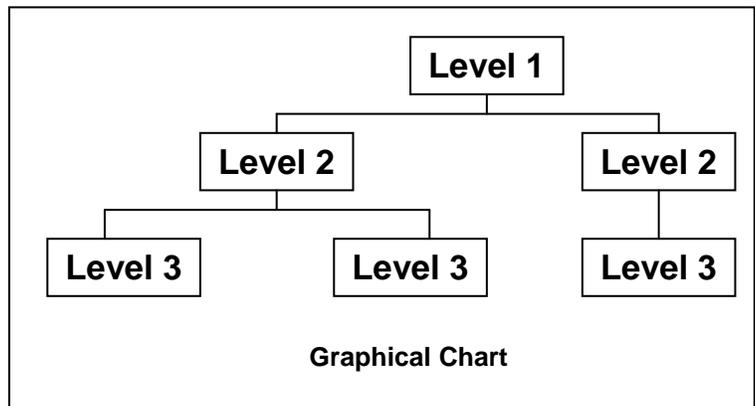
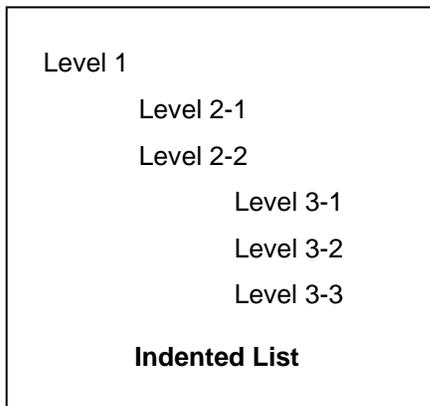
Verb-Type

- Design-Build-Test-Implement – Methodology or lifecycle phase focus
- Objectives – Senior management or customer focus on reporting to deliverables

Others

- Geographical – Coordination and communication focus across locations
- Business Function – Focus on business process with integration complications
- Departmental – Focus on organizational control of one manager

2. Identify the next level of work (Level 2) under each major component and list them under their top-level groups. This can be done with indented lists or graphically in an organization chart.



3. Continue to break down the work under each Level 2 item.

Break down to the level of activity detail. Continue until the top-level components are broken down far enough to identify all the work that needs to get done. Details under some may break into three or four levels. Others may require no more detail, or only one additional level. Further guidelines for WBS completeness are given later in this file.

Examples and Definitions of Typical WBS Levels

This section contains material contributed by ICS Group www.icsgrp.com

The following is one possible work breakdown approach starting with project lifecycle phases at Level 1, major deliverables of each phase as Level 2, and the activities and tasks to create each deliverable.

Phases	Identify major phases of work (e.g. specify, design, build, test...)
Major Project Deliverables	Identify the major component deliverables of work required (e.g., subsystems that must be designed, built, tested, during each phase.)
Activities	Identify the activities needed to create those deliverables. (Some interim, smaller deliverables such as documents may be involved.)
[Activities]	Some WBSs will have multiple levels of activities to break the work down to an appropriate level of detail.
Tasks	Break the activities down to an appropriate level of task detail.

Level 1 – Phases: A project plan, or schedule, is made up of the deliverables and milestones of the project, and depending on the level of detail required, the activities/tasks. Typically, this information can be organized into a number of natural groupings. In project planning, each group is called a phase and a name is given to it for ease of communication and reporting.

Level 2 – Deliverables: Deliverables are the clearly defined and recognizable results or tangible work products of successfully completed activities performed during the project. They appear in the past tense, to represent the completed activity and the accomplished result.

“Receivables” should also be included. They are deliverables owed to the project by others outside of the project (usually other project teams), and upon which the project is dependent.

Levels 3 and 4+ – Activities & Tasks: Each phase of a project is composed of a number of major activities that will lead to achieving one or more deliverables. Activities may be broken into a smaller set of activities at the next level in the WBS, which is typical in larger projects.

The bottom-level activities in a WBS may break down further into very detailed tasks that express the smallest pieces of work needed to complete the activity and produce the deliverable or output of that activity. NOTE: Project management standards call for WBSs to be created to the activity level, with very detailed tasks NOT listed in the WBS but instead left as lower-level detail to be handled by the owner of each activity. In practice, the terms “activity” and “task” may be used interchangeably. No matter what the terminology, what matters is getting the WBS to the right level of detail for accurate planning and tracking. The lowest-level items in the WBS form the schedule used by the project manager and team to estimate the project work and costs, then later track project progress. By definition, then, the WBS must be broken down far enough to yield accurate work and cost estimates and accurate measures of progress.

See the WBS Completion Criteria Checklist later in this file for how to test the bottom level of your WBS to ensure you’ve broken the work down far enough.

The brief WBS excerpt on the next page illustrates the Phase-Deliverable-Activity breakdown.

Example: WBS Excerpt for Creating a Promotional DVD

CONCEPT	(Phase)
<i>(Detailed deliverables and activities here)</i>	
DESIGN	(Phase)
<i>(Detailed deliverables and activities here)</i>	

This section of the WBS broken out to activity detail:

PROTOTYPE AND TEST DVD	(Phase)
<i>DVD Prototype</i>	<i>(Deliverable)</i>
Develop Video	(Activity)
Shoot sections	
Review video	
Edit video sections	
Edit video – full sequence	
Develop Narrative	(Activity)
Write narrative text	
Review and update text	
Record voice-over narrative	
Review prototype DVD	(Activity)
Update prototype DVD	(Activity)
<i>Tested DVD</i>	<i>(Deliverable)</i>
<i>(Detailed activities go here)</i>	
SELECT VENDOR	(Phase)
<i>DVD Fulfillment Vendor commitment</i>	<i>(Deliverable)</i>
Research options	(Activity)
Define selection criteria	
Identify potential vendors	
Select and sign vendor	(Activity)
Send requirements to fulfillment houses	
Get quotes and sample contracts	
Decide fulfillment house	
Sign contract	
PRODUCE AND SEND	(Phase)
<i>DVD First-Article for QA</i>	<i>(Deliverable)</i>
<i>(Activity detail here)</i>	(Activity)
<i>DVD First Mailing Out</i>	<i>(Deliverable)</i>
<i>(Activity detail here)</i>	(Activity)

How to Engage the Team in Creating the WBS

This is a team process and should *not* be done by the Project Manager alone.

Plan to engage the project team to analyze and break down the work into a sequence of deliverables and activities until the detail defines a project that can be accurately scheduled and managed.

Here is a suggested process:

- 1) **The Project Manager can propose** what the top level of the WBS should be.
- 2) **Call a core team meeting** to review the suggested top level of the WBS and define the next level of detail. In the meeting, agree on the top level of the WBS and brainstorm a list of items to include at Level 2 (e.g. deliverables that would show up for each major phase).
- 3) **Work collaboratively in the meeting** to identify subsequent levels of WBS detail, by drafting WBS activities and tasks onto a whiteboard or flipchart paper on the walls, or by writing deliverables and activities on sticky notes and sticking them to the whiteboard or wall underneath the appropriate top-level section of the WBS.
- 4) **Have individual team members thoroughly consider their own work** to identify potential missing items, covering everything they are involved in during the project including ‘secondary work’ such as reviews, through the entire project timeline.
- 5) **Draft early plans for particular major activities** to help think through lower-level activities that might need to show up in the WBS. For example, write preliminary plans to help break down later cross-functional efforts such as documentation, manufacturing, testing, etc.
- 6) **Create a “WBS dictionary” entry**—descriptions of each activity in the WBS, including explicit deliverable(s) from that activity—to ensure clarity.
- 7) **Publish a draft WBS to team members and others** to sanity check the contents, including the activity descriptions, and identify additional work.

Ultimately the WBS should take into account information from many sources:

- other team members
 - other project managers who have done similar work
 - previous project reviews
 - other appropriate groups
 - expert opinion
 - existing WBS templates
- 8) **Get the feedback and incorporate it into the WBS.**
 - 9) **Review the updated WBS with the team** and determine whether the items in the WBS meet the thoroughness checks and completion criteria on the next pages.
 - 10) **Update the WBS and evolve it** as necessary as activity owners do the next steps of planning, including assigning resources and estimating work, and the team identifies dependencies and builds the integrated schedule.

How Far to Go: How Much Detail Is Enough?

The ultimate goal in breaking the work down is to ensure that all of the work needed to meet the project's objectives is recognized and planned for as accurately as possible from the beginning.

WBS detail levels vary based on the size and complexity of the project. Greater levels of detail are generally required for projects that are:

- larger
- more risky
- dissimilar to past projects
- difficult to define (susceptible to change)
- performed by internal work groups
- planned for the near future

The WBS will continue to be updated during the Plan and Schedule development process. Generally, as the process goes forward, additional work may come to light and need to be incorporated into the WBS. (In fact, it's a good sign if forgotten work is discovered—it means people are thinking through the project thoroughly.)

Systematically Checking the WBS for Completeness

The WBS Completion Checklist on the following page will help the team validate whether their WBS forms a sound basis for the project's schedule going forward.

In addition, the team can take a systematic approach to reviewing the WBS together to ensure nothing has been missed:

Consider your project scope. (Use the Project Charter, Vision document, whatever expresses the full scope of your project.)

- Does this WBS express all the work to meet every aspect of the Scope of this project?
- If not, what additional WBS section and activities are needed to fulfill the Scope?

Consider the stakeholders of this project—those who are affected by (“have a stake in”) the outcome.

- Does this WBS express all the activities related to needs and concerns of the stakeholders?
- What additional WBS elements needed to work with and satisfy particular stakeholders?

Consider “project influencers”—those who can have a positive or negative impact on the project.

- Does this WBS express all the activities related to needs and concerns of the project influencers?
- What additional WBS elements needed to work with and satisfy particular influencers?

Look at the Team Roles and Responsibilities List, Responsibility Allocation Matrix, or any other team definition documents:

- Are the activities for all cross-functional groups currently on the team included the WBS?
- Are we sure we've involved all necessary groups and the WBS expresses their work?
- What group's work is missing and what needs to be added?

WBS Completion Checklist

Appropriate level of detail: Continue to break the work down until the resulting WBS list meets the following criteria:

- One (and only one) owner can be assigned to each of the lowest level activities.
- Clearly defined outputs (deliverables) are obvious for each activity.
- Quality can be monitored through completion criteria for each activity and/or its deliverable.
- The work listed at one level 100% defines the work needed to accomplish the activity at the level above it in the WBS.
- The activities communicate the work to be accomplished to the person who is accountable.
- The likelihood that an activity is omitted or workflow forgotten is minimized.
- Each activity is well defined and small enough so that estimates of work effort and duration are credible. Work effort or duration at lowest level should be less than 5% of the total project, to ensure visibility into progress, at a small enough resolution to recognize quickly if the project is off track.
- The project is broken down to the level at which you want to track progress.

No forgotten work: Project delays are often caused by forgotten work rather than inaccurate estimates. Ensure you have included items for the following:

- planning the project
- approval cycles
- key project meetings
- management/customer interfaces
- quality inspections/fixing defects
- training
- management
- test planning, development & execution
- project reviews and project closing

See the following pages for several examples of Work Breakdown Structures.

Additional WBS Examples

The following WBS examples illustrate using the top-down breakdown approach for several different project types. See also other, separate WBS examples on the site.

Example: WBS for Building a House (Indented List Format)

(ref: *Effective Project Management*, Wysoki et al, pg. 120)

- I. SITE PREPARATION
 - A. *Layout*
 - B. *Grading*
 - C. *Excavation*
- II. FOUNDATION
 - A. *Erect Forms*
 - B. *Pour Concrete*
 - C. *Remove Forms*
- III. FRAMING
 - A. *Floor Joists*
 - 1. Install first-floor floor joists
 - 2. Install second-floor floor joists
 - B. *Sub-flooring*
 - 1. Install first-floor sub-flooring
 - 2. Install second-floor sub-flooring
 - C. *Stud Walls*
 - 1. Erect first-floor stud walls
 - 2. Erect second-floor stud walls
 - D. *Frame Roof*
- IV. UTILITIES
 - A. *Electrical*
 - 1. Rough In
 - 2. Building inspection
 - 3. Finish work
 - B. *Plumbing*
 - 1. Rough in
 - 2. Building inspection
 - 3. Finish work
 - C. *Gas*
 - 1. Rough in
 - 2. Building inspection
 - 3. Finish work
- V. WALLS
 - A. Hang sheetrock
 - B. Tape and bed
- VI. ROOFING
 - A. Install sheathing
 - B. Lay shingles
- VII. FINISH WORK
 - A. Interior
 - 1. Install cabinets
 - 2. Install appliances
 - 3. Install furnace
 - 4. Lay carpet
 - 5. Paint walls and molding
 - 6. Hang wallpaper
 - 7. Lay tile
- VIII. LANDSCAPING

Example: Website Development WBS**1. Website Project****1.1. Design****1.1.1. Web User Interface**

- 1.1.1.1. Functional Specifications
 - 1.1.1.1.1. Create User Interface Mock-ups
 - 1.1.1.1.2. Conduct Design Review
 - 1.1.1.1.3. Deliver Final Functional Specs
 - 1.1.1.1.4. Obtain User Signoff
- 1.1.1.2. Technical Specifications
 - 1.1.1.2.1. Develop Tech Specs
 - 1.1.1.2.2. Review Tech Specs with Project Team
 - 1.1.1.2.3. Obtain Team Signoff

1.1.2. SQL Database

- 1.1.2.1. Technical Specifications
 - 1.1.2.1.1. Develop Tech Specs
 - 1.1.2.1.2. Review Tech Specs with Project Team
 - 1.1.2.1.3. Obtain Team Signoff

1.1.3. Interfaces

- 1.1.3.1. Technical Specifications
 - 1.1.3.1.1. Determine data import/export elements
 - 1.1.3.1.1.1. Define User needs
 - 1.1.3.1.1.2. Define IT needs
 - 1.1.3.1.2. Design interfaces
 - 1.1.3.1.3. Obtain Team Signoff

1.1.4. Reports

- 1.1.4.1. Functional Specifications
 - 1.1.4.1.1. Collect User Requirements
 - 1.1.4.1.1.1. Define Data elements
 - 1.1.4.1.1.2. Define Frequency
 - 1.1.4.1.1.3. Define Audience
 - 1.1.4.1.2. Design Reports
 - 1.1.4.1.3. Review Report Design with Project Team
 - 1.1.4.1.4. Deliver Final Functional Specs
 - 1.1.4.1.5. Obtain User Signoff

1.2. Development**1.2.1. Web Front End**

- 1.2.1.1. Code Web Pages
- 1.2.1.2. Conduct Unit Test
- 1.2.1.3. Review Web Page design/functionality
- 1.2.1.4. Obtain User Signoff

1.2.2. SQL Database

- 1.2.2.1. Identify table relationships
- 1.2.2.2. Build database tables
- 1.2.2.3. Review Tables with project team
- 1.2.2.4. Obtain Signoff

1.2.3. Interfaces

- 1.2.3.1. Build Interfaces
- 1.2.3.2. Conduct Unit test of import/export functionality
- 1.2.3.3. Obtain Signoff

1.2.4. Reports

- 1.2.4.1. Code Reports
- 1.2.4.2. Conduct Unit test
- 1.2.4.3. Review Reports with project team
- 1.2.4.4. Obtain Signoff

Continued next page

Example: Website Development WBS (continued)**1.3. Quality Assurance****1.3.1. Web Front End**

- 1.3.1.1. Verify design and functionality
- 1.3.1.2. Perform Integration Test
- 1.3.1.3. Perform User Acceptance Test
- 1.3.1.4. Obtain User Signoff

1.3.2. SQL Database

- 1.3.2.1. Verify design/data elements
- 1.3.2.2. Verify relationships
- 1.3.2.3. Perform Integration Test
- 1.3.2.4. Perform User Acceptance Test
- 1.3.2.5. Obtain User Signoff

1.3.3. Interfaces

- 1.3.3.1. Verify design and functionality
- 1.3.3.2. Perform Integration Test
- 1.3.3.3. Perform User Acceptance Test
- 1.3.3.4. Obtain User Signoff

1.3.4. Reports

- 1.3.4.1. Verify design and functionality
- 1.3.4.2. Perform Integration Test
- 1.3.4.3. Perform User Acceptance Test
- 1.3.4.4. Obtain User Signoff

1.4. Training**1.4.1. Create system documentation**

- 1.4.1.1. Assemble Tech Specs
- 1.4.1.2. Develop System Flowcharts
- 1.4.1.3. Deliver Source Code
- 1.4.1.4. Complete System Documentation manual

1.4.2. Create training materials

- 1.4.2.1. Assemble Functional Specs
- 1.4.2.2. Develop "As Is" and "To Be" documentation
- 1.4.2.3. Update Business Processes
 - 1.4.2.3.1. Write new business processes
 - 1.4.2.3.2. Obtain User Signoff
- 1.4.2.4. Complete User Training Manuals

1.4.3. Train users

- 1.4.3.1. Train IT Support Staff
 - 1.4.3.1.1. Identify trainees
 - 1.4.3.1.2. Identify trainers
 - 1.4.3.1.3. Construct training schedule
 - 1.4.3.1.4. Train users
- 1.4.3.2. Train Business Partners
 - 1.4.3.2.1. Identify trainees
 - 1.4.3.2.2. Identify trainers
 - 1.4.3.2.3. Construct training schedule
 - 1.4.3.2.4. Train users
 - 1.4.3.2.5. Verify user readiness

Continued next page

Example: Website Development WBS (continued)**1.5. Implementation****1.5.1. Hardware**

- 1.5.1.1. Determine hardware needs
- 1.5.1.2. Make Hardware selections
- 1.5.1.3. Purchase hardware
- 1.5.1.4. Deploy
- 1.5.1.5. Perform System test
- 1.5.1.6. Verify production readiness and signoff

1.5.2. Packaged Software

- 1.5.2.1. Determine software needs
- 1.5.2.2. Make software selections
- 1.5.2.3. Purchase software
- 1.5.2.4. Deploy
- 1.5.2.5. Perform System Test
- 1.5.2.6. Verify production readiness

1.5.3. Develop Implementation Plan

- 1.5.3.1. Construct Timeline
- 1.5.3.2. Identify Team
- 1.5.3.3. Identify Components
- 1.5.3.4. Finalize Plan

1.5.4. Installation

- 1.5.4.1. Convert hardware to production-ready status
- 1.5.4.2. Convert packaged software to production ready status
- 1.5.4.3. Install new programs into production environment
- 1.5.4.4. Verify code
- 1.5.4.5. Initiate limited production run for user acceptance
- 1.5.4.6. Turn over system to users

1.6. Post-Implementation**1.6.1. Verify System**

- 1.6.1.1. Obtain user acceptance of production system
- 1.6.1.2. Log issues

1.6.2. Monitor system

- 1.6.2.1. Verify performance
- 1.6.2.2. Verify functionality

1.6.3. Project Wrap-up

- 1.6.3.1. Obtain Final Project Signoff
- 1.6.3.2. Document and Review Lessons Learned

See also a number of Work Breakdown Structure example files on the ProjectConnections website: <http://www.projectconnections.com/templates/>.

See the next page of the file for an example plan development worksheet. This worksheet is included in each Plan and Schedule Development file, illustrating how the successive columns can be used to develop each aspect of the schedule. Your team may use similar worksheets in Excel, or do most of the work in a scheduling tool such as Microsoft Project. Regardless, this worksheet format helps illustrate how the components of the schedule evolve from the WBS.

Planning Worksheet: Create a Work Breakdown Structure

NOTE: The table below can be broken up to correspond to major groups of work as defined by the top levels of the Work Breakdown Structure to aid completion of the entire project's WBS by different team members or functional groups working separately in parallel.

WBS Level	Activity Name	Activity Description including deliverable	Owner Name + [FTE*]	Other resources needed Name+ [FTE*]	Specific competencies, skills, experience needed	Estimated Effort & Duration	Estimated Costs	Dependencies plus any true date constraints
1								
2								
3								

* FTE means "Full time equivalent." Express a person or generic resource's involvement as a percentage of a full time person, e.g. [0.5] for half-time.