

**Module Description, available in: EN**

## *Lifecycle Management of Infrastructures*

**General Information****Number of ECTS Credits**

3

**Module code**

FTP\_Life

**Valid for academic year**

2021-2022

**Last modification**

2021-01-05

**Coordinator of the module**

Christoph Heitz (ZHAW, christoph.heitz@zhaw.ch)

**Explanations regarding the language definitions for each location:**

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Berne	Lausanne	Lugano	Zurich
<b>Instruction</b>				X E 100%
<b>Documentation</b>				X E 100%
<b>Examination</b>				X E 100%

**Module Category**

FTP Fundamental theoretical principles

**Lessons**

2 lecture periods and 1 tutorial period per week

**Entry level competences****Prerequisites, previous knowledge**

Basic knowledge in mathematics (introductory lecture in analysis and linear algebra)

MS Excel (implementation of formulae, graphs)

**Brief course description of module objectives and content**

In this module, students are introduced into basic concepts of lifecycle management of infrastructures with respect to costs vs benefit. Established cost and benefit models of infrastructures are discussed. Based on lifecycle costs analysis, we introduce different methods for the assessment of maintenance strategies, and for decision making with respect to construction, preservation, and replacement. The cost-based approaches are complemented with methods for the analysis of reliability, availability, and risk.

## Aims, content, methods

### Learning objectives and acquired competencies

- the students understand the function and the benefit of infrastructures, and their effect on society, economy, and environment
- the students are familiar with the challenges for sustainable development of infrastructures
- the students are familiar with concepts for deriving requirements for infrastructures, their verification and validation.
- the students are familiar with the most important methods for decision making in infrastructure management, and are able to apply those methods in concrete cases; for example the calculation of life cycle costs or socio-economic impact, or the simultaneous minimization of costs and risks.
- the students are familiar with the different maintenance strategies (reactive, preventive, condition-based)
- the students know different models of failure and wear behavior, and can apply them
- students know the concepts of reliability theory
- the students are familiar with the method of risk-based maintenance, and can apply this method for maintenance management

### Contents of module with emphasis on teaching content

- basic concepts
  - introduction into the infrastructure networks of electricity, water, road, and rail
  - concepts of cost and benefit assessment
  - standards for life cycle management
- infrastructure costs
  - life cycle costing
  - maintenance and replacement strategies for cost minimization
- assessment methods
  - cost-benefit analyses
  - monetary models of benefit and their limits
  - utility analysis
- Basic concepts of maintenance
  - Reliability and availability
  - failure and degradation behavior of systems and components, and modeling
  - Basic maintenance strategies and associated processes
- Maintenance management
  - decision making in maintenance
  - condition based maintenance
  - Reliability Centered Maintenance (RCM)
  - Risk based maintenance
  - Maintenance management in large asset portfolios

### Teaching and learning methods

Lecture: Introduction in the relevant concepts with examples

Exercises: applications and use cases

### Literature

Supplementary publications.

Note: Since part of the module content is based on Swiss standards, some literature is provided in German/French only.

## Assessment

### Certification requirements

Module does not use certification requirements

### Basic principle for exams

**As a rule, all the standard final exams for modules and also all resit exams are to be in written form**

### Standard final exam for a module and written resit exam

Kind of exam

written

**Duration of exam**

120 minutes

**Permissible aids**

*Aids permitted as specified below:*

**Permissible electronic aids**

calculator (not programmable)

**Other permissible aids**

summary of content (max 20 pages)

**Special case: Resit exam as oral exam**

**Kind of exam**

oral

**Duration of exam**

30 minutes

**Permissible aids**

No aids permitted