MMI Guideline 2.0

MMI = Model Maturity Index

IMPORTANT NOTE

This English translation has not been reviewed or approved by the editorial group responsible for the original Norwegian guideline. It is provided for information purposes only.

Before applying the principles of this guideline in a project, readers should consult someone with practical experience in their implementation.

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1. Model Maturity Index (MMI)

1.1. Introduction

This document is produced in collaboration between Norwegian Contractors Association (EBA), Consulting Engineers' Association (RIF), Norwegian Machine Contractors Association (MEF), Norwegian Architects Association (AiN), Norwegian government's property manager and developer (Statsbygg) and Norwegian Railway Authority (Bane NOR)

1.2. About the revision

This version replaces earlier guidelines. It is a harmonization of use of MMI for the domains Building and Infrastructure (rail and road). The guideline can be applied to other domains. Some of the codes in this version deviate from earlier versions.

IMPORTANT NOTE: This English version refers to the life-cycle stages from ISO 29481-1. The original Norwegian version uses a self-defined stage model.

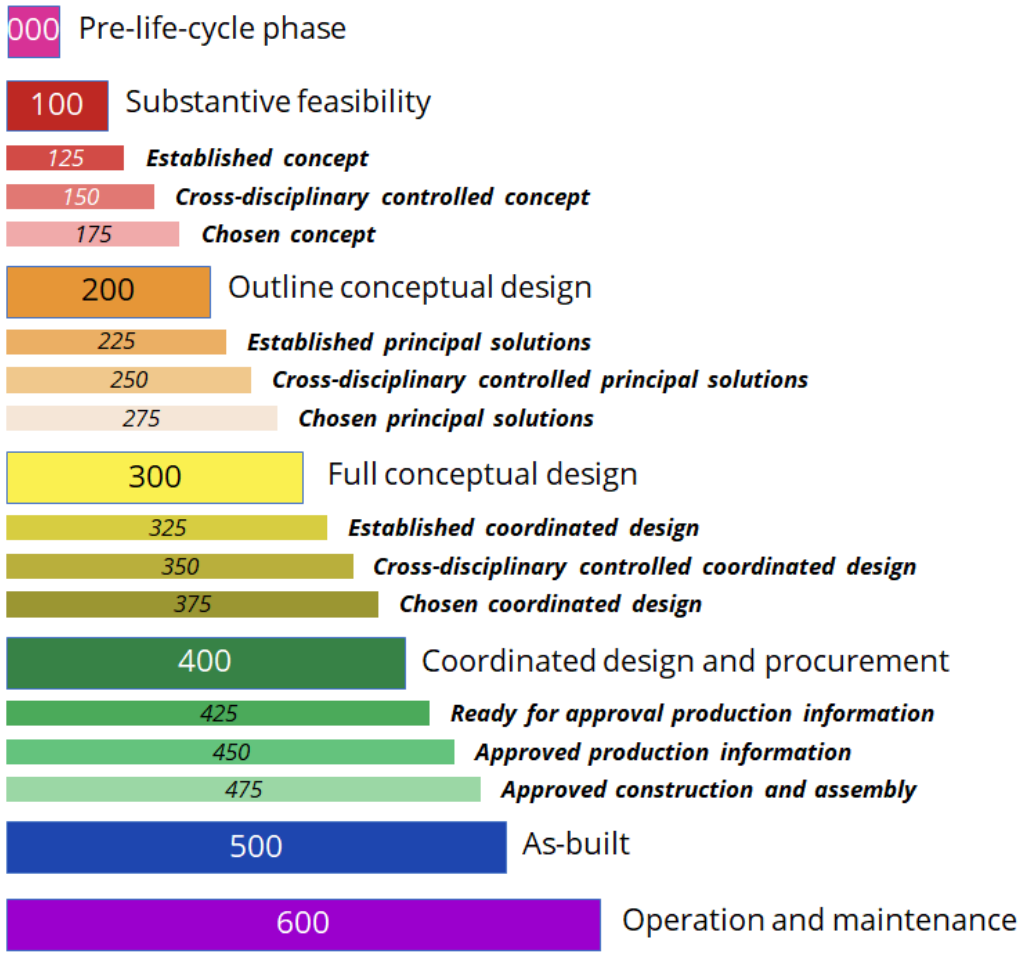


Figure 1 - Illustration of the MMI levels

2. Basic principles

2.1. What is Model Maturity Index (MMI)?

MMI, or Model Maturity Index, describes the maturity level of objects in building models through the use of agreed numerical codes. MMI is primarily a methodology for communication and management processes in the project and operational phases of a building.

Modeled objects do not in themselves communicate how mature they are in relation to the project's quality assurance and decision-making processes. For example, an object in a model may look like it is fully designed and apparently ready for construction, while in reality it has only been added to the model as a conceptual solution. For example, it is also not possible to see whether an object is interdisciplinary coordinated or approved for construction by a contractor. It is therefore necessary that the object's maturity level is communicated unambiguously. MMI values are therefore added or related to the objects to document the degree of maturity in relation to the project development. MMI levels indicate what the objects can be used for.

MMI can be applied to varying extents from smaller work packages to larger geographical areas, in groups or down to individual object instances. By planning when all or parts of a building will have a given MMI level, one will be able to control the design process according to the project's needs and resource use.

2.2. Relationship between MMI levels and information requirements

The MMI guide distinguishes between requirements for information and geometric level of detail on objects, and requirements for process. Requirements for information on objects are specified in individual projects based on their needs for properties and geometric information. The requirements can come from different actors, for example the project owner's requirements for information related to milestones, the design profession's need for information in the design, the execution profession's need for information in the execution of the work, etc. Requirements for information and geometric level of detail are not covered by this guide.

Process requirements are covered by the MMI guide. Other requirements must be linked to different MMI levels to define the need for information in project development. In this way, the MMI levels describe maturity development in relation to the satisfaction of information requirements.

Figure 1 illustrates a collection of all the requirements for a milestone deliverable in a project in the gray box, where the project specifies when the various requirements must be satisfied. These are set so that an appropriate development of information content or geometric detailing is achieved in relation to the project development.

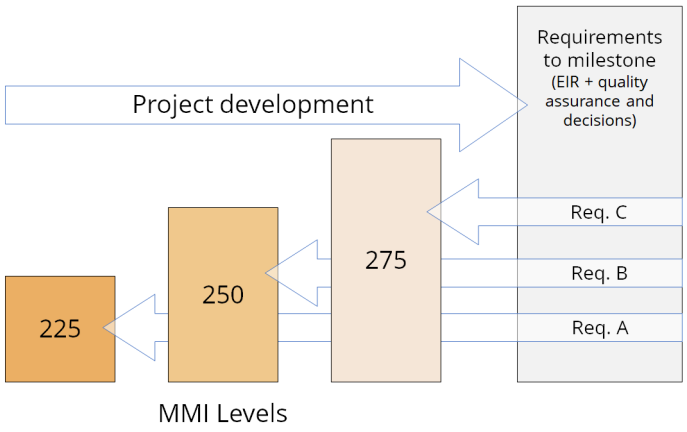


Figure 1- Conceptual illustration of the relationship between MMI levels and requirements for delivery of information and geometric level of detail on objects.

2.3. Approach to using MMI levels

The goal should be to plan for the most linear progression of model information development possible. Linear development implies that MMI levels are applied in ascending order as the project advances. However, there is no strict correlation between project steps or phases and MMI levels; these must be tailored to the specific project and its development strategy.

While MMI levels are intended to reflect project progress, this progression is often not linear due to changes in implementation, the discovery of errors, or deviations. In such cases, it may be necessary to reset MMI codes to a lower level for certain objects or groups of objects. Clear rules and routines for applying MMI levels should be established and communicated within the project.

When MMI codes are updated, it is crucial to communicate these changes clearly to all stakeholders, especially when there is a high risk of consequences from missing or incorrect codes. For instance, if an MMI code is downgraded but not properly communicated, it can lead to misalignment between designers and contractors.

Figure 2 illustrates an example: objects initially assigned an MMI level of 275 (chosen principal solutions) may become uncoordinated as new objects are added later in the design process. In such cases, the MMI code for affected objects must be downgraded, and the coordination process repeated. Importantly, this adjustment does not change the information requirements for MMI levels, but all new objects must still be validated against these requirements.

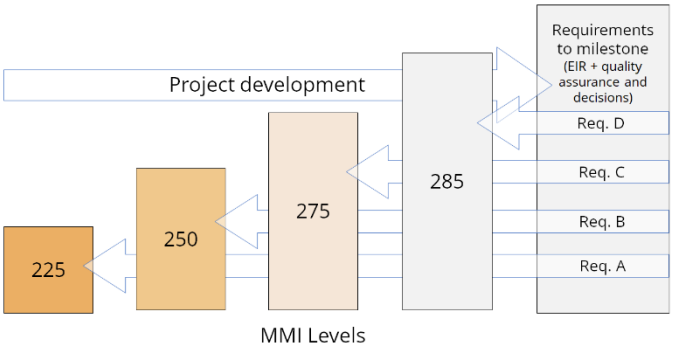


Figure 2- Conceptual illustration of how MMI levels can be downgraded.

2.4. Use and expansion of MMI levels

The use of this guide assumes that the MMI levels described here are fixed. Changes to the numerical codes, names, descriptions, or color codes for the defined levels in Table 1 are not permitted. However, due to varying project requirements, not all MMI levels may be relevant for every project.

Projects have the flexibility to determine which levels to apply and may also introduce additional levels outside the scope of this guide if needed. It is essential that the use of MMI levels is clearly agreed upon, thoroughly documented, and effectively communicated to all stakeholders involved in each project.

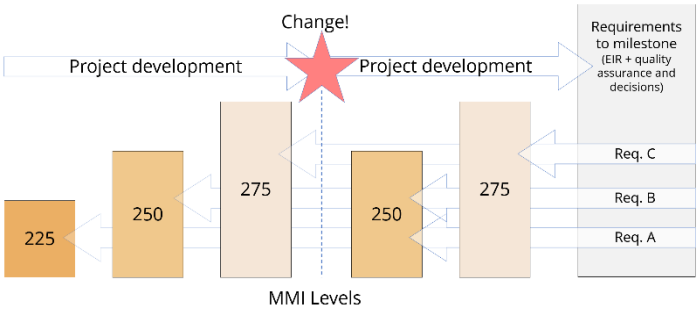


Figure 3- Conceptual illustration of how you can add your own MMI levels according to your own needs, and link these to requirements for the objects.

3. Basic MMI levels

Table 1 – Basic MMI levels

Code	Name Translated to ISO 29481-1	Description	Color code* (RGB) / Hex
000	**Pre-life-cycle phase**	Processes that precede the construction project, for example planning processes, architectural competitions, etc.	(215,50,150) #D73296
025	*Reserved***		
050	*Reserved***		
075	*Reserved***		
100	**Substantive feasibility**	Objects and information established as a basis for development of the project	(190,40,35) #BE2823
125	Established concept	Concepts have been established and form the basis for coordination until interdisciplinary control is carried out.	(210,75,70) #D24B46
150	Cross-disciplinary controlled concept	Cross-disciplinary control has been carried out and any deviations have been corrected to an acceptable level.	(225,120,115) #E17873
175	Chosen concept	Conceptual solutions selected and ready for decision on further development	(240,170,170) #F0AAAA
200	**Outline conceptual design**	Conceptual solutions have been decided, prepared for the development of principled solutions	(230,150,55) #E69637
225	Established principled solutions	Fundamental solutions have been established and form the basis for further coordination until cross-disciplinary control is carried out.	(235,175,100) #EBAF64
250	Cross-disciplinary controlled principled solutions	Cross-disciplinary control has been carried out and any deviations have been corrected to an acceptable level.	(240,200,140) #F0C88C
275	Chosen principled solutions	Principled solutions selected and prepared for decision on further development	(245,230,215) #F5E6D7
300	**Full conceptual design**	Principled solutions have been developed and decided upon, prepared as a basis for further detailing.	(250,240,80) #FAF050
325	Established coordinated design	Buildable solutions have been established and form the basis for further coordination until interdisciplinary control is carried out.	(215,205,65) #D7CD41
350	Cross-disciplinary controlled coordinated design	Cross-disciplinary control has been carried out and any deviations have been corrected to an acceptable level.	(185,175,60) #B9AF3C
375	Chosen coordinated design approved for procurement***	Approved basis for procurement, prefabrication, design, tender information.	(150,150,50) #9B9632
400	**Coordinated design approved for construction**	Ready for execution on site. The information can also be used for ordering, planning, execution and documentation	(55,130,70) #378246
425	Construction and assembly done	Solutions are implemented on site	(75,170,90) #4BAA5A
450	Construction and assembly according to production information	Execution is checked against the designed solution, and any changes to the actual execution are incorporated into the model.	(100,195,125) #64C37D
475	Approved construction and assembly	Actual execution has been approved and all information has been delivered in accordance with requirements, e.g. according to systematic completion.	(155,215,165) #9BD7A5
500	**As-built**	Delivery according to order transferred from appointed parties to appointing party.	(30,70,175) #1E46AF
525	*Reserved***		
550	*Reserved***		
575	*Reserved***		
600	**Operation and maintenance**	Prepared operational documentation transferred from client to operating organization	(175,50,205) #9B00CD
625	*Reserved***		
650	*Reserved***		
675	*Reserved***		
700	*Reserved***		
800	*Reserved***		
900	*Reserved***		

* Color codes apply for display in model software and model viewer to specify color based on MMI code/level
** Reserved for future versions of MMI guide, e.g. codes for rehabilitation and disposal.
*** In some cases, lower MMI level data will be used in tendering and bidding processes. In such cases, this must be defined/clarified and communicated clearly to all stakeholders in the individual project.

3.1. Color codes

The color codes for MMI levels in Table 1 should not be changed. Projects are free to choose color codes for additional user-defined levels. It is recommended that you try to choose colors aligned with the spectrum of established colors in Table 1.

3.2. Responsibility for approving of MMI levels

Responsibilities for specifying MMI levels in the model for levels 0-500 normally follows responsibility as regulated by the building authorities. However, other responsibilities can be agreed. Responsibilities is usually split between the party responsible for approving the use of a code and the party responsible for changing the code in the model.

Example: MMI levels in the construction phase is specified by the responsible contractor, while the responsibility for adding the codes to objects in the model is assigned to the responsible designer.

Responsibilities should be agreed in the individual projects, to exclude any doubt about responsibilities.

It is important to emphasize that primary MMI levels cannot be assigned in the model without the underlying basis being in accordance with the client's process for approval of the provided documentation. For example, level 300 (detailed design basis) cannot be assigned without the client's acceptance of the chosen principled solutions. Similarly, level 400 (work basis) cannot be issued to the construction site without the contractor's approval, and level 500 (as-built) cannot be assigned without the client's approval of the delivery.

Table 2 – Responsibility for approving of MMI levels

	Modell (NS-EN ISO 19650)	**Overall life-cycle phases**	**Responsible for approval of MMI levels**	**MMI levels**
CAPEX	Project Information Model (PIM)	Pre-construction phase	Lead Appointed Party Design	**000-400**
		Construction phase	Lead Appointed Party construction and assembly	**401-500**
		Handover	Appointing Party	**501-600**
OPEX	Asset Information Model (AIM	Operation and maintenance	Owner and operator	**601-700**

3.3. Syntax for code in model

A prerequisite for using MMI at the object level in project implementation is that it should be possible to search for and check the status of objects with given values throughout projects or project portfolios. The syntax for the MMI code must therefore be the same across disciplines, phases and projects. In addition, it is important that the code is suitable for use in databases, and therefore does not contain more information in the syntax than the code itself.

The value for the MMI code shall appear as a separate property, and unless otherwise agreed in the project, it shall be named “MMI”. Further localization of the property in the property set shall be agreed upon unambiguously in the individual project, and made applicable to all actors.

Code value must without exception be entered with a three-digit code, without the use of prefixes, suffixes, spaces or other characters, for example "100", "200", "250" etc. For defined codes see Table 1 – Basic codes.

3.4. Principles of MMI levels

A distinction is made between primary and secondary levels. Primary levels describe stepwise and preferably linear project maturation, while secondary levels describe repetitive processes, for example for intermediate coordination and quality assurance.

As stated in section 2.4, changes or merging of numerical codes, names, descriptions or colour codes at defined levels in Table 1 are not permitted. However, different project assumptions may mean that not all levels are relevant in all projects. In such cases, the MMI levels that will apply must be agreed, documented and communicated to all stakeholders at the start.

3.4.1. Primary level

The primary levels describe an increasing maturity in the project's development, linked to major milestones that are considered most important in the project's development. Codes are given with a full 100 value, for example:

- **2**00 – Outline conceptual design
- **3**00 – Full conceptual design
- **4**00 – Coordinated design approved for construction

It is recommended that all projects use the primary levels to ensure that necessary decisions are made at the right time and at the right level, as a basis for further project development, thereby reducing the risk of costly changes late in the project process.

3.4.2. Secondary level

Between each primary level, 3 secondary levels are established. These describe processes between each main milestone (primary level). Secondary levels are indicated by the last two digits of the three-digit level, for example:

- 2**25** – Established principal solutions
- 2**50** – Cross-disciplinary controlled principled solutions
- 2**75** – Chosen principled solutions

It is recommended to use secondary levels in all projects to define requirements for the establishment of solutions, and their quality assurance. It is optional which secondary levels one wishes to use in the individual projects and which of the codes one wishes to add as information on the objects. For defined secondary codes, no other names or descriptions than those stated in Table 1 of this guide should be used.

Secondary levels should not be used without an associated primary level, for example, levels 225 to 275 must always have primary level 200.

Any new levels, beyond those specified and described in this guide, shall not have definitions or descriptions that correspond to the levels specified in the guide, Table 1.

4. Terminology and abbreviations

The following list defines terms used in this guide, along with some other relevant terms and definitions that one will normally encounter in connection with carrying out model-based work.

Table 3 – Terminology and abbreviations

Term / abbreviation	Definition
Control volume	A spatial break of the construction into manageable volumes. The objects are assigned to their respective control volume by a property.
Object / BIM object	Something that can be understood or perceived. The object has its own identification and may have Properties and relationships to other objects. The object may refer to a physical or a non-physical "thing", i.e. something that can exist, exists or has existed.
Model	A digital representation of a building. Also called a BIM model. Often used instead of the more correct ISO 19650 terms PIM and AIM.
BIM	Use of a shared digital representation of a built asset to facilitate design, construction and operation processes to form a reliable basis for decisions
PIM	Project information model. Information model relating to the delivery phase
AIM	Building Information Model (operational model). Information model relating to the operational phase
Construction	Everything that is built or is the result of construction work. Includes both Construction and Civil Engineering (transportation).