

IDM ID: 12. Clash detection

IDM Header: Digital interdisciplinary coordination between consulting parties. The design phase: Preliminary design and Detailed design

**DIKON**

Prepared in accordance with international standard ISO/DIS 29481-1 Information Delivery Manual (IDM)

## **Instruction for building elements coordination**

### **(Clash detection)**

This instruction describes the purpose, procedure and specification of coordinating building elements between two or more disciplinary models. This IDM describes coordination between the consulting parties during the design phase for the level corresponding to conclusion of the preliminary design and detailed design.

The precondition for this IDM is a design process involving coordination between consultants only (architects and engineering disciplines). This IDM may, however, be used with adaptations for turnkey contracts, in which a parallel supplier design (joint design) is prepared. The starting point will then be that the preliminary design/detailed design becomes a coordinated and consistent interdisciplinary design, which can form the basis of further design and construction, and possibly of functional tenders. For functional tenders and other supplier design, clash detection should be effected between all current project models.

To specify the concept of clash detection, this IDM uses the following definition:

Clash detection aims to verify and allocate inappropriate interfaces between two or more building models (disciplinary models). The overall check consists of verifying matters such as accessibility (consistency), and location of geometrical clashes between domains. The check is digital, and may be performed manually, partly automated or fully automated.

### **Purpose**

The purpose of this instruction is to ensure strong interdisciplinary coordination of geometrical location of building elements between the designers contributing to the building design.

This coordination is to ensure the quality of the design and the use of the best possible buildable solutions. This applies both to individual disciplines and to interdisciplinary coherence. Defects in the building as a result of insufficient interdisciplinary coordination may raise the price of the overall project and for each of the parties involved.

It is a prerequisite that clash detection should be agreed between the parties to the project. Clash detection should be based on the project ICT specifications, which should include an agreement on performance of clash detection. This IDM can advantageously be used as an appendix to the project ICT specifications to specify the method of clash detection.

### **Instruction for readers**

This IDM must be used as an example of how clash detection can be effected between consulting parties to a construction project. The manual should mainly be used in preliminary design and detailed design.

The manual must be used as a tool for planning interdisciplinary checking. Note that a specific plan must be prepared for a specific design, and this manual can serve as an inspiration.

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## **Service overview**

The service is delivered by the parties responsible for preparing individual disciplinary models and the project model coordinator, a function under the design management and the ICT manager.

The roles and services covered by this instruction are described in brief below:

### **Roles**

- The client is responsible for any requirement for clash detection being included in the ICT specifications for the building, and for all parties to the project being informed of and accepting the conditions of the agreement.
- The ICT manager is a function under the design management, charged with ensuring digital collaboration between the parties to the project.
- Model coordination is a function under the design management and the ICT manager, covering performance, reporting and interpretation of clash detection. The model coordinator is NOT responsible for the content or lack of coordination in individual disciplinary models, but has the sole function of performing supplementary quality assurance between the project disciplinary models.
- The disciplinary model manager is the person in an individual discipline who is responsible for the disciplinary model and its interdisciplinary coordination.
- The design management is responsible for the design programme and therefore the overall plan for the content/requirements to content of the disciplinary models.

### **Services/ Transactions**

The design management defines the requirements for the disciplinary model content. The requirements are determined in accordance with the design programme, and thus accommodate requirements and prerequisites of the individual disciplines. Based on the design programme and input from each discipline, the design management and the model coordinator must prepare a plan for the model content for each discipline and the level of interdisciplinary clash detection. Table 1 shows an example of such a plan.

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	Architect	Structures	Services	Clash detection
<b>Preliminary design</b>	Building elements are modelled to a general extent, including walls, slabs, columns, roof etc. In addition, conditions for service shafts must be modelled. Any suspended ceilings must be included in the model.  Can be defined as Information level: 2	The main structural principles must be modelled and the main dimensions should be correct. Beams, columns, slabs etc. Elements are not subdivided. Necessary holes must be modelled for penetrations of main cable runs included in the model  Can be defined as Information level: 2	Main service runs for cable trays, pipes and duct systems and shafts must be modelled. Branches can be designed for a single area with the aim of allocating space. Plantrooms will have overall spatial allocations for equipment, shown as volume objects.  Can be defined as Information level: 2	Consistency must exist in location, geometry and number of facades, walls, columns, beams and slabs between architectural and structural models. No clashes may occur between main service runs, other service runs and/or primary structural elements. Services must be designed to suit the space available above suspended ceilings and in service shafts.
<b>Detailed design</b>	Building elements must be modelled to a specific extent, including walls (inner and outer leaf), flooring to slab, columns, roof etc. Necessary content of fixtures can be modelled. Room, windows and door schedules must be incorporated (quantities and surfaces must be defined).  Can be defined as Information level: 4	The primary building parts of the building must be modelled and divided into elements, such as walls and slabs. Holes for doors, windows and service penetrations not made on site must be included in the model.  Can be defined as Information level: 4	The model must contain all kinds of services. Components such as valves, dampers, pumps etc. must be included to their full extent. The model must also contain components such as switchboards, hubs, floor boxes etc. Zoning showing the volumes of the building services must be incorporated.  Can be defined as Information level: 4	Consistency must exist in location, geometry and number of all facades, walls, columns, beams and slabs between architectural and structural designs. Sizes and locations of all windows and doors and other openings must be co-ordinated. No clashes may occur between services and constructions of a size for which holes are not drilled, if this is planned. For service penetrations through structural units, box-outs must be incorporated in the structural model.

*Table 1: Example of "plan for model content and clash detection". The plan can be adapted for individual projects, e.g. to incorporate columns for deadlines, iterations etc. and for several disciplines, including supplier design.*

The disciplinary model must be prepared in accordance with the design programme and "plan for model content and clash detection", based on the given prerequisites. When the disciplinary model reaches the desired level, the model is transmitted for clash detection with the model coordinator nominated for the project. Self-checking and internal clash detection must be completed prior to the transmission.

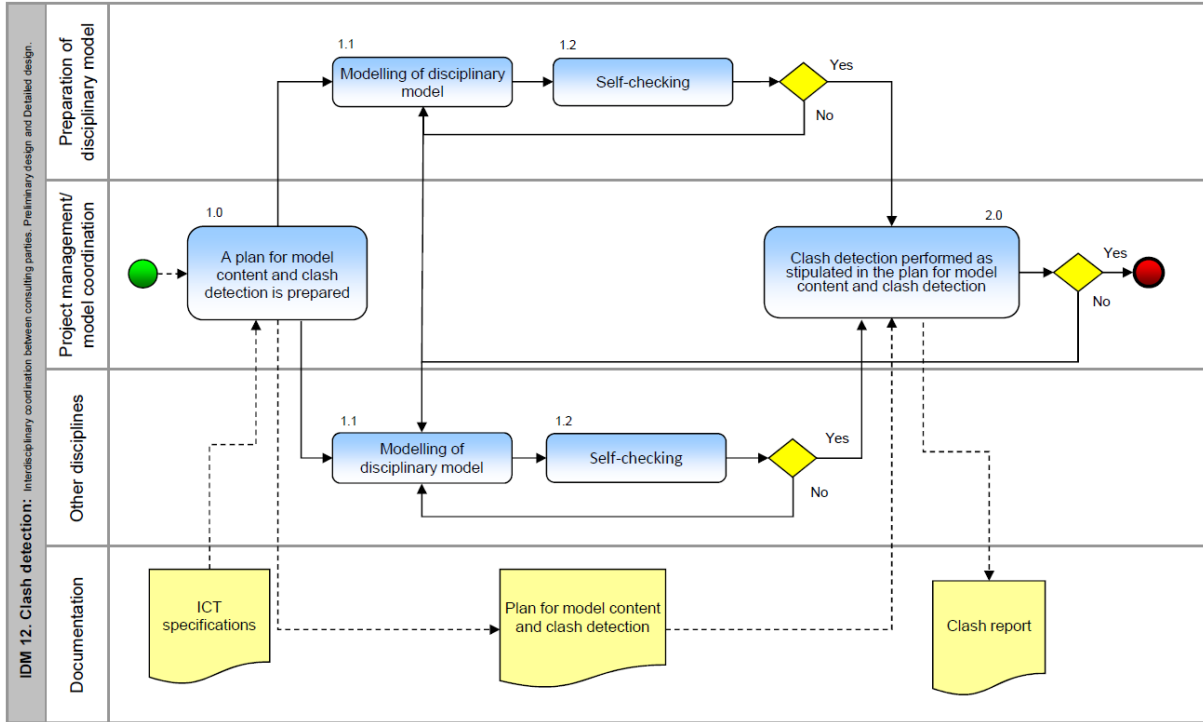
The model coordinator performs the check based on guidelines stated in the design programme, and the plan for model content and clash detection. This ensures that, in addition to being consistent and free from clashes, the disciplinary model also has the correct level of detail and correct model content. The result of the check must be documented in a report and communicated at a coordination meeting or design meeting, where the extent of any necessary follow-up will be agreed.

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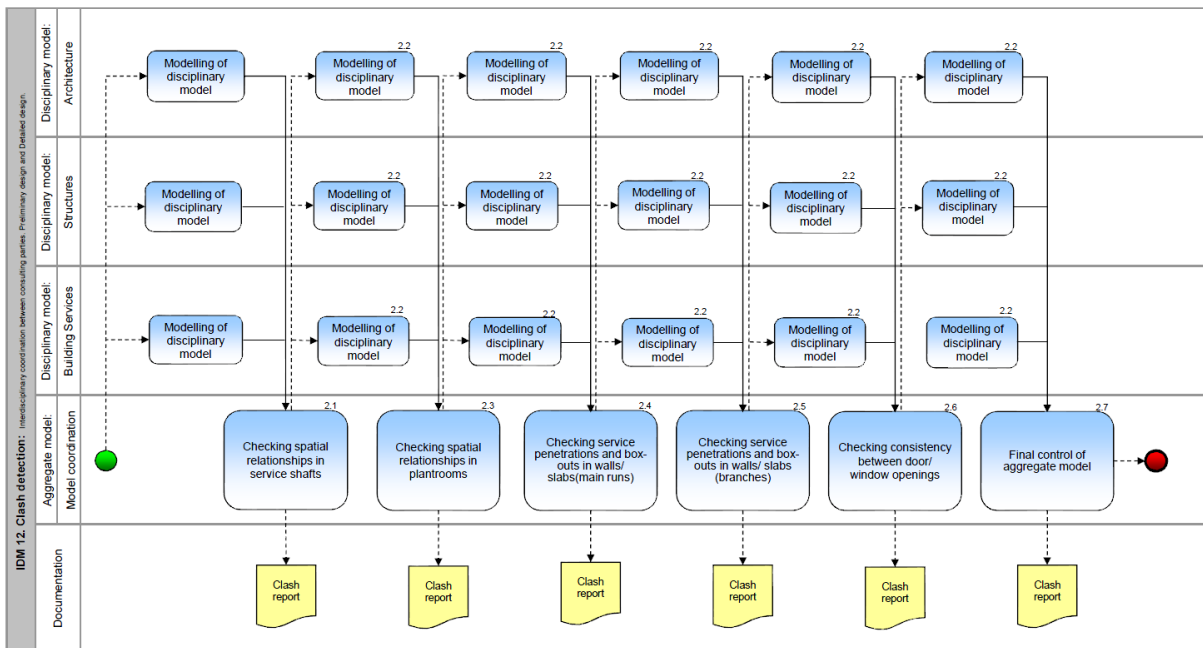
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Process description



Examples of interdisciplinary checking areas are given below.



**Specification of processes**

**Documentation**

[1.0] Prepare plan for model content and clash detection

The design management consisting of the ICT manager and the model coordinator must prepare a plan for the model content, detailing and extent of clash detection based on the ICT specifications and the design programme. The plan functions as the model coordinator's tool and checklist for performing clash detection. Another objective of the plan is to ensure that the disciplinary models are built up correctly as stipulated in the design programme.

[1.1] Model the disciplinary model

Modelling work must be performed for each discipline based on the necessary prerequisites, including the plan for model content and clash detection. The detailing and extent of modelling are defined in accordance with the project. Before the disciplinary model is transmitted, self-checking must be carried out on the model, including interdisciplinary coordination.

[1.2] Self-checking

Self-checking must be made on the disciplinary model to ensure that it meets the requirements of the project, including the plan for model content and clash detection. If the model meets the requirements imposed, it can be transmitted to the aggregate model or another discipline. If the model cannot be approved, it must be returned to the modelling entity for corrections.

[2.0] Clash detection

Disciplinary models for each discipline must be transmitted to the aggregate model for interdisciplinary clash detection. In addition to clash detection, the level of detail in the individual disciplinary models must be assessed in accordance with the agreed stage of the project. Note that clash detection is only a control unit, but the responsibility for the design remains with the people responsible for the disciplinary models. The scope of the check is described in the plan for model content and clash detection.

Example of checking area:

[2.1] Checking of spatial relationships in service shafts

Spatial relationships and construction of service shafts must be checked. The disciplinary models must contain all objects whose spatial needs influence the layout of the shaft. The check must reflect the coordination between architect and structural engineer with respect to the geometrical construction of the shaft.

[2.2] Modelling of discipline model

The result of clash detection must be communicated to the people responsible for the individual disciplinary models to enable them to perform the necessary corrections. The responsibility for incorporation remains with the people responsible for each discipline model/individual discipline.

Example of checking area:

[2.3] Checking of spatial relationships in plant rooms

Spatial relationships and plantroom construction must be checked. The disciplinary models must contain all objects whose spatial needs influence the layout of the plantroom. Service areas etc. may advantageously be incorporated into the disciplinary models so that they are covered by the check. The check must also reflect coordination between the architect and structural engineer with respect to geometrical layout of the plantroom.

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[2.4] Checking of service penetrations and box-outs in walls/ slabs (main runs)	Example of checking area:	Box-outs in walls and slabs must be checked relative to the systems services (pipes, ducts, cable trays, etc).The check must allow for tolerances and insulation around the services. The check must also reflect coordination between the architect and structural engineer.
[2.5] Checking of service penetrations and box-outs in walls/ slabs (branches)	Example of checking area:	Box-outs in walls and slabs must be checked relative to secondary service runs. The check may advantageously be performed in a key area, standard areas or similar as defined in the project. The check must allow for tolerances and insulation around the services and decisions about holes to be formed on site, and need therefore not be included in the check model. The check must also reflect coordination between the architect and structural engineer.
[2.6] Checking consistency between door/ window openings	Example of checking area:	A check must be made between the architect and structural engineer with respect to consistency of openings for doors and windows. The check can be made as an "inverse" clash detection, which locates areas where the models are incongruent, if such procedure is desirable. Alternatively, the check model can focus on structural walls and doors/windows including tolerances from the architect's discipline model.
[2.7] Checks on completion of overall model		A check must be performed on the total combined model. The purpose of the check is to locate areas not found in checks [2.1], [2.3] to [2.6].

**Specification of data objects**

Requirements for objects, Architectural model	Geometrical object	Building elements must be modelled to a specific extent, as specified in the plan for model content and clash detection.
Requirements for objects, Structures	Geometrical object	Building elements must be modelled to a specific extent, as specified in the plan for model content and clash detection.
Requirements for objects, Services	Geometrical object	Building elements must be modelled to a specific extent, as specified in the plan for model content and clash detection.
Requirements for functional tenders, or disciplinary models prepared by the supplier	Geometrical object	If design and detailing are performed by suppliers, e.g. in connection with functional tenders, the contractor and design management should initiate interdisciplinary clash detection between all current project disciplinary models prepared by both consultants and suppliers.
Report on completion of clash detection		A report must be prepared as documentation of the completed clash detection. The report must state the requirements for clashes as the basis of the checks performed. The report must be included in the overall project QA documentation.

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## Specification of coordination points

Common reference point

All disciplinary models must be prepared with common reference points (X,Y,Z). The reference points must, in addition to clash detection, also be used subsequently by contractors and clients. The reference points must be defined in accordance with the ICT CAD specification which forms part of the overall project ICT specifications.

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