FFC Proof of Load Capacity Data Sheet
Supplementary Provisions

References:
DIN EN 12812:2008-12, Falsework - Performance requirements and general design

Evaluation

Generally
The accuracy of FFC analysis allows to apply design class B1 according to DIN EN 12812, chapter 4.3.1.

Design method
Ultimate limit state: $\mathbf{E_d \leq R_d}$ acc. to Din EN 12812, chapter 9.2.2.1
$\mathbf{E_d}$ is the design value of an internal force amount,
$\mathbf{R_d}$ is the corresponding design value of resistance

Software for structural analysis
Structural **an**alysis is done with **STRAN**, a software for handling the mechanics of scaffolding systems most realistically.
Elastic/plastic design method, nonlinear Th.II.O. (*displacements elastically, resistances plastically*).

Modelling the structure
- For two-dimensional design analysis. Along the axis of members of the components
- Clearances at the joints of components are considered acc. to basic data of manufacturers. The members of a calculation group are projected on a plane through the axis of a row of standards.

That is state of the art according to DIN EN 12812 and related comments. All available data concerning resistance as taken from codes, physical testing and governmental permissions are addressed to these conventions.

Internal interactions between components
Modelling the stiffness and the resistance of the joint connections:
- Initially: Hinged
- Deformed structure: Restraint joint connections
  Applying resistances, which were confirmed officially, whether by European codes or governmental permissions for particular scaffolding systems.

External interactions
To supporting ground
- Vertically: Fixed, but settlements are considerable by means of equivalent springs (It is on the engineer in charge to consider it)
- Laterally: Commonly held only by friction

Steel to concrete **min. μ = 0.2** (*in case of it is not sufficient one can provide help with a wooden interlayer*)
Steel to wood **min. μ = 0.5**
Wood to concrete **min. μ = 0.8**

To the formwork build-up
The same as base plates laterally to the supporting ground!
If lateral displacements of the formwork build-up were restraint, e.g. from building structures like walls, columns, pillars and abutments, one may assume a supporting structure as laterally hold on top. Weaknesses of the restraints may be considered with equivalent springs (It is on the engineer in charge to estimate it).

Excentricities of external load attack
According to DIN EN 12812 e = 5 mm for rigid head plates
Imperfections = Regularly applied as deviations from compressed member axis
Sway of standards for freestanding structures: **ϕ0 = = 0.01** (may be varied situationally)
Alternatively bow of standards for laterally hold on top structures :
s = total length of standard components / 350 (suggested, but may be varied situationally)
Article Bow: **s = article length/ 250** (may be varied situationally)

Handling in the structural design process

1. Runs of “FFC Proof of Load Capacity” are concerned with only one particular row of standards = calculation group. The engineer in charge of the structural design decides how many calculation groups he has to investigate. The minimum is one calculation group for each single direction x/y.
2. “FFC Proofs of Load Capacity” have to be treated in the design process like load capacity checks by means of permissible loads as commonly given within graphs and tables. That means: “FFC Proof of Load Capacity Data Sheets” have to be incorporated in a comprehensive structural design document as to be edited by the engineer in charge. That comprises:
   - The load compilation
   - The load transfer to the standards via the formwork build-up

Serviceability

“FFC Proofs of Load Capacity” are done by applying design loads (*characteristic loads multiplied by* $\boldsymbol{\gamma_F}$). They are automatically supplemented by a “FFC Proof of Serviceability Data Sheet”, which files the results of an extra run with characteristic loads (*service loads*) in order to find out considerable displacements.

How to read the data

1. **Layout of calculation group**
   Indicates where in the shoring unit the object of the FFC data sheet is positioned.
2. **Magnitudes and locations of maximal degrees of utilization**
   Indicates the most sensitive components and joints in the structure and the related degrees of utilization of the structural resistance.
3. **Modelled interaction with the formwork build-up**
   Explains, how the interaction with the formwork build-up was modelled.
   - Coupling: Formwork enforces unique displacements of all standards
   - Continuous beam: Bending stiffness of the formwork build-up was activated for redistribution of the loads.
   - Hinged beam: Bending stiffness of the formwork build-up was not activated
4. **Restraints**
   Files which types of restraints were considered on top and at base of the standards:
   For type restraints see Evaluation: “External interactions”!
5. **Applied loads**
   Files the total sum of applied external loads as design loads. For service loads they must be divided by $\boldsymbol{\gamma_F = 1.5}$
6. **Related documents**
   The data sheet for proof of load capacity is only applicable for a particular shoring unit as referred which is represented by its “FFC Assembling Data Sheet”!
7. **Displacements**
   Have to be taken from the added “FFC Proof of Serviceability Data Sheet”!

This paper is automatically generated with each “FFC Proof of Load Capacity Data Sheet”. To edit bring into action it means acceptance of the corresponding supplementary provisions by its editor!

For more studies of background information: **See also FFC Tutorials**