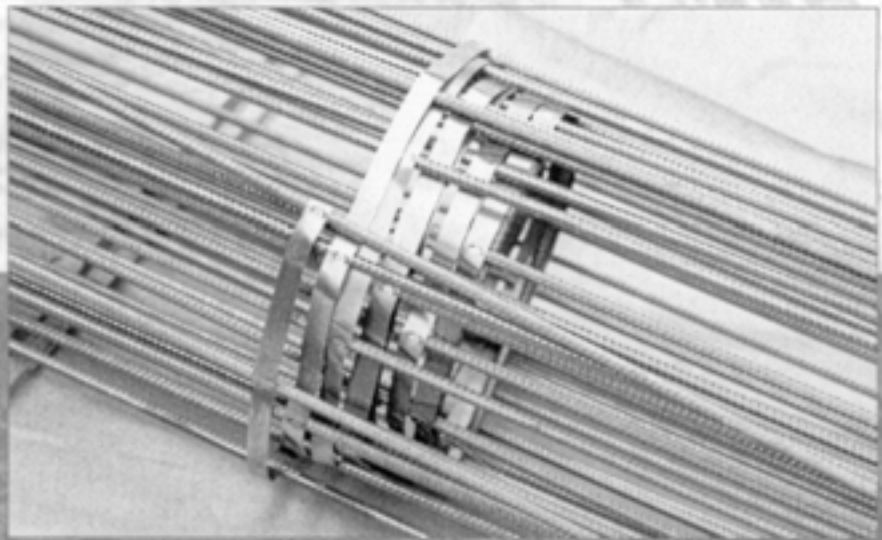




Bamtec®

ENGINEERING



A Reinforcement System for the Future
For Construction Engineers, Construction Companies
and Reinforcement Contractors

Bamtec® – The Revolutionary Reinforcement System on a Roll

Bamtec® is a new and particularly economical method of creating concrete slab reinforcement. Instead of conventional steel mesh or cut and bent bar, Bamtec reinforcement carpets can be used using an automated engineering process and fully automatic production. Bamtec is rolled out on site just like a carpet.

With Bamtec, the reinforcement on a roll, you can automatically reinforce plate structures optimally designed by finite element analysis using the minimum amount of steel.

The round steel bars are used in carpet production with different diameters and lengths, allowing carpets to fit slab layout precisely and cope with varying load requirements.

The new technology optimizes the stages of the normal structural analysis procedure and drawing production by using the latest computer based techniques.

With savings in fixed costs of up to 80 %, materials savings of 20-40% and shorter and more automated design and detailing time, Bamtec reduces the overall construction time leading to true cost savings.

Bamtec was developed by consulting engineers Häußler, Kempten, in conjunction with the Nemetschek AG, Munich and offers many consulting engineers the key to the future.



The Concept of Bamtec



Process Oriented Thinking

Bamtec was developed by structural engineers with a process-oriented approach in mind. Not only was the structural engineers work process considered in developing Bamtec, but the program developers thoroughly investigated the whole working process including the bar bending plant and on site construction. The result was a reinforcement program that provides drawings that serve two purposes simultaneously: as work instructions for the production floor, and as working drawings for onsite preparation work.

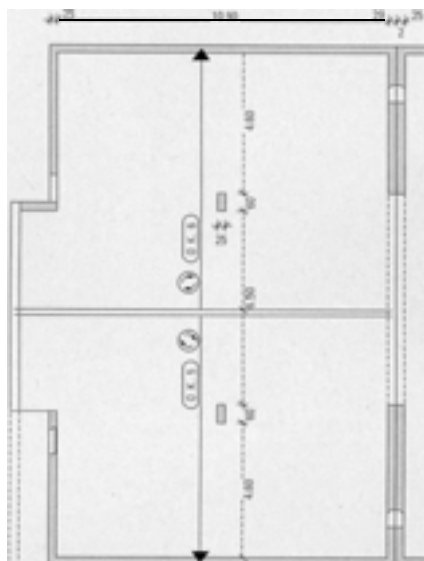
Data Transfer Interfaces

The transfer of data from one system to another can often lead to data loss. Traditionally such data transfers have been the source of many errors, costing all those involved both time and money. With Bamtec, data transfer becomes a process you can depend on. Data is transferred one to one, without loss of information allowing actual manufacturing to be carried out by a robot. The structural engineer plans the onsite work himself. For example, by positioning a carpet, he

chooses the placement sequence. This allows the work program to be optimized for all aspects of reinforcement.

Savings in Materials

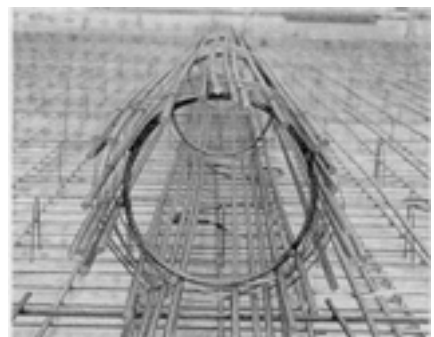
With Finite element analysis software you can design plate structures. Now with Bamtec you can perform the plate calculations and automatically reinforce those plate structures optimally using the minimum amount of steel. The resulting reinforcement analysis is carried out using the same principle as for continuous beams. In turn, production work in the reinforcement bending plant and on site is made much simpler.



Reinforcement for highly reinforced beams is created using tensile force envelopes. The user can oversee the optimization of diameter, bar length, number of marks and manufacture of the reinforcement cage. For reinforced concrete slabs this process must take place simultaneously in two directions. Bamtec provides the solution and the saving in materials of 20-40% compared to conventional reinforcement methods.

The Solution

Bamtec offers separate bar reinforcement optimized for each deck reinforcement direction, the best solution. The Bamtec production process welds bars at the calculated distances apart on to transverse steel strip carriers. This means the reinforcement can be rolled up like a carpet and then unrolled on site.



Bamtec Application

Design

The structural calculations for floors are carried out using a finite element program directly in the CAD system. for example based on the shell plan. This determines the reinforcement required in the x and y directions in both the top and bottom of the section. After dividing up the floor surface into the minimum number of carpets, the Bamtec software automatically determines the make up of the carpets, as well as the position, length and diameter of all the bars in the carpet.

Four carpet positions are required per floor: That is, the top and bottom carpet positions in both x and y directions, not necessarily at right angles to one another.

The exact positions of the individual carpets are shown in the placing plan. In all, three plans are created per carpet: An assembly drawing, a placing drawing and a drawing showing the plan view, the results are a calculated reinforcement position and the FE analysis.

All the data is available at a glance, helping the structural designer and checking engineer, for example, in approving the reinforcement. The automatically created assembly and production drawings are then used in the Bamtec manufacturing process. The placing drawing gives the start point and the direction for rolling each carpet out on site.



Manufacture

A robot welds the bars at the calculated spacings on to the carrier strips to create an accurately dimensioned reinforcement carpet. The robot follows the data provided by the structural engineer without deviation.

The Bamtec welding plant is approx. 16.5 m long, 1.7 m high and 3 m wide. Carpets can have the following dimensions:

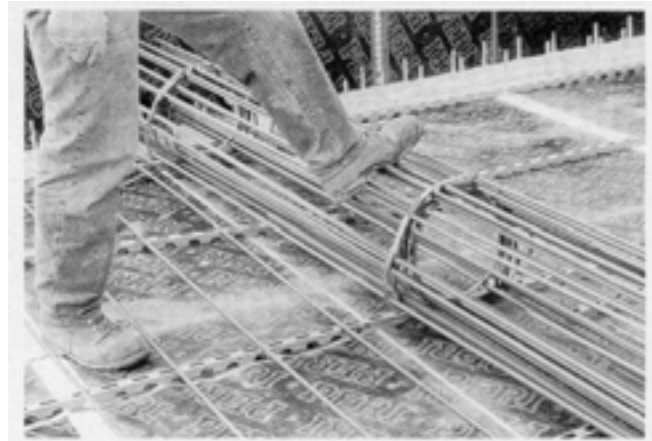
Maximum width = 15.00 m

Minimum width = 1.65 m

Bar diameters = 8 to 28 mm

Assembly

Placing and fixing the carpets could not be simpler. A crane with a spreader beam can be used to deliver the carpet to its starting point. The weight of a carpet depends on the capacity of the crane. As long as the rolls do not weigh more than 1.5 tonnes, they can be placed without much difficulty by two site operators. The time required to fix the reinforcement is minimized. Each carpet position is exactly defined by Bamtec reinforcement technology insuring quality and high accuracy in placing and fixing.



Designing with Bamtec is Simple

For the Structural Engineering office, designing with Bamtec reinforcement carpets means that the structural calculations, drafting and on-site planning procedures are done all at once. The engineer creates the Bamtec files, which are then used for the computer controlled creation of the Bamtec carpets in the Bamtec production plant.

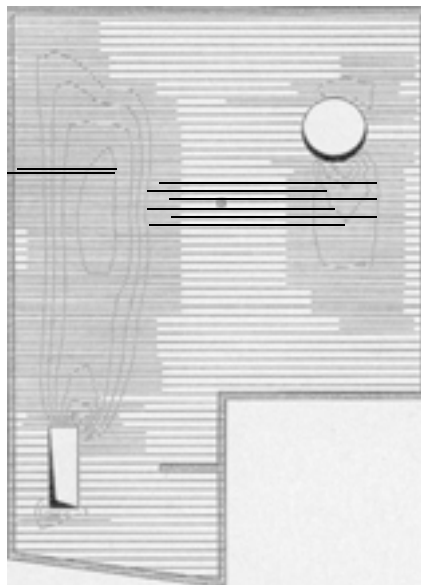
Calculations using the Finite Element Analysis

The finite element analysis allows complex load bearing structures with complicated plan shapes to be quickly and comprehensively analyzed. The input to the reinforcement process is in the form of contours and is provided separately in the x and y directions for top and bottom reinforcement positions. The Finite Element program carries out these calculations.

Creating the Bamtec files

After dividing into different Bamtec carpets, the software automatically determines the make-up of the individual carpets, as well as the position, length and diameter of all the bars in the carpet. The engineer can select the parameters himself; for example, the bar diameter and spacing of the main reinforcement can be individually set. The system then calculates the additional reinforcement for the applied internal forces. The Bamtec CAD module is used to divide up and prepare the carpets. The result of this operation is the Bamtec assembly drawing, which is also used as the production drawing for the carpet manufacture.

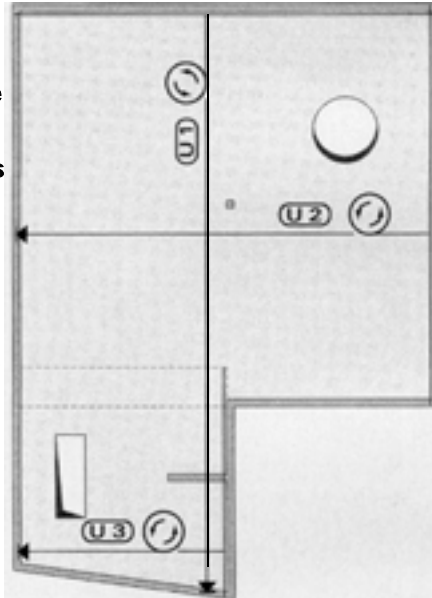
The engineer can also intervene in the automatic process, for example, and directly introduce extra bars required for a particular design into the carpet.



Division of Bamtec Carpets

In order to be able to place the carpet in an efficient manner, the floor surface is divided into the smallest number of Bamtec carpets. This operation takes into account the plan shape and dimensions of the floor. The system is able to deal with non-rectangular or curved plate edges as well as recesses. The division process takes into account the maximum carpet width of 15.0 meters and the recommended carpet weight of approx. 1,500 kg.

Four carpet positions are required for each floor section: Top and bottom positions in the x and y directions. The result of this stage of the process is the Bamtec placing drawing, which shows the exact position and the unrolling direction for each carpet



Benefits for the Construction Engineer:

In preparing the reinforcement drawings with the Bamtec module, the construction engineer is able to provide economically designed concrete plates and a reduced construction period. The seamless flow of CAD data from the architects, through FE analysis and the Bamtec design program into the Bamtec production process form the basis for an economical, quick and error-free reinforcement.

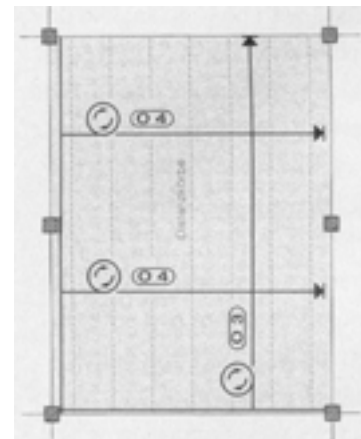
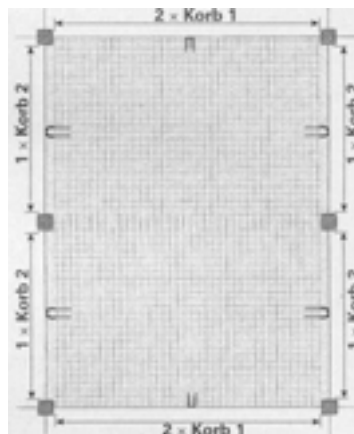
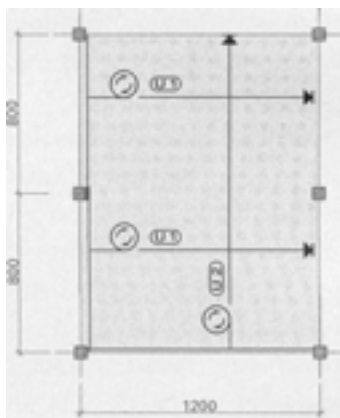
Building with Bamtec

Example 1

In a Swiss project:

There were 6,000m² of floating floors between the supporting structural frame for an SFS press plant. The in-

dividual floors were poured in sizes up to 200 m² in about 30 floor slabs arranged in a checker board pattern.



Phase 1

The first phase consisted of the spacers placed on the blinding concrete. Carpets in position No. U 1 were then rolled out. The second layer, consisting of position No. U 2, is rolled out over the first placement.

Phase 2

The individual floor slabs are connected to one another with dowels. The plate edges are reinforced as normal with U shaped reinforcement cages. The floor plate edges are easily reinforced with Bamtec using these 8 cages.

Phase 3

The top reinforcement is rolled out over the spacers. Carpets in position No. 3 are placed over the spacers. The fourth placement consists of the two carpets in position No. 4.

Materials per floor slab

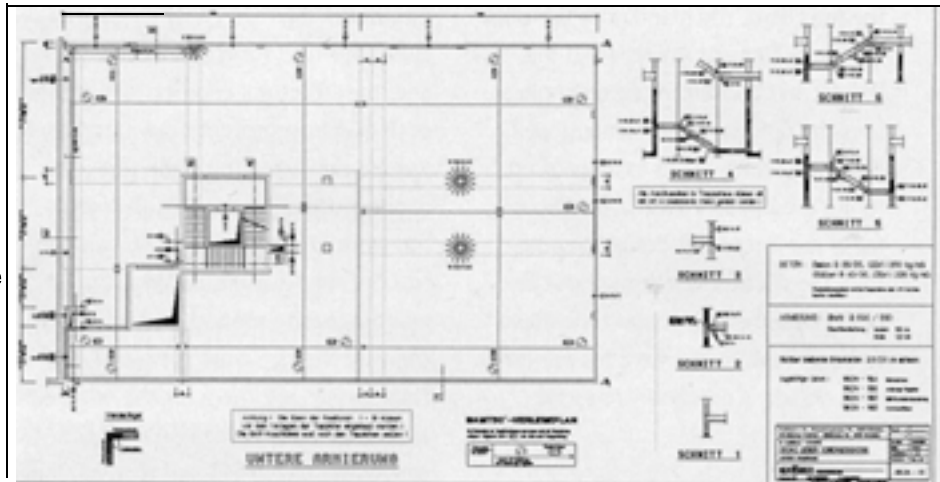
Pos.	Quantity	Weight	Reinforcement	Length
U 1	2 No.	2 x 385 kg	77 Ø 10 mm	l = 8.10 m
U 2	1 No.	1 x 743 kg	107 Ø 10 mm	l = 11.25 m
O 3	1 No.	1 x 743 kg	107 Ø 10 mm	l = 11.25 m
O 4	2 No.	2 x 385 kg	77 Ø 10 mm	l = 8.10 m
Cage 1	4 No.	4 x 202 kg	6 Ø 12 mm und 46 Ø 10 mm	l = 6.00 m/2.20 m
Cage 2	4 No.	4 x 131 kg	6 Ø 10 mm und 35 Ø 8 mm	l = 7.50 m/0.80 m
Total	14 No.	4'358 kg	894 pieces or bars	

■ The example clearly shows the enormous reduction in handling and the consequential shortening of the construction time. Instead of 894 bars, only 14 Bamtec carpets were used.

Example 2

The design of an extension of a workshop for the company Kaufmann involving a floor system.

In order to compare conventional reinforcement drawings and Bamtec, the reinforcement drawings were done twice. Both cases used the Finite Element calculations as the basis for the reinforcement design. So as to minimize the amount of steel required, the conventional method used exclusively bar reinforcement. A conventional mesh reinforcement design would not have been economic.



The comparison of the two reinforcement designs gave the following results:

	Optimized bar	Bamtec	Result	Saving placement
Steel Required				
Bottom Reinforcement	14,96 to	13,15 to	1,81 t o	approx. 12%
Top Reinforcement	11,69 t o	9,73 to	1,96 t o	approx. 17%
Bar Reinforcement items	3.629	521 (additional)		
Carpets		25		

Even with this simple and conventional floor, the result is a reduction in weight of steel of 3.77 tons. The reduction in the number of items placed is quite clear. The deck reinforcement design selected was, of course, Bamtec.

Bamtec – The Advantages

Advantages for the Client

For the client, the mandatory use of the Finite Element Analysis and the Bamtec bar reinforcement technology uses the optimal reinforcement well designed, which yields savings of up to 40% compared with a traditional mesh reinforcement design. In addition, the client saves throughout the project from construction time down to bank loans as the time for reinforcing on site is drastically reduced.

Advantages for the Structural Engineer

Using this new form of software package, the structural engineer can create perfect reinforcement drawings fully automatically. At the same time, the engineer takes part in the planning of the work on site, because he can control the robots used for the Bamtec manufacturing process and influence the way the site work is carried out. Thus savings are there for the engineer as well as a big increase in quality, which also pays dividends in approving the reinforcement design.

Advantages for the Construction Company

For the Construction Company the advantages are numerous. The Construction time is greatly reduced, due to savings in fixing cost of up to 80% and materials savings of up to 40%. At the same time, the work on the site becomes less weather dependent. There is the opportunity to consider other options and make alternative suggestions. Quality is improved. And Bamtec offers a complete work process to the supplier.

The saving in the cost of placing reinforcement is between 80 and 90 percent. Two men and the crane driver can place a ton of reinforcement in 15 minutes.

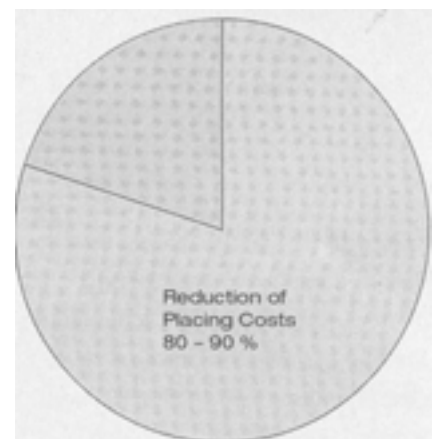
Saving in materials

The saving in materials compared with conventional mesh reinforcement amounts to between 20 to 40 percent overall.



Cost reduction

Practical comparisons show a reduction in placing costs of between 80 and 90 percent.



Bamtec – At a Glance

Bamtec – A leader through Innovation!

The power of Bamtec Reinforcement Technology.

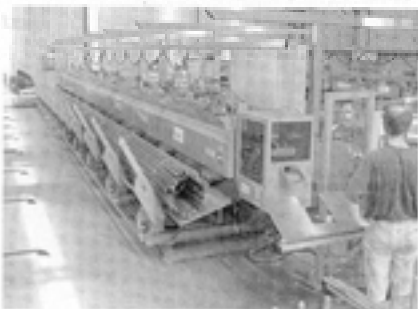
Bamtec Design

- Efficient drawing creation using Bamtec software
- Data transferred to manufacturing robots
- Area reinforcement for x and y axes
- Result for the design office:
Enormous reductions in time and steel used
- Simplified approval and supervision of reinforcement



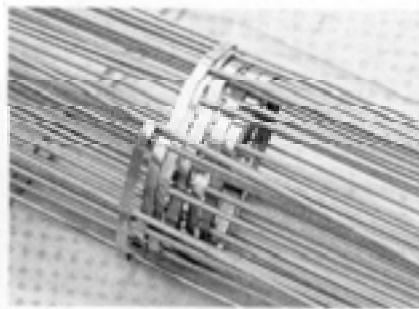
Bamtec-Manufacturing

- Fewer mistakes through on-line production
- Faster production due to higher productivity



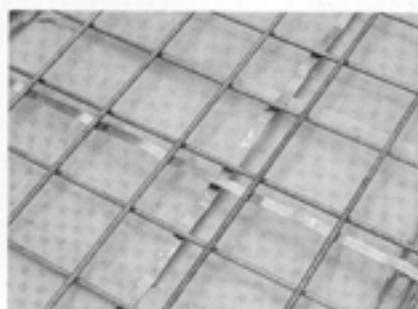
Bamtec – The Unbeatable System!

- Reduced reinforcement placing costs
- High quality with fewer mistakes in reinforcement placing
- Shorter construction times
- Flexible for use with large and small reinforced concrete slabs



Bamtec Benefits

- Enormous increase in quality through automatic drawing creation and production
- Material savings from 20 to 40% compared with conventional mesh reinforcement
- Savings in placing costs of 80 to 90%
- Reduced design and construction times



Make the Intelligent Choice

The Nemetschek Allplan/Allplot family provides the foundation for a series of architectural, civil and structural engineering applications which expand Allplot to include: Structural Engineering, Reinforcement, Position Drawings, Preliminary Work/Formwork, Digital Terrain Modeling, Site Plans, 3D for Civil Engineers and Plates & Slabs for Finite Element Analysis. Whether a multi-million dollar project, residential building, commercial office building or remodeling projects, our products adapt to your changing needs and those of your clients.

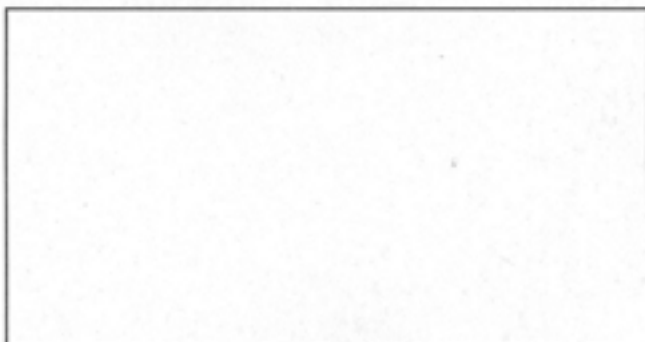
Nemetschek

A World Leader in AEC Software

Headquartered in Munich, Germany, The Nemetschek Group is a premier provider of solutions for building design and construction and facility/real-estate management. Founded in 1963 as an engineering consultancy, Nemetschek AG is today one of the largest AEC software vendors in the world, with annual sales in excess of DM 250 million. An industry leader in Europe, Nemetschek specializes in software for architecture, civil engineering, and facility/real-estate management. Architects in more than 80 countries around the world currently use our software solutions.

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