

**WALTER BETON GmbH**

**PRESTRESSED CONCRETE SLEEPER**



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# 1

## 1. THE COMPANY

# 1.1

## 1.1 General Information

## Company Profile 2005

WALTER BETON GmbH was a 100% subsidiary of WALTER BAU-AG vereinigt mit DYWIDAG based in Munich. On August 2005 the company was disaggregated from the Walter Group and moved to Augsburg.

WALTER BETON GmbH is mainly composed of the same staff from the international sleeper business of WALTER BAU-AG.

The company is dedicated to delivery special equipment for production of every kind of precast elements. The core business is the transfer of technology for manufacturing of prestressed concrete sleepers.

WALTER System is market and technological leader in Germany and Europe. The principle of the technology and the product "WALTER Sleeper" is based on a system developed and approved with and by the Deutsche Bundesbahn - German Railways, which has been defined as a standard in many countries by railway operators.

The scope of services provided by the company is mainly subdivided in four items:

- 1 Delivery of know-how, training of the staff and delivery of the production equipment including after sales services, design of buildings, workshops, laboratory and required infrastructure
- 2 Supply and installation of the sleepers factory
- 3 Production and delivery
- 4 Technical assistance during the production

## Company Registration

WALTER BETON GmbH

The company was registered on 14/09/2005 as limited liability company in the Register of Companies at the Amtsgericht (District Court), Augsburg, under the number HRB 21416

## Management

WALTER BETON GmbH

Managing Director  
Manfred Randecker, MBA

Technical Team  
Felix Cramer, mechanical engineer  
Dietmar Stoldt, mechanical engineer  
Roberto de Freitas, civil engineer

Commercial/Logistics Team  
Theodor Maximilian Leythausen, MBA  
Mark Brand

# 2

## 2. EXPERIENCE

# 2.1

## **2.1 History and Technical Description of WB Production Method**

## **HISTORY AND TECHNICAL DESCRIPTION OF THE WALTER PRODUCTION METHOD**

The WALTER SLEEPER method for the production of sleepers reflects the experience gained during the long-term development of pre-stressed concrete monoblock sleepers in Germany.

With the assistance of some of the major German construction companies - among them THOSTI Bauaktiengesellschaft (predecessor of the Walter Bau-AG) - the German Federal Railways started in 1949 a large scale experiment with approximately 3 million concrete sleepers of different types, in order to learn about the stress and strain resulting from the manifold combinations of various influences effecting the service life of concrete sleepers.

The findings of 4 years of research and comparative testing made the German Federal Railways finally decide for the pre-stressed monoblock sleeper to be used in the German track network. Ever since, the fundamental principles and technical conditions for the design, construction and production of sleepers have been improved continuously and have influenced very much the development of the WALTER manufacturing method.

The sleeper type B 58 was used successfully until 1970, when it was supplemented by the technically more advanced sleeper type B 70. This modern type of monoblock sleeper complies with the consultancy rising requirements relating to loads on the track and travelling speeds of the trains as usual today. It's advantages are higher load weight, lower ground pressure and higher load bearing capacity which results in a more stable bedding in the track and consequently in lower maintenance costs.

The WALTER System has continuously been accommodated to the very high international standards. By using the well proved principle of pretensioning this system allows for the provision of larger pre-stressing forces and guarantees much better stress distribution within the given areas of concrete. All sleepers are designed according to the actual statical conditions resulting from the loads to be applied, from the support conditions in the track, and from the quality of material to be used, such as aggregates, cement and steel.

The uniform distribution of stresses along the entire length of the sleeper is obtained by installing 4 pre-stressing elements, each consisting of 2 cold-drawn high tensile patented steel reinforcing wires. The wires are anchored at both ends by means of upset heads and anchor plates and will be fixed to the mould with anchor bolts at one end and tensioning bolts at the other end. The reinforcement wires are then initially tensioned against the moulds. After concreting, there will be an immediate bonding effect between concrete and prestressing wire.

Optimal strength and long service life are obtained by curing of the sleeper in steam chambers under carefully controlled application of temperature. The pre-stressing force is transferred to the sleeper body only after the concrete has hardened sufficiently.

The arrangement of the pre-stressing wires and the bonding action cause a favourable effect, when the sleeper is subjected to heavy blows (e.g. in the event of derailments of train), and even when damages occur to the concrete (cracks), the pre-stressing force will be maintained.

Any large-scale preparation of work and additional operations, as to be applied with the post-tensioning systems, such as installing of matrix before concreting, removing of the same after concreting, inserting of pre-stressing wires into the ducts, grouting of the ducts and closing of the holes are not necessary. Also costly investments for long pre-stressing beds, additional ground area, enlarged hall construction, and foundation structures (abutments of the pre-stressing facilities), as dictated by the long-line process of manufacture, are avoided.



## **WALTER BETON GmbH**

Boeheimstr. 8, 86153 Augsburg, Germany  
Tel +49 821 5582 110 – Fax +49 821 5582 216  
[www.walter-beton.com](http://www.walter-beton.com) – [info@walter-beton.com](mailto:info@walter-beton.com)



On the whole the WALTER System offers an economical production method with a minimum of special equipment and maintenance. It warrants highest protection against production errors and accuracy of dimensions as stripping from the moulds is performed after hardening of concrete.

Failures will already be detected before the sleepers are placed in the track. As production operations are very simple and no sophisticated equipment has to be operated, training of unskilled labour force can be performed within a very short time.

Every WALTER sleeper leaving the factory is proved on transfer of stress and high quality.

As the system is suitable for any kind of rail fastening, it may be applied for tracks anywhere in the world.

## 2.2

## 2.2 General Description of the Production Process

## GENERAL DESCRIPTION OF THE PRODUCTION PROCESS

The form of design chosen for the WALTER pre-stressed concrete sleeper necessitates a manufacturing method with which the sleepers can remain in the moulds until they are in a position to take up the full pre-stressing force. The mould cycle shown in the manufacturing diagram is therefore typical of the production process.

The pre-stressed concrete sleepers are manufactured in steel moulds, three sleepers being combined in each case in one mould. The individual manufacturing stages are as follows:

- Cleaning and oiling the mould
- Assembly of the dowels, inserts
- Assembly of the pre-stressing fittings
- Pre-stressing of the reinforcement
- Concreting and compaction of the sleeper
- Hardening of the concrete (the hardening process is performed either with open steam or a central heating in order to accelerate the circulation of the moulds)
- De-stressing the sleeper and removal of the mould

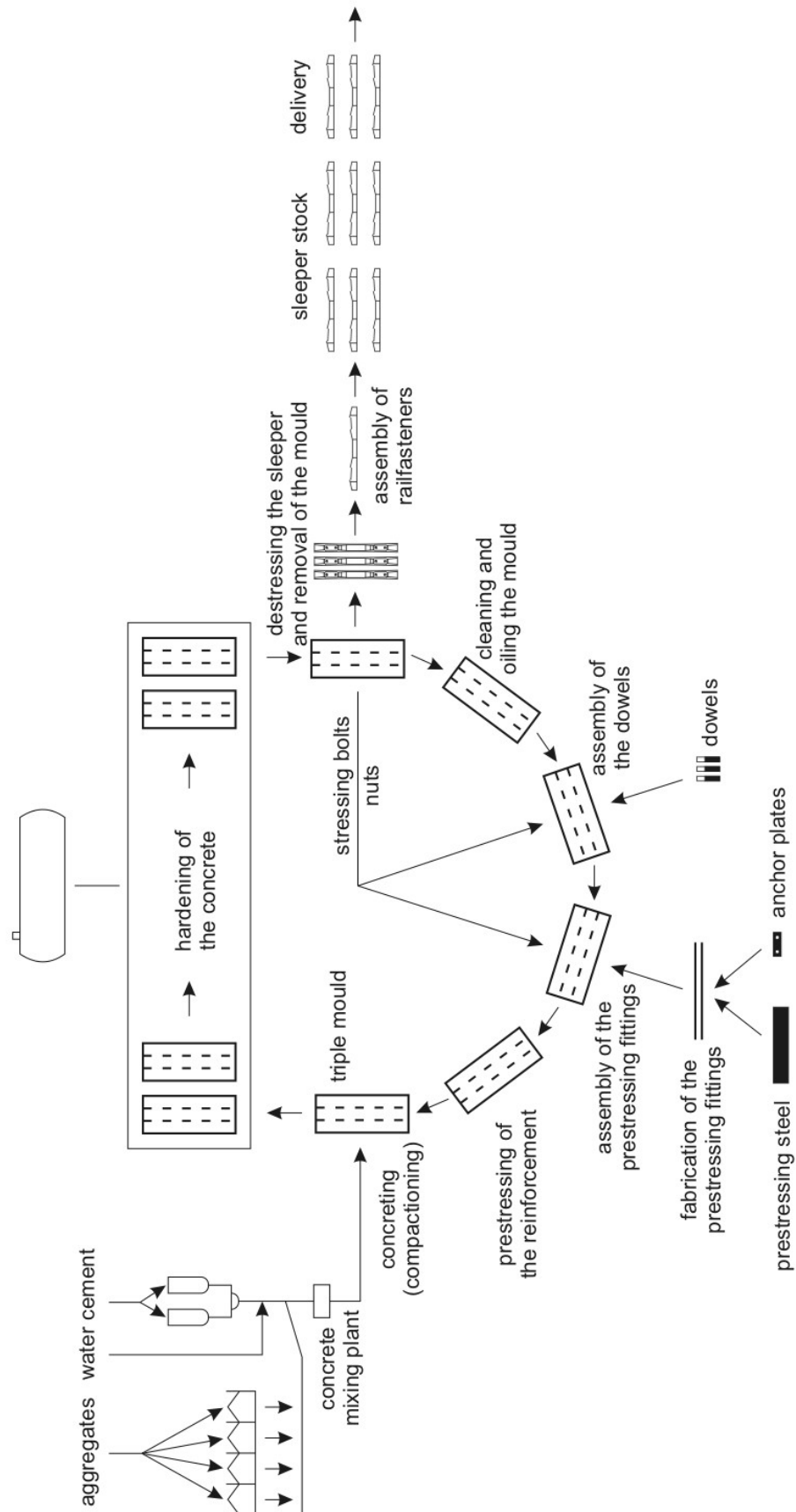
When the steel mould has been removed, it is immediately taken back into the production process again while the rail-mounting attachments are fastened on the sleeper.

Apart from the operating facilities required for these process steps, it is also necessary to have the usual auxiliary plants and facilities of a stationary plant for the manufacture of the WALTER pre-stressed concrete sleeper:

- Concrete-fabrication plant
- Fitter's shop
- Electrician's shop
- Tool shop
- Stock of spare parts
- Internal transport facilities for material, moulds and sleepers
- Store-house for the manufacturing materials
- Recreation rooms

It is necessary to set up a testing department for performing continual tests on concrete and for investigating the mechanical properties of the concrete and the load-bearing capacity of the sleepers. In addition to quality control, the tasks of this department also consist in achieving the specified minimum strengths with a minimum amount of effort and expense by means of constant supervision, the aim thus being economic manufacture.

## MANUFACTURING DIAGRAM



## 2.3

## 2.3 Advantages of WALTER Sleepers

## ADVANTAGES OF WALTER PRE-STRESSED CONCRETE SLEEPERS

1. A positive end anchorage by anchor plates
  - avoids pretension losses due to bad adhesion between reinforcement and concrete
  - offers a very good distribution of tension force and makes available already the full pretension force under the rail seats
  - enables a transmission of the splitting tension forces to the upper passing anchor plate
2. The production of one single sleeper enables the use of a high-strength concrete with large-size aggregates (up to 32 mm) and a low factor of cement. An optimal compaction can be carried out with the aid of particular vibrating tables.

The low cement content in the concrete mixture not only gives the benefit of a good price, but also the benefit of a better quality of the sleepers:

- low shrinking of concrete
  - lower risk for shrinking cracks
  - high modulus of elasticity
  - smaller quantity of total mortar
  - smaller content of hardened cement paste
  - lower hydration heat
3. By using 8 pre-stressed wires an optimal tension force can be distributed to the sleeper cross section, since the tension force is also available in the outer area of the sleeper.
  4. Due to the production system of one single sleeper in tripe or quadruple moulds individual plants for cycle production can be designed for existing buildings or halls. Producing sleepers in cycle production plants does not require an increased demand for areas to erect plants.
  5. Upon request and demand the production plant can be dismantled and erected very quickly so that the location requirements can be met in a flexible manner.

Taking into account all these advantages the manufacture of pre-stressed concrete sleepers according to the WALTER system offers the benefit of an operation-safe and cost-effective production system. This system gives fewer opportunities for the production personnel to make mistakes in the production. The success is high-quality sleepers with a low number of defective sleepers (approx. 0,05 %).

## 2.4

## 2.4 List of References

## WALTER BETON GmbH

Boeheimstr. 8, 86153 Augsburg Germany  
Tel +49 821 5582 110 – Fax +49 821 5582 216  
www.walter-beton.com – info@walter-beton.com



### LIST OF REFERENCES (June 2004)

**WALTER-type Prestressed Concrete Sleepers produced worldwide under licence by partners  
in cooperation with WALTER BETON GmbH**

Country	Name of Supplier	Name of Railway	Gauge	Amount of Sleepers	Start of Production
AUSTRALIA	John Holland Constr. Pty. Ltd.	Australian National Railway	convertible	120,000	1992
	John Holland Constr. Pty. Ltd.	Westrail	1005 mm	85,000	1992
AZERBAIJAN	Joint Venture Walter Bau - Tepe	ADDY - Azerbaijan State Railway	1520 mm	130,000	2002
BRAZIL	Brasicon Ltda., Sao Paulo	Various Railway Companies and Federal Railways, Brazil	1600 mm	340,000	1980
COSTA RICA	Productos de Concreto, San Jose	Inst. Costaricense de Puertos del Pacifico INCOP	1000 mm	215,000	1962-70
GERMANY	WALTER BAU AG (vorm. Thosti) Augsburg	Deutsche Bundesbahn Deutsche Bahn	1435 mm B70 W60/54	7,200,000	1970
	WALTER BAU AG, Gusen	Reichbahn Deutsche Bahn AG	1435 mm B70 W60/54	2,000,000	1991
INDIA	Mysore Structurals Ltd., Bangalore	Indian Railways	1676 mm	1,300,000	1976
INDONESIA	P.T. Bina Sarana Dirgantara, Jakarta	Indonesian Railways	1065 mm	1,000,000	1985
IRAN (3 factories)	Iranian Railways, Teheran	Iran. Islamic Rep. Railways	1435 mm	3,000,000	1980



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Country	Name of Supplier	Name of Railway	Gauge	Amount of Sleepers	Start of Production
ITALY	SCAC Società Cemento Armati	Ferrovia dello Stato Centrifugati, Roma	1435 mm	9,000,000	1964
JORDAN	Jordan Precast Concrete Ind. Amman	Aqaba Railway Corp.	1050 mm	195,000	1986
MALAWI	Malawi Railways, Lilongwe	Malawi Railways	1000 mm	1,700,000	1968
NEW ZEALAND	BBR New Zealand Ltd., Masterton	New Zealand Railways	1000 mm	35,000	1972
PHILIPPINES	John Holland International (Pty) Ltd.	Philippines Nat. Railways	1065 mm	200,000	1992
SAUDI ARABIA	Archirodon R/R, Hofuf	Saudi Government Railroad	1435	770,000	1982
SERBIA AND MONTENEGRO	Joint Venture Walter Bau - ITIMEX	JZTP - Serbian Railways	1435 mm	182,000	2003
SOUTH AFRICA	Grinaker Duraset, Johannesburg	SAR, various private Railways	1065 mm	12,000,000	1964
SRI LANKA	John Holland International (Pty) Ltd.	Sri Lanka Government Railway	1065 mm	500,000	1989
SWITZERLAND	WALTER BAU AG, Augsburg	Schweiz. Bundesbahnen	1435 mm	50,000	1976

## **3. REFERENCES**

# 3.1

## 3.1 Deutsche Bahn AG

DB Verkehrsbau Logistik GmbH • Ruschestr. 104 • 10365 Berlin  
Niederlassung Berlin

WALTER Bau AG  
International Division  
z.Hd. Herrn Schaedle  
Boenheimstr. 8  
86153 Augsburg

Ihr Zeichen/Ihre Nachricht vom

Unser Zeichen/Bearbeitung

Telefon/Fax/E-Mail

Datum

DB VbL - ths  
Thomas Scheibe

(030) 297 - 23 322  
(030) 297 - 23 309  
Thomas.Scheibe@tku.db.de

10.02.2000

## Zertifikat über die Lieferung von Spannbeton-Gleisschwellen

Sehr geehrte Damen und Herren,

seit dem Jahre 1949 beschafft die Deutsche Bahn AG (im Januar 1994 hervorgegangen aus der Deutschen Bundesbahn und der Deutschen Reichsbahn) in großem Umfang Spannbeton-Gleisschwellen.

Seit 1970 wurden Spannbeton-Gleisschwellen der Form **B 70 W - 54** bzw. **B 70 W - 60** mit Winkelführungsplatte und Spannklemme neu in das Sortiment der Oberbauformen aufgenommen. Ab 1974 werden Spannbeton-Gleisschwellen bei der DB AG nur noch mit diesem Schienenbefestigungssystem beschafft. Von diesem Schwellentyp wurden von der **WALTER Bau AG** bis dato ca. 8,5 Mio Stück Spannbeton-Gleisschwellen nach dem **WALTER-Bau-System** gefertigt und geliefert.

Diese Spannbeton-Gleisschwellen sind für eine Spurweite von 1.435 mm konstruiert. Es lassen sich Schienen mit einem Gewicht von 49 kg/m und 54 kg/m (Schienenfußbreite 125 mm) oder 60 kg/m (Schienenfußbreite 150mm) montieren. In der Regel verkehren diesel- oder elektrogetriebene Züge auf Gleisen die mit diesen Spannbeton-Gleisschwellen verlegt sind. Die maximale Achslast beträgt 22,5 t.

Bei der Deutschen Bahn AG werden diese Spannbeton-Gleisschwellen in Strecken eingebaut, deren zugelassene Höchstgeschwindigkeiten bis 250 km/h betragen. Eine derartige Strecke ist zum Beispiel **Hannover - Fulda - Würzburg** (Streckenlänge 327,36 km). Auf anderen Strecken der DB AG auf denen Spannbeton-Gleisschwellen der Form **B 70 W - 54** bzw. **B 70 W - 60** verlegt sind werden mit 160 km/h bis 200 km/h befahren.

Geschäftsführer:  
Dr. Christian Böhning  
Alois Lübbersmeyer (Sprecher)  
Thomas Wiedemann  
Vorsitzende des Aufsichtsrates:  
Birgit Gantz-Rattmann

Registergericht  
Amtsgericht Mainz  
Registernummer: 90 HRB 6974  
Ust-IdNr.: DE 174448230

Bankverbindung:  
Deutsche Verkehrsbank AG  
Frankfurt  
BLZ 501 103 00  
Kto.-Nr.: 26 10 82 46 90

Sitz Mainz  
Rheinstraße 4b  
55116 Mainz  
Telefon (06131) 15-70001  
Telefax (06131) 15-70290

Seit 1949 wurden von der Deutschen Bahn AG bzw. deren Vorgängern Spannbeton-Gleisschwellen, die nach dem Verfahren der Firma WALTER Bau gefertigt und bedingungs- sowie fristgemäß geliefert wurden, eingekauft. Sie wurden unter ständiger Güteprüfung in Gleise der Deutschen Bahn AG eingebaut.

Mit freundlichen Grüßen  
DB Verkehrsbau Logistik GmbH

  
Lübbesmeyer

  
Dr. Pfeiffer

## WALTER BETON GmbH

Boeheimstr. 8, 86153 Augsburg Germany  
Tel +49 821 5582 110 - Fax +49 821 5582 216  
www.walter-beton.com - info@walter-beton.com



### Translation

**DB** Verkehrsbau  
Logistik GmbH  
Deutsche Bahn Gruppe

DB Verkehrsbau Logistik GmbH • Ruschestr 104 • 10365 Berlin  
Niederlassung Berlin

WALTER Bau AG  
International Division  
Attn.: Mr. Schaedle  
Boeheimstr. 8

**86153 Augsburg**

Your reference/Your letter dated	Our reference/POC	Phone/Fax/e-mail	Date:
	DB VbL - ths	(030) 297 - 23 322	10/02/2000
	Thomas Scheibe	(030) 297 - 23 309	
		Thomas.Scheibe@bku.db.de	

### **Certificate of Delivery of Prestressed Concrete Sleepers**

Ladies and Gentlemen,

Since 1949 the German Railways (emerged from the German Federal Railways and the German Reichsbahn in January 1994) have procured prestressed concrete sleepers on a large scale.

Since 1970 the prestressed concrete sleepers of type B 70 W - 54 resp. B 70 W - 60 with angle support plates and tension clamps have been adopted to the wide range of superstructure type products. Since 1974 the German Railways have procured prestressed concrete sleepers only with this kind of rail fastening. **WALTER Bau AG** has manufactured and supplied up to now approx. 8,5 million prestressed concrete sleepers of this kind according to the WALTER-Bau-System.

The prestressed concrete sleepers are manufactured with a gauge of 1.435 mm. Rails with a weight of 49 kg/m and 54 kg/m (rail base width 125 mm) or 60 kg/m (rail base width 150 mm) can be installed. Usually the trains running on the tracks where the prestressed concrete sleepers have been installed have diesel engines or electric engines. The maximum axle load amounts to 22.5t.

The German Railways are installing the prestressed concrete sleepers on lines with an allowable maximum speed of 250 km/h. Such a line for example is the line **Hanover - Fulda - Würzburg** (length 327.36 km). On other German Railways' lines where prestressed concrete sleepers of type B 70 W -54 resp. B 70 W - 60 have been installed the speed ranges from 160 km/h up to 200 km/h.

## **WALTER BETON GmbH**

Boeheimstr. 8, 86153 Augsburg Germany  
Tel +49 821 5582 110 – Fax +49 821 5582 216  
[www.walter-beton.com](http://www.walter-beton.com) – [info@walter-beton.com](mailto:info@walter-beton.com)



Since 1949 the German Railways resp. their predecessor have purchased prestressed concrete sleepers which have been produced according to the WALTER Bau AG's system and delivered according to the specifications as well as in a timely manner. During permanent quality assurance the prestressed concrete sleepers have been installed in tracks of the German Railways.

Regards

DB Verkehrsbau Logistik GmbH

Signatures



DB Verkehrsbau Logistik GmbH • Rheinstraße 4b • 55116 Mainz

WALTER BAU AG  
International Division  
Boenheimstr.8

86153 Augsburg

Ihr Zeichen	Unser Zeichen VbL-Einkauf.Rie	Bearbeiter Gabriele Rietz	Durchwahl 06131/1570011 06131/1570290 Gabriele.Rietz@bku.db.de	Datum 21.01.00
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## Referenzschreiben

Die von der WALTER BAU AG hergestellten Spannbeton - Gleisschwellen der Form B 70 W-54 bzw. B 70 W-60 werden in Gleisen mit endlos verschweißten Schienen eingebaut, d. h. es sind keine Dehnfugen im Gleis vorhanden. Die Strecken sind mit elektrischen Signalschaltkreisen ausgestattet.

Die Spannbeton - Gleisschwellen vom Typ B 70 W-54 und B 70 W-60 werden entsprechend den TECHNISCHEN LIEFERBEDINGUNGEN TL 918143 der DB AG hergestellt. In Abschnitt 3 sind alle erforderlichen Arbeiten und Tests spezifiziert, die zur Qualitätssicherung erforderlich sind. Ebenso gehen aus diesem Abschnitt die Zeiträume und Perioden hervor, in denen diese Tests durchgeführt werden müssen.

Die Lebensdauer der von WALTER BAU AG hergestellten Spannbeton - Gleisschwellen der Formen B 70 W-54 und B 70 W-60 wird, von der Firma mit ca. 50 Jahren angesetzt. Da diese Schwellenformen erst seit dem Jahr 1970 hergestellt werden, ist die Lebensdauer noch nicht bestätigt. Gesichert ist eine Lebensdauer von 30 Jahren. Da an den Schwellen durch in Augenscheinnahme im Gleis und stichprobenartige Tests (Abmessung und Biegeprüfung in Schwellenmitte gem. TL 918143 Abschnitt 3) an ausgebauten Schwellen kein übermäßiger Verschleiß festzustellen ist.

Die von der WALTER BAU AG entworfenen Spannbeton - Gleisschwellen gem. Zeichnung Nr. BS 99-014/022 und BS 99-014/023 entsprechen im wesentlichen Spannbeton - Gleisschwellen B 70 W-60 und B 70 W-54. Geringfügige Abweichungen im Schienenauflegerbereich ergeben sich

- durch die Schienensitzneigung von 1:20 (bei DB 1:40) und
- durch die Schiene UIC 54 mit Schienenfußbreite 140 mm (bei DB Schiene S 49 oder S 54 mit Schienenfußbreite 120 mm).

Die Sickenmaße sind so festgelegt, daß sich eine Normalspur von 1435 mm ergibt.

Mit freundlichen Grüßen

DB Verkehrsbau Logistik GmbH

*Moras*  
Moras

*G. Rietz*  
Rietz

Geschäftsführer:  
Dr. Christian Böhring  
Alois Lübbersmeyer (Sprecher)  
Thomas Wiedemann  
Vorsitzende des Aufsichtsrates  
Rimst Rietz-Rethmann

Registergericht:  
Amtsgericht Mainz  
Registernummer: 90 HRB 6974  
Ust-IdNr.: DE174448230

Bankverbindung:  
Deutsche Verkehrsbank AG  
Frankfurt  
BLZ 501 103 00  
Kto.Nr: 26 10 62 45 90

Rheinstraße 4b  
55116 Mainz  
Telefon (06131) 15-70001  
Telefax (06131) 15-70290



## WALTER BETON GmbH

Boeheimstr. 8, 86153 Augsburg Germany  
Tel +49 821 5582 110 - Fax +49 821 5582 216  
www.walter-beton.com - info@walter-beton.com



### Translation

**DB** Verkehrsbau  
Logistik GmbH  
Deutsche Bahn Gruppe

DB Verkehrsbau Logistik GmbH • Ruschestr 104 • 10365 Berlin  
Niederlassung Berlin

WALTER Bau AG  
International Division  
Boeheimstr. 8

**86153 Augsburg**

Your reference/Your letter dated	Our reference/POC VbL - Einkauf.Rie Gabriele Rietz	Phone/Fax/e-mail 06131 /157001 06131 /1570290 Gabriele.Rietz@bku.db.de	Date: 09/02/2000
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### Reference Letter

The company WALTER BAU-AG is manufacturing prestressed concrete sleepers of type B 70 W-54 resp. B 70 W-60 and has supplied to the German Railways several million of sleepers of this type. These sleepers are installed on tracks with endlessly welded rails, i.e. the track has no expansion joints. The lines are equipped with electrical switching circuits.

As a rule diesel or electrically driven trains run on the tracks, which consist of these prestressed concrete sleepers. The maximum axle load is 22,5 t. The German Railways are installing the prestressed concrete sleepers among other things on lines with an allowable maximum speed of 280 km/h.

The prestressed concrete sleepers of type B 70 W-54 resp. B 70 W-60 are manufactured in accordance with the German Railways' TECHNICAL CONDITIONS OF CONTRACT TL 918143. All required works and tests necessary for quality assurance are specified in Section 3. Furthermore the periods of time and the cycles in which the tests have to be performed are included in this section.

WALTER BAU-AG has stated a life span of approximately 50 years for the prestressed concrete sleepers of type B 70 W-54 resp. B 70 W-60. Since this kind of sleepers is only manufactured since 1970, the life span cannot be confirmed yet. Since no unusual wearing of sleepers inspected on the track and by spot-checking (measurement and bending test of the middle of the sleeper according to TL 918143) of sleepers removed was found, a life span of 30 years can be assured.

The prestressed concrete sleepers according to Drawing No. BS 99-014/022 and BS 99—014/023 designed by WALTER BAU-AG mainly conform with the prestressed

concrete sleepers of type B 70 W-60 resp. B 70 W-54. Minor deviations on the rail supporting area are resulting from

- a) a slope of the rail position of 1:20 (German Railways: 1:40) and
- b) a rail UIC 54 with a rail base width of 140 mm (German Railways' rail S 49 or S 54 with a rail base width of 120 mm)

The beading sizes will be estimated in such a manner that a normal gauge of 1435 mm will be resulting.

Regards,

DB Verkehrsbau Logistik GmbH

Signatures