

BOStrab

German Federal Regulations on the construction and operation of light rail transit systems

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Translation of

**Verordnung über den Bau und Betrieb der Strassenbahnen
(Strassenbahn-Bau- und Betriebsordnung - BOStrab)
vom 11. Dezember 1987**

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TRANSLATOR'S NOTES

The German word "Straßenbahnen" includes, for the purposes of this document LRT as well as Tramways and the regulations also apply to Underground railways (metros), including those which would be thought of in USA as "heavy rail transit", such as the Munich underground system.

Until 1934, Tramways as well as light railways and undergrounds were dealt with under the same regulations as main-line railways, albeit when appropriate, having regard to road traffic laws as well. At that time it was decided to make separate regulations for "Straßenbahnen", then actually mainly street tramways, and extended them to cover all the cases included in the above paragraph.

Similarly the word "Betrieb" has been interpreted throughout this document as either "Operation, Operational or Operating", except where clearly meaning the whole system or undertaking. In fact, although these are the most accurate and appropriate English words to describe the meaning of Betrieb, the latter covers a much wider range of activities than the words, Operations, Operational or Operating convey to an English reader with a railway, background. A good definition of the German meaning intended in this document appears in § 1, Clause (4)

Thus while an English reader distinguishes between a depot or workshop which he regards as an "Engineering" installation, and a station or signal box which he regards as an "Operating" installation, both would be included in German as "Betriebsanlagen", i.e. "Operational installations", or installations belonging to the system.

There is a particular problem in the case of the definition of the "Betriebsleiter". This person may be both the general manager of the "Betrieb", i.e. the Undertaker, and he may also be the Operations Manager. Some of the German LRTs or Metros are small enough, not to differentiate between the two functions, but even where such a division is required, the "Operations" Manager will, although subordinate to the Chairman or Board to whom other "chief officers" also report, still be responsible for the safety of operation of the "Betrieb", i.e. the whole undertaking. This individual requires specific qualifications (including engineering qualifications) and certification, which carry with them certain legal responsibilities, the exact equivalent of which do not necessarily exist in the UK.

Similarly, "Fahrpersonal" has been translated as "Train and Traffic Staff" since staff of both these categories are included in the German term. There is much greater difficulty in defining "Betriebsbedienstete", which has been translated as "Operational Staff". An attempt to define the status of this part of the staff is made at an appropriate point in the text, but the position is not fully resolved even in Germany.

It should also be noted that the term "Signalanlagen" in German includes signs and indicators which would NOT be regarded as Signals in English usage, while on the other hand, "Zugsicherungsanlagen", (i.e. Train safety or protection systems) includes point interlockings for example, which would be included in English as a part of the Signalling system.

The difficulties of reconciling language, semantics and perceived notions, must be borne in mind when reading the English language version of the document. An attempt has been made throughout to interpret the sense rather than literally to translate the actual wording of the original, where the two seem to be in conflict, or a literal translation makes no sense in English.

It should also be noted that where the Regulations refer to the "Unternehmer", this HAS been literally translated as the "Undertaker", although the word undertaker is normally confined, in English usage, to a person who undertakes the disposal of the dead. However, the term IS used when referring to "The Statutory Undertakers", i.e. the gas, electricity and water undertakings that have powers to dig up the public highway, although the word Undertaker without the qualification "Statutory" is seldom used in English except in its other sense. Thus the Regulations always speak of the "Undertaker" being responsible for certain actions, rather than "the board", or the " company" or even "the undertaking". There is a parallel in UK practice where public works contracts frequently refer to "the Engineer", rather than the client undertaking as being responsible for approving certain works.

Further to assist the reader who is used to (British) English forms of expression,

- (1) where it has been felt necessary to insert additional wording not in the original text, in order to make the sense clear, this wording has been inserted within square [] brackets,
- (2) British usage has been employed for all dimensions. That is to say, metres and Km's are generally confined to descriptions of distance and speed, and in building matters. But all vehicle and other fixed dimensions are given in millimetres. This applies principally to vehicle and loading/structure gauge dimensions, platform heights, etc., which thereby become directly comparable with those used in British drawings or in the Department of Transport "Blue Book". Thus a vehicle width of 2.65 m is shown as 2650 mm.
- (3) No attempt has been made in this translation to interpret American usages, many of which differ substantially from British usage's. It was felt that it would be better to have, if required, an American version produced rather than attempt to cover both usages in the one document.

Regulation on the construction and use of light rail transit systems

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FIRST PART

General

§ 1 Area of application and general definitions (of terms)

- (1) These regulations apply to the construction and operation of Light Rail Transit(LRT) undertakings as defined in Chapter 4 of the Passenger Transport Act (PBefG). The construction laws of the individual states (Länder) remain unaffected.
- (2) Light Rail systems are:
 1. Street running systems (Chapter 4 Subsection 1 Passenger Transport Act)
 2. Independent (i.e. non street running systems) (Chapter 4 Subsection 2 Passenger Transport Act)
- (3) Construction means new building or alterations to installations or vehicles.
- (4) "Operation" [Betrieb] means the totality of all the means, including the training of "Operational staff" [Betriebsbedienstete] and the maintenance of the installations and vehicles necessary to effect the transport of passengers.
- (5) "Train Operation" (Fahrbetrieb) includes the setting up and interlocking of routes, "station duties" (for the despatch of trains), train driving and also shunting.
- (6) Operational Staff are those Employees who are competent in (or responsible for):
 1. Train Operation (Train, Station and Signalling staff or "Train and Traffic staff")
 2. The control and supervision of the train service
 3. The maintenance of installations and vehicles
 4. The management or control of those employees included in 1 to 3 above.
- (7) Operational installations are all those which serve operations and in particular:
 1. The civil, mechanical and electrical installations required for train operation, including auxiliary constructions.
 2. The installations required for the reception, accommodation and ticketing of passengers.
 3. Stabling sidings
 4. Rail-connected workshops.
- (8) Vehicles means those which, running on rails, can operate as, or form part of trains. Units consisting of a number of cars/carbodies which cannot be separated in traffic count as a single vehicle.
- (9) Service vehicles are vehicles which are not used in passenger traffic. In particular, they are used for staff training, for maintenance of the installations and for breakdown recovery purposes.

- (10) Trains are units running on the Undertaking's main lines. They can operate as passenger or service (empty stock or works) trains, and may consist of one or more "vehicles" [as defined in (8) above].

§ 2 Ground rules

- (1) Installations and Vehicles must be so built that they meet safety requirements and good order. These requirements are deemed to be met when the construction and the operation of the installations and vehicles conform to these Regulations, to the requirements of the Technical Supervision Authority and the planning/licensing authorities, and to generally recognised best technical practice.
- (2) Variation from the generally recognised best technical practice is permissible, provided that at least the same level of safety can be guaranteed.

§ 3 General requirements for the construction of installations and vehicles

- (1) Operational installations and vehicles must be so constructed that in normal use they can injure nobody, and endanger or hinder nobody more than is unavoidable . They must, in particular, be so built that:
1. They can withstand the maximum mechanical, electrical and thermal stresses to which they are subject in operation without operational danger or damage.
 2. Dangerous parts and apparatus cannot be accidentally touched.
 3. The outbreak and spread of fire is prevented as far as possible by appropriate precautionary measures, and means exist for rescue and fire-fighting.
 4. On dc railways using the running rails for traction current return, the corrosive effects of stray currents are minimised.
 5. Components and apparatus are protected from external influences as far as is operationally required.
 6. The existence of too high contact potentials is being prevented by protecting measures.
 7. Operational safety is not reduced by *[external]* electrical influences.
- (2) Devices in buildings and vehicles destined for the use of, or operation by, passengers, must be easily accessible and recognisable.
- (3) Means must be taken in installations and vehicles to reduce to a minimum unavoidable danger caused by unauthorised operation *[of apparatus or devices]*.
- (4) Failures and non functioning of automatic devices in installations and vehicles must be indicated in staffed locations where operationally necessary.
- (5) The construction requirements include means to assist the disabled, aged, infirm, pregnant women, children and passengers with small children to use the system

without particular difficulty. Special provisions for these purposes must be clearly indicated.

- (6) Rail systems in neighbouring undertakings should consider the possibility of joint operation in regard to technical layouts and designs. *[There is no recognised English term for "Betriebsverbund" such as those which exist in Düsseldorf/Duisburg, Köln/Bonn, Heidelberg/Mannheim/Ludwigshafen etc. "Operating union" is a literal translation. It is assumed that such co-operation will be pursued both where two or more light rail undertakings agree to share common trackage over part of their system or run parallel to one another or have junctions with another, and also in those cases where a light rail vehicle and a main line vehicle such as for example as appears in Karlsruhe, run over the same tracks.]*

§ 4 General operating requirements

- (1) Sufficient operational staff must be employed to ensure safe and reliable operation.
- (2) Operational installations and vehicles must be maintained in good order. If, during operations, deficiencies/defects occur which affect safe working, the vehicle or installation must be partly or completely taken out of service, and secured where necessary.
- (3) Incidents or disturbing conditions, must, insofar as they are not indicated automatically in the appropriate control room/office, be notified to these locations as soon as they come to attention.
- (4) Precautionary measures must be taken to ensure that traffic delays are promptly dealt with and, in the case of accidents and fires, that arrangements for providing immediate help are in force.

§ 5 Technical Supervision

- (1) The Technical Supervisory Authority as defined in Chapter 54, Subsection 1, Statement 3 of the Passenger Transport Act will supervise the observance of these Regulations. To accomplish this task it will conduct the necessary tests, signify agreements, issue certificates and give the necessary instructions.
- (2) The Technical Supervisory Authority may, during the process of carrying out its technical supervision, use other competent persons and organisations. These include the Operations Manager [Betriebsleiter] - see § 8 and the Project Manager - see § 7, clause 6 *[of these Regulations]*.
- (3) Where the proper construction of installations, vehicles or components require in substantial measure the expertise and experience of specially qualified persons or equipment with special features, the Technical Supervisory Authority may require from the Undertaker *[in the person of its manager or chief executive]*, a certificate that it *[he]* or the contractor carrying out the work, has access to the required experts or equipment, and will ensure their use.

- (4) Where any doubt exists as to whether installations, vehicles or operations conform to the requirements of these Regulations, the Technical Supervisory Authority may require from the undertaking the submission of special documentation or consultants' opinion.
- (5) Should the Technical Supervisory Authority declare that the Undertaking is not meeting its duties as laid down in § 7, it will take the necessary steps. In particular, it may:
 - 1. Require the Undertaking to rectify the deficiencies within a fixed time.
 - 2. Where the required level of safety has not been provided, require the interruption or cessation of building works, or limit or prohibit the use of installations or vehicles.

§ 6 Exceptions

The Technical Supervisory Authority may permit variations from these Regulations in defined single cases, or in a general manner for a particular proposal.

SECOND PART

Operating Management

§ 7 Transport Undertakers

- (1) The Undertaker must ensure that the requirements for safe working and orderly operation enumerated in § 2 are met. It [*he*] must in particular make absolutely certain that the installations and vehicles are always in proper condition and that operations are conducted safely.
- (2) The Undertaker is required in the selection, deployment and supervision of operational staff to use the care required to ensure safe and orderly conveyance of passengers.
- (3) The Undertaker, in fulfilment of the obligations laid upon him by these Regulations and without diminishing in any manner his personal responsibility must appoint an Operations Manager [Betriebsleiter]. Where several different forms of operation are carried on, an Operations Manager [Betriebsleiter] may be appointed for each form. Each Operations Manager must have at least one nominated Deputy.
- (4) The appointment of the Operations Manager and his Deputy require the confirmation of the Technical Supervisory Authority.
- (5) The Undertaker must satisfy himself that the Operations Manager is capable of satisfactorily carrying out the obligations laid upon him. Decisions of the Undertaker or the Board which may affect operations must be brought to the attention of the Operations Manager, and especially items concerned with:
 1. Planning and construction of installations.
 2. Design and construction of vehicles.
 3. Determination of the operational staff establishment.
 4. Selection, use and supervision of operational staff.
 5. Enquiries into staff errors and any actions resulting therefrom.
 6. Notice of the transfer of any tasks which may affect the responsibilities of the Operations Manager, to any organisation or persons who do not belong to the Undertaking. [*e.g. contracting out*]
- (6) The Managers [*e.g. a consortium or main contractor*], of a Project who hold a responsibility equal to that of an Undertaker, (as defined in Chapter 3 Subsection 3 of the Passenger Transport Act), do not require to appoint an Operations Manager where the responsibility for design and construction has been conferred on an official of the higher technical management or an employee in the Public Service with equal qualifications and experience. [*This is intended to cover the situation where major projects are no longer managed by transport undertakings themselves but are carried out by consortiums often including both private and public sector organisations*].

- (7) The Undertaker must assist the Technical Supervisory Authority in carrying out its duties and must provide it with all necessary information.
- (8) Where works or other installations which are not constructed and maintained under the requirements of these Regulations are used [or jointly used] by LRT systems, the Undertaker must declare that they are suitable for operation on an LRT system, and that their maintenance can be guaranteed. *[This will apply, for example, to a road bridge with LRT tracks on it].*
- (9) Where there is any danger that actions by third parties may compromise the safety of operations, the Undertaker must ensure that suitable precautions are put in place to obviate any such compromise of safety.

§ 8 Operations Managers [Betriebsleiter]

- (1) The Operations Manager is responsible for the safe and orderly operation of the system as a whole.
- (2) The Operations Manager must produce Instructions *[a Rule book]* for operational staff which will ensure that the requirements of these Regulations are observed, and must ensure that they are worked to.
- (3) The Operations Manager must bring such Instructions *[Rule book]* to the notice of the Technical Supervisory Authority.
- (4) The Operations Manager must notify the Supervisory Authority without delay:
 1. Of any fatal or serious accident to persons, or serious damage to vehicles or installations.
 2. Operational incidents which raise public concern.
- (5) Where joint operation is involved, the duties of clause (4), rest on the Operations Manager responsible for the section of line concerned.
- (6) Deputies may act as Operations Managers, except in emergencies, only after receiving instruction in writing.

§ 9 Confirmation as Operations Managers

- (1) On application by the Undertaker, the Technical Supervisory Authority will confirm the appointment of the Operations Manager for that Undertaking provided that:
 1. He has passed the examination for Operations Manager.
 2. No circumstances exist which would disqualify him from holding an Operations Manager's post.
- (2) As a variation from the provisions of clause (1) No. 1., a person may also be confirmed as an Operations Manager who has passed the Major State Examination for

the higher technical public service in a speciality which covers to a major extent the planning, construction and operation of railways, and has had at least three years experience as an engineer in a department of an LRT undertaking concerned with construction and operations. Experience with a railway during the preparatory phase before sitting the Major State Examination, may also be wholly or partly taken into consideration.

- (3) The application for confirmation as an Operations Manager, must be accompanied by:
 1. A curriculum vitae with photograph.
 2. A certificate of good character.
 3. The Operations Manager's examination certificate, or in cases covered by clause (2), the Major State Examination certificate and evidence of experience in LRT systems.

- (4) for the appointment of the and Deputy of the Operations Manager

THIRD PART

Operating Staff

§ 10 General requirements for Operational Staff

- (1) A person may only be employed as Operational Staff who is:
 1. At least 18 years old
 2. Mentally and physically able. [*e.g. vision and hearing requirements*]
 3. Is not handicapped (disadvantaged) by facts which appear to make him inadmissible as a member of the Operational Staff.
- (2) Physical fitness must be certified by the LRT system's appointed Medical Officer before taking up duty form the first time.
- (3) A person who has reached 40 years of age may only continue to be employed on Operational duties after further certification by the Medical Officer as in clause (2). This must be repeated every 5 years.
- (4) Where any doubt exists as to fitness, particularly following a serious illness, the person concerned may resume duty only after further medical examination as per clause (2).
- (5) For Operational Staff described in § 1 clause (6) No. 1. and 2. notes must be kept in which their fitness, initial education and training, results of examinations, supervision, instruction and subsequent courses attended, are clearly recorded.

§ 11 Special requirements for train and traffic staff

- (1) Train and Traffic staff must be at least 21 years old. This does not apply to Platform Dispatchers, Conductors or staff employed solely in stabling sidings and workshops.
- (2) Train and Traffic staff may only be employed where their fitness has been certified in accordance with the provisions of § 10 clause 2. Re-examination is required every 3 years.
- (3) Train and Traffic staff that are concerned with driving, accompanying or despatching trains must be instructed in the immediate actions to be taken in case of accidents.

§ 12 Training and examination of train and traffic staff

- (1) Train and Traffic staff must be trained for a specified period under the supervision of Instructors.
- (2) During training, the Instructor carries the responsibility for the safe operation of installations and vehicles.

- (3) Following training, the Operations Manager, or a member of the Train and Traffic staff designated by him, not involved himself in the training process, has to examine the trainee for competence. When his competence has been confirmed, the trainee will receive a certificate of competence for the designated duties signed by the Operations Manager.
- (4) Train and Traffic staff must receive regular refresher training.

§ 13 Conduct during duty

- (1) Operational Staff working in or with installations or vehicles must exercise such care as will produce the safe transport of the persons confided to them.
- (2) Operational Staff must behave in a discreet and considerate manner to Passengers.
- (3) Operational Staff are forbidden, while on duty or while ready for duty, to take alcoholic drinks or other substances which may reduce their ability to carry out their tasks, or to start a tour of duty whilst under the influence of such drinks or substances.
- (4) Train and Traffic staff are forbidden, during such duty to use receivers or reproduction apparatus for sound or vision other than for operational purposes.

§ 14 Conduct during sickness

- (1) Operational staff suffering from any illness which may restrict their ability to carry out their duties may not take up duty.
- (2) Train and Traffic staff who drive or accompany or despatch trains, or other operational staff who may have contact with passengers, may not exercise their duties while they or members of their household are suffering from an infectious or contagious disease as defined in Chapter 34, Subsection 3, No. 2, 4, 6, 8, 11 of the Federal Epidemic law version of 20 July 2000 (BGBl. I p. 1045), unless they are able to produce a medical certificate to the effect that no danger of transmission of the disease exists.
- (3) Diseases coming under the provisions of clauses (1) and (2) of this paragraph must be notified to the Undertaker.

FOURTH PART

Operational Installations

§ 15 The Line of Route

- (1) The line of route and the location of stopping places (stations) must be such as best to meet traffic requirements and in particular to facilitate convenient interchange with other means of transport.
- (2) Curve radii and gradients must be dynamically favourable and suited to high speeds *[as far as possible]*. Nevertheless, speeds for each section must meet the current use of the right of way *[including street use where appropriate]* and the urban situation; to that extent curve radii and gradients will vary in accordance with the conditions.
- (3) LRT tracks may not intersect at grade main line railway tracks open for public traffic.
- (4) Where LRT tracks cross main line railway tracks not open for public traffic [e.g. industrial sidings, spurs to depot or stabling sidings etc.], the Technical Supervisory authorities of the two undertakings will decide on the type and scope of the safety measures to be taken.
- (5) The use of single line sections for bi-directional traffic should if possible be avoided. *[Presumably this provision is not retrospective as still some single line sections exist on German tramways, and it should be noted that there is no provision for fully signalled single line working. The text is not clear as to whether "soll nicht" should be taken to mean "may not" or "must not"]*.
- (6) Sections (or lines) should have segregated or particular track formations. *[Again it is not clear whether "should" or "must" is meant. It is also not clear how "particular" the formation is expected to be where street running is concerned]*.

§ 16 Track formations

- (1) Track formations comprise the permanent way itself and the infrastructure supporting it which may consist of earth-, support- or built engineering-works.
- (2) The infrastructure must be stable having regard to the geological and hydrological conditions.
- (3) Satisfactory track drainage must be provided.
- (4) Track formations may be:
 1. "In-street" track formations [embedded in the road surface, roadbound]
 2. "Segregated" track formations (e.g. ballasted tracks between carriageways)
 3. "Independent" track formations

- (5) "In-street" track formations are those embedded in the carriageways or pavements (footways) *[of the public highway]*.
- (6) "Segregated" track formations are those which, while located within the limits of the public highway, but are divided from other traffic by kerb stones, railings, hedges, rows of trees or other fixed barriers. Crossings at grade which count as "level crossings" with regard to § 20 clause 7 are included in the definition of "Particular" formations.
- (7) "Independent" track formations are those which, on account of their location or their form of construction are independent of other traffic. Level crossings as defined in § 20 may also be included in independent formations.
- (8) Where there are public footway crossings of "Segregated" formations, traffic islands (refuges) must be provided between the LRT tracks and the neighbouring carriageways, unless the foot crossing of both street and tracks is controlled by traffic light signals.
- (9) Where Driverless Operation is used, unauthorised entry, passage over and use of the formation must be prevented by enclosure or other means. Where this will assist operational safety, the Technical Supervisory Authority may require such measures where other forms of operation are practised.

§ 17 Permanent Way

- (1) The permanent way must be able to absorb the static and dynamic stresses to which it is subjected at the maximum permitted speed for the section concerned, without permanent deformation.
- (2) Track and vehicle dimensions must be so matched that for the permitted speeds, there is no risk of derailment even when wearing parts are in the fully worn condition, and also so as to achieve the quietest possible running.
- (3) Curve radii on sections with independent tracks should be large enough to obviate any need for reductions in the general line speed limit.
- (4) Curves should be so laid out that at the permitted speed, non-compensated lateral accelerations and their rates of change, are as low as possible, by the use of super elevation, super elevation gradients and transition curves as necessary.
- (5) Gradients and traction/braking performance must be so matched with one another that:
 1. That trains can be brought to a halt under the most unfavourable conditions.
 2. A failed train can be removed by an assisting train.
- (6) Remotely controlled pointwork must be mechanically locked to prevent movement under a train.

- (7) The moving parts of points which may be approached at more than 15 km/h in the facing direction, must be mechanically locked in their final position.
- (8) Where pointworks can be set by means of a device on a vehicle, the setting process must not be dependent on the current being taken by the traction equipment.
- (9) Track end devices [*e.g. buffer stops*], must be indicated and so constructed as to meet operational requirements.

§ 18 Definition of the "Clear Area" (Structure and loading gauges)

- (1) The "clear area" [*a term not used in English but apparently equivalent to "structure gauge"*], is that space round each track which is required to be kept free of fixed and movable objects in order to provide for the safe operation of vehicles. [*It may be reasonably compared to the kinematic loading gauge in British practice*].
- (2) The delineation of the "clear area" [*i.e. the kinematic loading gauge*] must be so coordinated with the parameters of vehicles and track that in no state of permissible operating conditions can dangerous interference between vehicles and other objects or between vehicles on any neighbouring tracks occur.
- (3) The determination of the kinematic loading gauge shall take into account the likelihood of all the factors affecting the maximum deviations in the same direction occurring simultaneously. [*This is what, in English terms, the kinematic as opposed to the static loading gauge is intended to cover*].
- (4) Between the "clear area" and the actual structure gauge, there shall be a safety margin which is fixed by the accuracy with which the structure gauge can be delineated.

[Note: Strictly the "Structure Gauge" in English terms consists of the "Lichtraumbedarf" plus some features of the safety zones described in § 19, but as no English term equivalent to the "Lichten Raum" and "Lichtraumbedarf" exist, the latter term has been translated by the term "Structure gauge".]

§ 19 Safety zones

- (1) To protect persons, there must be at the side of each track, a space outside the structure gauge. It must be accessible from the track and from the (side) doors of the vehicles. Where two tracks are adjacent, only a single safety zone is required between them.
- (2) These safety spaces must be at least 700 mm wide and 2000 mm high and be vertical. Where the tunnel section is not square, the width may be reduced by a small amount at the top and the bottom.
- (3) The continuity of the safety zone may be broken over short distances, by the interposition of objects, particularly posts and signals, provided always that there is a minimum clearance between the object and any vehicle of at least 450 mm. This

clearance need only be on one side in the case of objects in common safety zones as defined in the 3rd sentence of clause (1).

- (4) In the traffic area of a public highway, (other than motorways or expressways), that part of the highway bordering the formation may count as a safety zone.
- (5) At stopping places [*including stations*] the platform surface may be regarded as a safety zone providing the platform level is no more than 500 mm above the walkable level of the formation, [*e.g. above ballast level or cess*]. Where the platform level is higher than this, a safety zone must be provided either on the other side of the track or below the platform.
- (6) Safety zones below platforms must be at least 700 mm wide and 700 mm high. They must be accessible even when the track is occupied. Current rails may not be placed on that side of the track adjacent to the safety zones.
- (7) In the case of raised walkways between sidings, the provisions of clauses (5) and (6) apply.
- (8) In the case of elevated tracks, safety zones may be dispensed with provided that the safety of passengers and staff is assured by other means, especially by emergency rescue measures being in place.

§ 20 Level crossings

- (1) Level Crossings are to be indicated by St Andrew's Cross signs as shown in Appendix 1 figure 1 where roads, ways or places (squares, courtyards) etc. cross LRT tracks at grade on an independent formation.
- (2) At level crossings, LRT traffic has priority over road traffic.
- (3) The St. Andrew's Crosses indicating the priority accorded as in clause (2) are to be placed at the points at which drivers of road vehicles must wait when they may not traverse the level crossing.
- (4) Level crossings must be technically protected, but this provision does not apply to:
 1. Level crossings which are used, on average, by not more than 100 road vehicles per day, and at which safety is provided by a clear sight of the LRT line.
 2. Foot crossings and bicycle crossings which have a clear view of the tracks and may be protected by stiles, turnstiles or similar installations.

[Translator's note - there is no distinction in these regulations between "public" and "occupation" level crossings as in UK].

- (5) The technical safety measures required by clause (4) consist of:
 1. Light units displaying yellow followed by red lights as shown in Appendix 1 figure 2, which may be combined with half-barriers as shown in Appendix 1 figure 3.

2. Signs providing the indications shown in Bü 0 and Bü 1 of Appendix 4 or alternatively the supervision of the indications provided in 1. may be included in, [interlocked with], the signalling (train safety) system.
- (6) Safety by "a clear view of the tracks" may be regarded as provided where a road vehicle driver can see far enough along the tracks and from a sufficient distance away from the crossing, that by taking the care normally required in road traffic, he may safely traverse the crossing or bring his vehicle to a halt before it.
- (7) Places where streets, ways and places (squares, yards) cross LRT tracks installed on "Segregated" formations(see above) are considered as level crossings, provided the measures described in clauses (3) to (6) are in place.

§ 21 Signal installations

[Note: "Signale" in German includes signs and indicators]

- (1) Signal installations must be so constructed that they provide for the purpose intended unambiguously, work appropriately and provide indications as signals *[or signs or indicators - see translators note on pages 1 and 2.]*
- (2) Installations for main (stop) signals and for repeating (distant) signals as shown in Appendix 4 sections 1 and 2, must be bound up with the train safety system described in § 22. *[This does not really make sense in normal English as in English the signalling system IS the "train movement safety system, whether or not any ATP is provided].*
- (3) "Driving on sight" signals as shown in Appendix 4 section 3 must be provided as required by operating needs, and in particular at places at which:-
 1. Drivers require instructions which differ from those given by the road traffic light signals.
 2. A single track is used for bi-directional traffic, in which case the signals must ensure that the section is cleared for traffic in one direction only, and that the direction for which it is cleared cannot be changed unless the section is unoccupied.

[Translator's note: This clause conflicts with § 15 clause 5, which states that single-line sections for bi-directional working are not permitted. Presumably that applies only to future construction and not retrospectively.]

- (4) Where driving on sight signals are incorporated in road traffic light signal installations, as provided for in § 37 of the road traffic regulations, the same safety measures must be applied to all parts of the installation.

§ 22 Train safety installations

[this would normally be called "the Signalling System" in English and includes ATP/ATO apparatus]

- (1) The train safety system [*"the Signalling System"*], consists of installations to control and protect operation. These installations serve to:
 1. Set and secure routes
 2. Transmit movement instructions to trains.
 3. To supervise technically the movement of trains and to control any deviations from the safe state.
- (2) Routes will be regarded as secured, provided:
 1. That there is, and will remain, a minimum of the safe braking distance between a technical safety hindrance (e.g. an electro-magnetic or mechanical train stop or other technical means of applying the brake) and any obstruction.
 2. Any pointwork within this distance is mechanically locked in position.
 3. The permitted speeds for the instruction given are taken into account.
- (3) Train safety system installations must be reliable and, in so far as they are not purely concerned with train control (i.e. exclusively ATO systems), also technically safe in a signalling sense, (e.g. must consist of fail-safe elements)
- (4) Train safety systems must be so constructed that instructions concerning train operation, may only be effective when safe operation has been confirmed. [*Put more simply, "the ATO must be dependent on the signalling/ATP"*].
- (5) Clauses 3 and 4 apply, as appropriate, to those parts of the train safety system which are installed on the vehicles.

§ 23 Communications installations

- (1) Suitable communications installations must be available to enable operational staff to communicate with control centres and signal boxes. Particularly important messages to the Central Control Centre must have priority over other traffic.
- (2) CCTV installations used for operational purposes must have an ample field of vision, and enable the operational procedures to be clearly observed.
- (3) Where Driverless Operation is to be used, communications installations must be available to ensure priority voice communication between passengers and the control centre.
- (4) In tunnels, facilities must be available to enable rapid two-way communication between Police, Fire Service, Rescue Services, their command centres and the (LRT System's own) Central Control Centre.

§ 24 Power supply installations

- (1) Power supply installations are those installations needed to take power (energy) from the public or the LRT system's own network, to convert it, to convey it further, to distribute it and to supply it to operational apparatus on vehicles and in operational installations. Power supply installations include any LRT System-owned generating facilities.
- (2) Power supply installations must be so dimensioned that they are able, throughout the operating load range, to hold the nominal voltage within the tolerances permitted by the apparatus being supplied.
- (3) Protection measures against the persistence of excessive contact voltages, and protection measures for third parties' installations, must not be allowed to become mutually ineffective.

[It is understood that this point is to cover cases such as heavy portable tools, supplied from the public supply and fitted with a protection conductor, (earth wire) coming accidentally into contact with the earth (return) system of the traction supply, for example by the housing of the portable tool being in contact with a rail, having been laid on the ground during a tea break. Such an action will affect neither the traction supply nor be apparent in the functioning of the portable tool, but because part of the traction return current can now flow to earth through the earth (safety) conductor of the public supply, it may well make the safety system of the latter ineffective].

- (4) Traction power supply installations which feed sections of the OHLE [See § 25] or third rail system and which trip out on short term overload, should re-close automatically.
- (5) For supplies to operational apparatus [*i.e. equipment which is required for the continued operation of the railway*], there must be in addition to the normal source of supply:
 1. An auxiliary supply, so far as operational requirements demand.
 2. An emergency supply from an independent source for:
 - a) Emergency Lighting as defined in § 27 clause 4, marker lights for Emergency exits as defined in § 30 clause 6, and so far as operational use demands it, for communication equipment as defined in § 23. The emergency supply must provide power for a sufficient time in case of prolonged outage of the normal main supply.
 - b) Train safety installations as defined in § 22, so far as is operationally required. The emergency supply must be able to cover the run-out of the service during the failure of the main supply. [Presumably where traction supply is maintained, or trains are able to coast to a station].

The emergency supply must be provided with automatic changeover facilities.

- (6) In tunnels and in underground stations, a sufficient supply of socket outlets for the use of portable apparatus must be provided.

§ 25 Traction contact wire installations (OHLE)

- (1) Those parts of the OHLE which are necessarily live, must be at least partially protected against accidental direct contact. This includes the area which can be reached by a pantograph under tension.
- (2) In the traffic area of public highways and level crossings, contact wire installations must provide sufficient clearance for road traffic. This requirement will be deemed to have been met, in the case of ac nominal voltages up to AC 1000 V and DC 1500 V, where the clear height between the roadway surface and any part of the contact wire installation (OHLE) above it is at least 4700 mm. This height may be reduced under built works [*e.g. bridges*] as also in the immediate vicinity before and after them, to 4200 mm.

The section which is at reduced height must be indicated by sign No. 265 with a lightning flash, in accordance with the Road Traffic Regulations and Warning Signs Regulations. The permitted height shown on the sign is to be the actual clear height less a safety margin of 200 mm.

- (3) OHLE must be divided into separate switchable sections.
- (4) OHLE installations must be provided with over-voltage protection where there is any danger of excessive voltages occurring in them.
- (5) Measures must be taken to avoid electrical danger due to breakage of the contact wire, derailment or breakage of the pantograph.
- (6) Portable wires must not be allowed to wear to less than 60 % of the nominal cross-section.
- (7) Contact leads which act as earthing (protection) leads and leads connected to these must be electrically and mechanically reliable and may not be detachable without the aid of tools. [*See also § 39 (2).*]

§ 26 Return current conductors

- (1) Return current conductors must be electrically and mechanically reliable. Connections to return conductors from operational apparatus must be detachable only with the aid of tools.
- (2) Every sub-station must be connected to the running rails with at least two separate return current conductors.
- (3) Measures must be taken to guard against dangerous contact voltages occurring in the running rails.

§ 27 Lighting installations

- (1) Lighting installations must be provided:
 1. In those operational areas designated for passengers' use and for access to and exit from them.
 2. In tunnels, underpasses and subways where they exceed 100 m in length or cannot be seen straight through.

Where appropriate, the requirement under 1. can be met by the general street lighting.

- (2) Lighting installations must, taking into consideration operational needs, be so constructed and arranged that:
 1. Operational premises as defined in clause (1) may be used without danger and in particular platform edges are clearly recognisable.
 2. Signals are not obscured.
 3. The recognition of signals [*and other indicators*] is not impaired.
- (3) There is a requirement for tunnel lighting to be switched on by means of the communication system. This does not apply where the interval between switches is a maximum of 50 m and each may be switched on directly. Additionally, there is a requirement that the tunnel lighting be switched on automatically when there is an outage of traction current exceeding 60 seconds. The lighting must only be capable of being switched off by authorised persons.
- (4) An emergency lighting installation is required for:
 1. Platforms, so far as operational requirements dictate, and particularly where stations are situated at high or low levels.
 2. Escape and rescue routes
 3. Safety zones (refuges) in tunnels with the exception of safety zones under platforms or (elevated, i.e. for staff boarding) walkways.
 4. Emergency exits
 5. Rooms used by passengers
 6. Accesses to and exits from platforms as in No. 1. and rooms as in No. 5.
- (5) Emergency (safety) lighting must be so constructed and arranged that the operational installations enumerated in clause (4) are adequately lit. They must be activated to operational requirements within 0.5 seconds of failure of the mains supply. In tunnels and emergency exits this delay may be increased to 10 seconds.

§ 28 Pipework

Metallic pipework must be galvanically isolated at entry to railway structures where dc return conductors described in § 26 exist. This provision applies also to metallic armouring (or other metallic protection) of cables, if they are not insulated within the structures.

§ 29 Bridges

- (1) Bridges must be designed to carry the loads defined for the section of line concerned as also to absorb safely the static and dynamic stresses occurring at the highest permitted speeds.
- (2) Curves of less than 300 m radius on bridges must have additional guidance devices in so far as the possibility of derailment is not guarded against by other means.
- (3) Bridge supports which are located near traffic lanes of roads must be so dimensioned that they will withstand a road vehicle running into them. Otherwise they must be protected either by their location, or by special protective works.
- (4) The provisions of clause (3) apply as appropriate to bridge supports on the property of the undertaking itself or in the vicinity of other transport structures.
- (5) Where safety zones run along bridges, railings must be provided to ensure that persons cannot fall from the structure even when being evacuated from vehicles.
- (6) The provisions for bridges also apply, as appropriate, to passageways and other elevated railway structures which carry or support the permanent way.

§ 30 Tunnels

- (1) Tunnels must be so constructed that:
 1. The upward pressure of water, [*buoyancy effect*] at the highest expected level of the ground water table does not affect stability.
 2. That the stability of the support elements remains unaffected in case of fire.
 3. Damp penetration is never sufficient to affect operation.
- (2) The results of surveys and investigations [*e.g. boreholes*] on soil conditions and water courses must be taken into consideration in load calculations for determining the dimensioning of the tunnels. In particular these investigations must reveal the effects of chemical influences and soil statistics.
- (3) Endangered supports must be so dimensioned that they remain stable in the event of a vehicle [*train*] colliding with them, otherwise should a support be destroyed, the rest of the structure must be able to support the loads imposed on it.

- (4) In reinforced concrete tunnels in which return current conductors as in § 26 exist, armourings and/or other metallic protection elements must be bonded to one another. These bonds must be separable at insulated joints. The protection (armouring) must not be electrically connected with:
 1. The running rails.
 2. Protection or other metallic parts of other railway structures or non-railway installations.
- (5) Tunnels must be provided with emergency exits to the open air, and be so arranged that the rescue/escape distance to the nearest platform, nearest other emergency exit or the tunnel mouth never exceeds 300 m. Emergency exits must also be provided at the dead-end of tunnels where the nearest other emergency exit or station platform is more than 100 m away.
- (6) Emergency exits must be clearly indicated by a blue light.
- (7) Emergency exits must be constructed to allow the evacuation of casualties on stretchers.
- (8) The openings from emergency exits into the open air must:
 1. Be situated a reasonable distance from traffic lanes on roads.
 2. Be accessible at all times and incapable of being obstructed by road vehicles.
 3. So covered that they can be opened from the inside at any time without tools, but are not openable from the outside by unauthorised persons.
- (9) Where the natural air change rate in a tunnel, from the proximity of stations, emergency exits and tunnel mouths is not sufficient, or discomfort to passengers from excessive draft is likely, additional measures [*e.g. provision of draft relief ducts*] must be taken.
- (10) Where tunnels lie below water, and any risk of water penetration causing flooding over a long section of the line exists, floodgates must be provided to limit the flooding to the shortest possible length. Where the mass and flow of water is likely to be small, or the tunnel is covered by a substantial depth of impervious ground, derogations from these measures may be accorded.
- (11) Floodgates as in clause (10) must be so interlocked with the train safety system [the signalling system], that:
 1. Trains may not be trapped within the isolated area by automatic operation of the apparatus.
 2. Trains may not approach closed floodgates.
- (12) The provisions of clauses (1), (2) and (4) apply, where appropriate to cases where retaining walls in combination with an invert form a trough.

§ 31 Stopping places (stations)

[Note: In this English version, "Stopping Places" is used to indicate open street level stops on LRT systems, and "Stations" to indicate stopping places on elevated and underground sections as also those places which, although at ground level, are completely separate from the public road system, as appropriate.]

(1) Stopping Places (Stations) must:

1. Be clearly marked as such by appropriate signs. In the case of elevated or below ground stations, the accesses must be so marked.
2. Display the station name and display also a plan (map) of the network and timetables.
3. Be specially marked as double stopping places where two trains can be dealt with one behind the other simultaneously.

Stopping places should have platforms and provide protection from the weather and the opportunity for passengers to sit.

(2) Accesses and exits must be comfortable and safe.

(3) Stopping places on ground level sections should be accessible without steps. Elevated or underground stations should also be accessible by lifts.

(4) Stopping places must, as far as operational requirements dictate, be provided with:

1. Installations for informing passengers and assisting them on their way.
2. Installation for the surveillance of boarding and alighting passengers.
3. An emergency call installation.
4. Fire extinguishers, and fire hydrants.
5. First aid supplies and apparatus.

(5) Where Driverless Operation is concerned, special provisions must be made at stations to ensure that persons are not endangered by moving trains.

(6) The width of platforms must reflect the traffic pattern and location. Along the platform edge, there must be a usable width of at least 2 m, although this may be reduced to 1500 mm where the platforms are situated in the traffic area of public highways. *[See § 16 (5)].*

(7) The horizontal gap between the platform edge and the vehicle floor must be as small as possible. In the most unfavourable circumstances this dimension may not exceed 250 mm at the centre of the doorway.

(8) The height of platform surfaces, car-floor and vehicle steps *[where the latter are used]*, must be so related to one another that passengers are able to board and alight comfortably. Platform heights should not exceed car-floor heights when the latter are at their lowest level. Platforms must be provided with non-slip surfaces.

[Note: This would appear to rule out the use of low floor and high floor vehicles without stepboards on the same system. See LUL's use of tube and surface stocks at compromise height platforms].

- (9) The danger of falling from platform ends must be prevented. Platform ends must be clearly recognisable.
- (10) Where there is a height difference in a station of more than 8 m, a ramp, escalator or other mechanical aid must be provided.
- (11) Sales booths or kiosks, advertisement hoardings and similar installations must not be permitted to hinder traffic. In particular they must not hinder rapid distribution of passengers over the length of platforms.

§ 32 Escalators and travelators

- (1) Escalators and travelators must be designed to ensure that:
 - 1. Steps and handrails are safe for walkers.
 - 2. Pinch points and sharp edges are to be avoided or guarded.
 - 3. The risk of falls by users, particularly while escalators are being stopped is prevented.
- (2) Where escalators and travelators are started by stepping on to them, the direction of travel must be clearly indicated.
- (3) Emergency Stop switches must be provided at least at entries and exits.
- (4) Automatic safety devices to stop escalators and travelators must be provided.
- (5) Once an escalator or travelator has stopped, it must not be able to be restarted except under supervision, and neither treads nor handrails must be able to move forward or backward, even under load.
- (6) Sufficient space must be provided at entries and exits to absorb congestion *[without danger]*.

[Note: The term "travelator" has been used in this document to translate the German word "Fahrsteig" , designating either level or inclined conveyors without steps].

FIFTH PART

Vehicles

§ 33 Vehicle design

- (1) The design of vehicles must take into account all the static and dynamic loads to which the structure will be subject, including tare, payload, acceleration and braking stresses. coupling forces and any other stresses arising from the operating conditions.
- (2) The payload of passenger vehicles is to be regarded as:
 1. A load of 750 N per seat.
 2. A load of 5 kN (5000 N) per m² standing area (or surface).
- (3) The materials and components used for passenger vehicles must reflect the current state of fire prevention technology. In particular:
 1. Materials and components in passenger compartments must offer satisfactory resistance to ignition and fire spread.
 2. Devices which carry a higher risk of ignition must be so placed or enclosed that there is no risk of fire breaking through into a passenger compartment.
 3. The fire resistance is such that the rate of spread and development of heat and noxious combustion products will enable the train to be satisfactorily evacuated.
- (4) Window and similar glass, must have properties at least as good as Safety glass [*using the term as generally understood*].
- (5) Windows of passenger compartments must be so designed that passengers cannot lean out.
- (6) Passenger vehicles must be provided with sufficient emergency exits properly arranged and suitably conceived.
- (7) Neither inside, nor on the immediate exterior of a vehicle may components or fittings be so placed or project that persons may be endangered more than is unavoidable.
- (8) In articulated vehicles, the area over the articulation must be so arranged that passengers may remain in the area without danger.
- (9) Car floors must be non-slip, vehicle foot-boards "step-safe" and edges clearly recognisable.
- (10) Seats and passenger spaces must be so designed and arranged that injury is unlikely to occur.
- (11) Sufficient hand-holds, grab-rails etc. must be provided in passenger compartments particularly in doorway areas.

- (12) Passenger vehicles in service on sections of line without safety zones [*e.g. in tube tunnels and elevated sections without side walkways*], must be so designed that:
1. No outbreak of fire in a passenger compartment can occur due to a fault in the systems installed in that compartment itself.
 2. Where a fire occurs outside the passenger compartment due to a fault in another part of the vehicle system, passengers will be protected as far as possible from injury until evacuated.
 3. Means are provided to rescue passengers.

§ 34 Vehicle dimensions

- (1) The loading and structure gauge parameters of vehicles and structures must be so determined relative to one another that contact between vehicles and objects, as also between vehicles on adjoining tracks is impossible in all permissible operating conditions.
- (2) In street running sections on public highways, the throwover on curves must not produce a projection of more than 650 mm outside the kinematic loading gauge permitted on straight track.
- (3) Vehicles required to run on tracks located in the public highway may not exceed the following dimensions:
 1. Width:
 - a) up to 3400 mm above rail level 2650 mm
 - b) above 3400 mm above rail level 2250 mmIndicator and marker lights, rear-view mirrors, open doors and retractable footsteps in the extended position do not need to be included in the vehicle width.
 2. Height:

The maximum height above rail level to the top of the pantograph in the lowered position must not exceed 4000 mm.
- (4) The height of car floors, footsteps and platforms relative to one another must enable passengers to board and alight comfortably. The car floor height, in the lowest state of the suspension [*and cant*] *should* never be below that of the platform.
- (5) The clear height available in passenger compartments must be at least 1950 mm. Above seats, it must be at least 1700 mm. These restrictions do not apply to vehicles without standing areas, where rapid and unhindered boarding and alighting is possible.

§ 35 Running gear

- (1) Track and running gear dimensions relative to one another, must be such as to ensure that even in the fully worn condition of any component(s), there is no risk of derailment at the maximum permitted speed, and that the quietest possible running is maintained.
- (2) The requirements in clause (1) apply equally to the design of suspension and damping, both of vehicles and tracks.
- (3) Safety against derailment must be maintained even when damage has occurred to suspension or damping systems.

§ 36 Brakes

- (1) Vehicles must have at least two brake systems. These must be so independent of each other, that in case of faults within one of the brake systems the effectiveness of the other system is preserved; its effectiveness has to be assured also when the contact line voltage fails.
- (2) The brake systems have to be so designed and adjusted against the other, including their control equipment, that
 1. vehicles and trains can be decelerated to a standstill with a jerk as small as possible and without endangering the passengers (Service Braking),
 2. the wheel/rail adhesion can be used to the extent required for operation,
 3. they, when operated together, present continuous performances which suit the gradients and operating conditions.
- (3) In case of failure of one brake system the average braking decelerations according to Appendix 2 Table 1 must be achieved with the remaining brake systems.
- (4) One of the brake systems must prevent the roll-off of a stationary vehicle with maximum load on the maximum gradient within the system. This brake system has to work as a spring applied system; the braking forces have to be provided and transmitted by mechanical means only.
- (5) Vehicles in street running systems, except service vehicles according to clause (6), must
 1. have a brake system independent of wheel/rail adhesion,
 2. have sanding equipment for the other brake systems,
 3. achieve the average deceleration rates according to Appendix 2 Table 2 (Emergency Braking).
- (6) As an exception to clause (1), service vehicles which do not exceed 40 km/h on independent tracks and 30 km/h on other tracks, require only one brake system. With this, the average decelerations according to Appendix 2 Table 1 must be achieved at least.
- (7) The brake systems of vehicles operated as trains have to be controlled so that the train achieves the braking decelerations according to the clauses (2) to (6).

- (8) In case of unintended train separation, at least the train sections not occupied by train and traffic staff have to be braked automatically; the train separation has to be recognizable for the driver or an occupied control centre.
- (9) Passenger vehicles must be provided with equipment, by which passengers in an emergency can initiate a braking (Emergency Braking). Within sections without safety space [e.g. on viaducts, other elevated sections] and within tunnel sections, the actuation of this equipment beyond stations must result in a stop at the next platform only.

§ 37 Traction

Traction motors, gear drives and other components used for transmission must be designed, having regard to the characteristics of the line(s), train compositions, and running speeds, to meet the maximum motoring and braking requirements required for operation.

In this regard, it is especially necessary to take into account the maximum stresses occurring due to:

1. dynamic braking, [*rheostatic and regenerative*].
2. slip/slide and over-braking,
3. sudden changes in line voltage.

§ 38 Traction and brake control

- (1) The control of traction and braking must be so designed that:
 1. Braking commands have precedence over traction commands.
 2. Traction and braking forces are altered with the minimum jerk.
 3. In Driverless Operation, the operation of braking commands is monitored.
- (2) Passenger vehicles must be provided with a vigilance system (or "dead person's device") which will apply a brake to bring the train to a halt in the event of the driver's incapacity.
- (3) Passenger vehicles which are in use on sections of lines equipped with train safety systems to § 22, must be fitted with these supplementary train safety devices [*AWS, ATP, inductive/mechanical trip systems*].

§ 39 Current collectors and shoegear

- (1) The compatibility of current collectors and contact line system must be such as to ensure reliable current collection up to the maximum permitted speed. This also applies to shoegear.

- (2) (Earthing) shoe gear must be so designed that it cannot be disconnected from the return conductor or earthing conductor until the corresponding current collectors have been retracted, and that it is re-connected to the return conductor or earth conductor before the current collectors raised. *[This clause and § 25 (7) refer to current collectors on people movers and other special forms of guided transport which use 3-phase a.c. power supply.]*

§ 40 Warning and indicator installations

- (1) Warning and Indicating installations must be provided in sufficient quantity to meet operational needs, and so designed that the indications provided by the train and the protection indication described in Appendix 4 (Protection Indicator Sh 5) can be clearly and unambiguously given. Their operation must not be dependent on the availability of traction current.
- (2) Where street running is involved, the two lower lights on the front of the vehicles (see Appendix 4, Z 1), must be projectors *[headlamps as understood in road vehicle usage]*. They must:
 1. Illuminate the whole of the track area sufficiently.
 2. Be dippable simultaneously and to the same extent.
 3. So fixed that they cannot be inadvertently misaligned.
- (3) On vehicles used for street running, the flashing direction indicators on each side (Z 4) must, at a minimum, be fitted at both the front and rear of the sides of the vehicle.
- (4) The provisions of clause (3) apply equally to Z 5 (hazard) indication. The indicators must flash in unison.
- (5) Cab repeaters must be provided to inform the driver of the operation and sense of direction and hazard indicators, as also for head lamps on main (undipped) beam.
- (6) Vehicles used for street running must be fitted with two red tail lamps.
- (7) Unpowered service vehicles are exempted from the requirement for direction and hazard flashers, if other means are used to provide an equivalent standard of safety.

§ 41 Life guards

- (1) Vehicles must be provided (ahead of the leading axle), with devices to clear obstructions which might otherwise cause a danger of derailment. They must be fitted as near as possible to the wheels, and as low as possible above the rails.
- (2) On vehicles for street running, the track sweepers must also protect against risk of derailment arising from objects at the side of the track.

- (3) Track or rail sweepers may be dispensed with where other means are employed on the vehicle to cover their function.

§ 42 Couplings

- (1) Coupling arrangements for vehicles which run coupled in train formation must be designed to match one another.
- (2) Where automatic couplers are used, it must be possible to recognise that they have mated and locked properly.

§ 43 Passenger doors

- (1) Doors must be designed and installed so as to assist rapid boarding and alighting.
- (2) Doorways must have a clear passage of at least 650 mm. On each vehicle side one doorway must have a clear passage of at least 800 mm.
- (3) Doors must have a means of preventing persons from becoming trapped.
- (4) Power worked moveable footsteps may operate only in conjunction with the movement of the doors to which they relate.
- (5) Passenger vehicles must be provided with devices that:
 1. Indicate to the driver that the doors are closed.
 2. Release the doors on each side separately.
 3. Where Driverless Operation is employed, the train cannot start unless all the doors are detected closed.
- (6) Doors must be maintained in the closed position. They must, however, be capable of being opened by passengers in emergency. *[It should be noted that in practice, this means that on modern German stock, operation of the Passenger Emergency Alarm will result in an automatic release of the doors as soon as the train has been brought to a stand, but not before].*
- (7) As an exception from the requirements of clause (6), vehicles used on sections without safety zones [e.g. no side walkways], may have doors which cannot be opened by passengers, where there are other means of ensuring the evacuation of passengers.

§ 44 Driving cabs

- (1) Driving positions, *[whether in cabs separated from the rest of the vehicle or not]*, must be so designed that the driver may carry out his duties safely. In particular he must be provided with an ample field of vision, as also means of combating adverse weather conditions and protection against draughts. Interference by passengers must

be guarded against by suitable technical means. The driving position, and especially the driver's seat, must meet all the generally recognised technical, safety, ergonomic and hygiene standards, as well as the characteristics specific to the task for which it is designed.

- (2) Driving cabs and positions must be arranged so as to provide rapid means of escape in emergency.
- (3) Driving positions must be provided with speedometers and trip recorders (tachographs).
- (4) On vehicles used for street running, a rear view mirror within the field of vision of the driver, must be provided on the near side at least.
- (5) For driving positions used only for shunting movements and in failure conditions, clauses (1) to (4) are applicable only in so far as is necessary to ensure fitness for use.

§ 45 Interior lighting, heating and ventilation

- (1) Passenger compartments must have ample lighting. The lighting must not be capable of being switched off by passengers.
- (2) The interior lighting must not interfere with the driver's vision.
- (3) Footstep areas must be lit so as to ensure that the steps are easily recognised.
- (4) Passenger vehicles must have emergency lighting which is activated by failure of the normal lighting. The emergency lighting must (as a minimum) illuminate the doorway and emergency exit areas.
- (5) Passenger compartments and driving cabs must be adequately heated and ventilated.

§ 46 Information installations

- (1) Passenger vehicles must have:
 1. Line description and destination indicators on the front.
 2. On the boarding side(s), route indicator, destination and, as necessary the route description.
 3. On the rear, the line description.
 4. In passenger compartments, the system map or the line diagram, and where necessary, the line description.

These indications must be readable in the dark.

- (2) The arrangements in clause (1) 1. may be dispensed with where the relevant information is given by Train Describers on the platforms.

- (3) Passenger vehicles must be provided with devices:
 1. For announcing the name of the next stop and any other operational announcements necessary.
 2. For requesting (and confirmation that the request has been given) that the train should call at the next stop, where request stops are in use.
- (4) Vehicles must have voice communications facilities between drivers and a control centre/signal box. Arrangements must exist for giving emergency messages priority.
- (5) Where Driverless Operation is in use, passenger vehicles must be provided with a voice communication system for passengers to speak with the control centre. Clause (4) No. 2. applies as relevant.
- (6) The arrangements detailed in clauses (1) and (3) may be dispensed with in cases where passengers themselves determine the destination of the trains. Passengers must be able to recognise clearly the trains that they have ordered up. *[This provision is designed to cover individual cabin people movers].*

§ 47 Signs and pictograms

- (1) The following must be displayed on the outside of the vehicles:
 1. On the sides, the name and headquarters of the undertaking, or its logo or arms, as also the vehicle number.
 2. Instructions *[e.g. for opening doors]* and other necessary passenger conduct requests *[e.g. "let the passengers off first please"]*.
 3. Jacking points.
 4. On service vehicles, the maximum permissible load.
- (2) On the insides of passenger vehicles, the following:
 1. Instructions for operation of equipment, *[e.g. window vents]* and passenger conduct regulations/requests *[e.g. "no smoking" etc.]*.
 2. Pictograms (see Appendix 3) identifying seats for the handicapped, elderly, infirm and parents with children etc.
 3. Notices concerning emergency equipment.

§ 48 Emergency equipment

- (1) Passenger and powered service vehicles must have at least a first aid box and a fire extinguisher. In so far as street running is involved, they must also have a warning triangle.
- (2) Vehicles running on independent tracks do not require first aid boxes providing these are available in sufficient number at all stopping places (stations).

SIXTH PART

Operations

§ 49 Traffic control

- (1) Trains may follow one another only at such an interval, that even in unfavourable circumstances, and especially where the train in front comes to a halt unexpectedly, the train can be stopped safely. This interval must:
 1. be determined by the driver when driving on sight.
 2. be enforced by the signalling (train safety) system in accordance with § 22.
- (2) Driving on sight is not permitted for:
 1. Trains in independent systems[see § 1 (2)].
 2. Trains in street running systems [see § 1 (2)]:
 - a) on sections with a speed limit exceeding 70 km/h;
 - b) in tunnels.
- (3) The provisions of clause (2) do not apply to:
 1. Shunting movements.
 2. In short tunnels on street running systems where the entire service braking distance is visible.
 3. In failure conditions, when operating to rule.
- (4) On double track sections, right hand running must be observed for two-way traffic.
- (5) Single line sections must not be used in both directions simultaneously. This must be ensured by:
 1. When driving on sight by the signals shown in § 21 clause (3) 2.
 2. When operating on signalled sections, by the train safety installations detailed in § 22.

During temporary single line operation, these requirements may be met by other means [e.g. provisions in the rule book].

§ 50 Permissible speeds (speed limits)

- (1) The general line speed limit for the system will be set by the technical supervisory authority.
- (2) Restrictions below the general line speed limit for specific sections of the line are set by the Operations manager according to the type of vehicle and local conditions obtaining, as well as on particular occasions. Permanent speed restrictions are to be notified to the Technical Supervisory Authority.

- (3) On in-street running track formations, the general speed limit imposed on road traffic must not be exceeded.
- (4) The following general restrictions apply:
 1. Through station platforms when non-stopping: 40 km/h.
 2. When passing over non-locked facing points: 15 km/h.

§ 51 Signals (including signs, indicators and audible signals)

- (1) Signals (plus signs etc.), must be used to the extent that operational requirements and safety dictate.
- (2) Signals (plus signs, indicators and audible signals) must have the form, colours and sounds described in Appendix 4.
- (3) Signals (plus signs and indicators) which give instructions visually, must have an adequate sighting distance and be unambiguously recognisable. They must not affect the operation of light signals, traffic signs or indicators of other means of transport, and provide no occasion for confusion.
- (4) Where a signal has failed or cannot be unambiguously accepted, it must be interpreted in the most restrictive sense [*i.e. to ensure the greatest possible safety.*]
- (5) Repeater (or distant) signals must be installed wherever the sighting distance of the main (stop) signal is less than the service braking distance.
- (6) Stop-signals (stop instruction signs) for driving on sight, (F 0) must be preceded by warning signs F 4 (expect to have to stop), at a sufficient distance: except where trains are always required to stop at the stop sign concerned, or where a change from indications F 1, F 2 or F 3 (clear to proceed within the meaning of the respective signal) to F 0 (stop) cannot take place within the service braking distance of the passing train.
- (7) Train marker, head and tail lights are to be exhibited whenever visibility conditions require, particularly at dusk, during darkness and in tunnels.
- (8) Where driving on sight is the general rule, Z 3 (brake-lights), Z 4 (direction indicator flashers) and Z 5 (warning flashers) must be used. Clause (7) remains unaffected.
- (9) Any reductions in the maximum permitted speed must be marked by the placing of speed limit signs G 2 in the numbers operationally required.
- (10) Where speed limit signs to pattern G 2 cannot, because of local conditions, be seen sufficiently far in rear, speed limit signs to pattern G 1, or warning signs to pattern V 2 must be exhibited.

- (11) Where, in sections operated by driving on sight, there are facing points not interlocked with the Train Safety System, and which are taken at speeds above 15 km/h, Point Indicators to pattern W 11, W 12 or W 13 must be provided.
- (12) The changeover from signalled to driving on sight sections must be marked by the special indicator SO 2, and the changeover from driving on sight to signalled operation by special indicator SO 1.
- (13) Outside stabling areas and away from station platforms, the location of main (stop) signals must be marked by the special signs SO 3 or SO 4. [These are merely white and yellow posts or white and black striped plates designed to call attention to the existence of a stop signal at that point, but see below at clause (14)].
- (14) At main (stop) signals to pattern H 0, the signal may only be passed at danger when special sign SO 4 (Order sign) is exhibited, or when a special order has been received [*e.g. by radio from the control centre in failure conditions, or by written train order*].
- (15) At main (stop) signals to pattern H 0, "stop and proceed" may be exercised where it is clear that a signal failure has occurred, and the layout and traffic situation permit. This does not apply to single line sections operated in both directions. Passing a stop signal at danger in such cases is only permitted on receipt of specific instructions [*Rules presumably must be drawn to cover this eventuality*].
- (16) Where level crossing indicators [showing that the road traffic lights/barriers are functioning properly] remain dark, trains must stop in rear of (before reaching) the crossing, and then resume their journeys only when it can be seen that traffic conditions allow.
- (17) Shunting instructions, where technical means of passing instructions [*e.g. shunt signals*] are not provided, are valid only when both audible and visual hand signals are accepted. Where only the one or the other can be recognised, the shunting movement must be stopped.
- (18) Signals, signs and indicators which are not operational must be removed or covered and marked with a white cross with a black rim.

§ 52 Employment of Operational staff

- (1) Operational installations may only be staffed by Operating Staff who have been suitably trained and assigned to the duties by the Operations Manager.
- (2) In special circumstances, and particularly during commissioning and maintenance operations, vehicles and installations may be worked on by suitably trained authorised staff who are not employed by the undertaking. Responsibility for safety of operation remains with the Operating Staff.
- (3) Installations or vehicles which operate wholly or partly automatically or are remotely controlled, must be monitored by Operating Staff as necessary for satisfactory working.

- (4) Records must be kept of the duties of Train and Traffic staff, which must include:
 1. Name
 2. Start and finish of duty
 3. Exceptional occurrences

§ 53 Staffing of trains

- (1) Every train, while moving, must be staffed by a driver with route knowledge.
- (2) As an exception, trains on railways with independent formations need not be staffed by drivers, provided that:
 1. Apparatus and equipment for automatic operation [ATO + ATP-NOPO] (= Driverless Operation) is installed which meets the requirements of § 22 and is monitored according to § 52 (3);
 2. The area within the structure gauge is regularly checked to be free of persons or objects which may interfere with safe operation;
 3. Speech communication is available between passengers and the control centre, and;
 4. That passengers can be promptly rescued in emergency.
- (3) Service trains, if not equipped with a driver's vigilance device (or deadperson's device), to § 38 (2) or, when running on sections equipped with a train safety installation [ATP or train-stops] and are not equipped with train safety apparatus to § 38 (3), must be accompanied by an additional member of the traffic staff apart from the driver.
- (4) When a failed train can no longer be driven from the leading cab, another member of the train and traffic staff must ride in that location and advise the driver by radio or other means as to movement and dangers.

§ 54 Train operation

- (1) Passenger trains may not start unless it can be visually observed or technically proved that all the passenger doors are closed.
- (2) In normal service, doors may be released only at stopping places and stations, only on the platform side and only when the train has come to a stand.
- (3) Passenger trains must be accelerated and braked in such a manner that passengers are not endangered unavoidably.
- (4) Stopping place (station) names and interchange possibilities are to be announced in trains in good time, except where trains shuttle only between two (terminal) stations.

- (5) Passengers should be advised of disruptions to the service, where these are likely to be of some length. In particular, they should be advised of alternative means of transport or alternative routes that are available.
- (6) Communications equipment and information apparatus must not be used other than for operational purposes.
- (7) Service vehicles must be loaded safely. Loads may not project beyond the vehicle structure. Exceptions may be permitted where the necessary precautions have been taken.
- (8) Stabled vehicles must be secured against running away and against unauthorised movement.
- (9) Records must be kept of train compositions and service use.

§ 55 Operation in roads

- (1) On "in-street" track formations [*see § 16 (5)*], the trains form a part of road traffic. In such cases, drivers must observe the relevant provisions of the Highway Code and Road Traffic Acts.
- (2) Trains which form a part of road traffic, must not exceed 75 m in length.
- (3) On "segregated" track formations [*see § 16 (6)*] and on "independent" track formations [*see § 16 (7)*], including passage over level crossings as defined in § 20, trains do not form part of road traffic.

§ 56 Defective Trains

- (1) Trains with safety defects may not remain in service. Where it is possible to continue to a convenient point at which they can be taken out of service, safety measures must be taken as necessary, according to the nature and severity of the defect. Passengers should, where circumstances permit, be taken to a station.
- (2) Trains with brake defects, must be moved at a speed commensurate with the brake power available.
- (3) Where Driverless Operation is in use, or where safety zones [*e.g. walkways*] are unavailable, precautionary procedures must be taken to ensure that passengers may be promptly rescued from stranded trains.

§ 57 Maintenance of installations and vehicles

- (1) Maintenance of installations and vehicles comprises servicing, examination, inspection and repairs. These operations must cover, at the minimum, all those parts which may affect operational safety.

- (2) The manner and scope of servicing and examination, and of inspection, must relate to the construction and severity of use of the installations and vehicles.
- (3) Inspections must be carried out on a scheduled basis, and within the following maximum intervals:
- | | |
|--|----------|
| 1. Tunnel and station works, other works except earthworks | 10 years |
| 2. Power supply installations | 5 years |
| 3. Bridges | 6 years |
| 4. Contact line system | 5 years |
| 5. Trackwork | 5 years |
| 6. Train Safety installations | 5 years |
| 7. Signal installations | 5 years |
| 8. Mechanical installations affecting safety | 5 years |
| 9. Level crossings | 2 years |
| 10. Escalators and travelators | 1 year |
| 12. Vehicles, every 500,000 km but not exceeding | 8 years |
- (4) Without regard to clause (3), operational installations and vehicles are subject to inspection after serious accidents in which parts which may affect safety have been damaged.
- (5) The Technical Supervisory Authority may in certain cases extend the intervals laid down in (3). They may also, on systems with peculiar features, set shorter intervals.
- (6) Servicing, examinations and inspections must be recorded. The records must be filed with the documentation which is essential for the structures and maintenance, in particular the acceptance certificates [*e.g. for the vehicles*], and for built works and fixed installations, the supporting documents which formed the basis for the building consent.
- (7) Records for servicing and examination must be retained until the next inspection or a minimum of 3 years. Records of inspections, must be retained until the vehicle or installation is withdrawn from service.

§ 58 Use of, and access to, operational installations and vehicles

- (1) Persons who are not Operational Staff may not enter, use or work in operational installations or vehicles outside the areas open to the public for traffic purposes. They may cross tracks on special or independent formations only at the places designated for this purpose.

[Note: The above regulation is in conflict with a more recent decision of the Federal Ministry of Transport and the "States' Committee (Länderfachausschuss) for Urban

Railways and other rail-bound local transport systems" (LSO), who have, in collaboration, attempted to re-define "Operational Staff" (Betriebsbedienstete), in order to limit their numbers, and in so doing have made it difficult for other employees to enter and work in areas hitherto reserved to "Operational Staff". At present, derogations from the above requirement in § 58 (1) are conceded by the appropriate Technical Supervisory Authority, but it is expected that the regulations will be amended to cover the matter in the next issue of BOStrab. A copy of the original (German) definition of "Operational Staff" is attached to this English version of BOStrab as Annex 1.]

- (2) Representatives of the Technical Supervisory Authority and also persons engaged in the national survey (Ordnance Survey) have the right of access to installations and vehicles in the execution of their duties. They must be able to identify themselves.
- (3) The Technical Supervisory Authority may, in conjunction with the Road Traffic Authority permit passenger transport undertakings to use special and independent track formations by buses and trolleybuses in public service. *[This must be done in such a manner that]* the safety of railway operations shall not be affected.

§ 59 Actions endangering operational safety

- (1) It is forbidden to damage or misuse installations or vehicles, to erect obstructions or take other actions which may endanger or reduce operational safety.
- (2) Passengers are particularly forbidden to misuse the passenger alarm (emergency brake) system or interfere with the external doors.

SEVENTH PART

Procedural Requirements

§ 60 Approval of supporting documents for construction of installations

- (1) Building work of installations may not start until the Technical Supervisory Authority's examination has demonstrated that the requirements of these regulations have been met, and that the Undertaker has been notified of this result by the issue to him of a "Plans determination decision" or "Notice of Approval" in accordance with (3) below. *[These documents, as also the whole of the procedures in § 60 are specifically related to German Law and have no exact equivalents in English legal or other procedures].*
- (2) Operational installations of subsidiary importance to technical safety are exempted from these approval procedures. This applies particularly to installations for which stress and strength calculations, gauging calculations or other safety information is not required. In cases of doubt, the Technical Supervisory Authority will decide.
- (3) The Technical Supervisory Authority will issue a "Notice of Approval" concerning the results of the examination process providing:
 1. No "Plans determination decision" is required in accordance with Chapter 28 Subsection (2) or Subsection (3) sentence No.1 of the Passenger Transport Act, or
 2. The examination is not conducted within the framework of an approval or "Plans determination" process in accordance with the Passenger Transport Act.
- (4) In addition to the "Notice of Approval", any consents and approvals required by other public legal regulation remain unaffected. The Technical Supervisory Authority may require production of such approvals.
- (5) The construction documentation must include those required for the examination, Included among these are drawings, materials lists, specifications and similar documents, as also essential descriptions and calculations for safety determination.
- (6) If the Project Manager (the applicant) is other than the Undertaker, (Chapter 3 Subsection (3) of the Passenger Transport Act), the construction documentation may only be submitted in agreement with the latter, to the extent that the Undertaker's interests are involved. In cases of doubt, the Technical Supervisory Authority will decide.
- (7) Apart from the cases cited in clause (2), installations may only be built to the designs in the approved documentation. Where deviations from these are made, amended documentation must be submitted to the Technical Supervisory Authority. Clauses (1) to (6) of this still apply.
- (8) Where a number of installations are to be built to the same designs, (i.e. in accordance with the same documentation), simplified documentation may be submitted in those cases where the Technical Supervisory Authority has granted a type approval.

- (9) The Notice of Approval will cease to be valid should a start on a substantial part of the approved works not have been begun within 3 years of the date of grant, or the work has been interrupted for more than 3 years. On application, the expiry date may be extended for a period not exceeding a year.
- (10) For installations belonging to the Undertaker, but which do not have any operational purpose ("other installations"), but nevertheless may affect operational safety, clauses (1) to (9) as well as those clauses of § 61 and § 62 apply where they are relevant. If there is any doubt as to whether such an installation can affect safety, the Technical Supervisory Authority will decide.

§ 61 Supervision of construction works

- (1) The Technical Supervisory Authority supervises construction of installations. They may limit their activity to spot checks. The Technical Supervisory Authority may require timely notice to be given of the start and completion of the works.
- (2) Supervision will include determination:
 1. that the construction work is being carried out correctly;
 2. that the materials and components used are suitable;
 3. and that the operation of the system during construction works has been adequately safeguarded.
- (3) Arrangements must be made to ensure that the officials charged with supervising the works always have access to the site, the works and the supporting documentation.

§ 62 Acceptance (by the authorities)

- (1) New or modified vehicles or installations may not be brought into service, apart from commissioning and suitability for service tests, until the Technical Supervisory Authority has accepted them.
- (2) Acceptance includes measurements, functional tests or other checks which demonstrate that the installation or the vehicle is safe in operation and complies with the approved documentation.
- (3) The results of the Acceptance Process must be minuted.
- (4) The Undertaker must apply to the Technical Supervisory Authority for Acceptance. In the case of vehicles, the application for Acceptance is to be made as soon as the [*"as made" or definitive*] drawings become available and the documentation specified in § 60 clause (5) is to be attached.
- (5) Where an application relates to a batch of vehicles built to the same design, the documentation needs to be deposited only with the application for Acceptance of the first vehicle of the series.

- (6) After completion of Acceptance, the Technical Supervisory Authority will issue an Acceptance Certificate to the Undertaker. The Technical Supervisory Authority may require that any acceptance documents required under other public-legal regulations are submitted by the Undertaker with the application.

- (7) Where the tests and checks described in clause (2) above concerning safety compliance have been met, the installation or the vehicle may be put into service before the actual Acceptance Certificate has been issued, unless the Technical Supervisory Authority has decided otherwise.

EIGHTH PART

Contraventions, conclusion provisions and transitional provisions (*from the previous Regulations*)

§ 63 Contraventions

(1) An Undertaker will be in Contravention [*of the Regulations*] within the meaning of Chapter 61 Subsection (1) No. 4. of the Passenger Transport Act, where he, deliberately or negligently:

1. Fails to appoint an Operations Manager or a Deputy Operations Manager contrary to § 7 clause (3) 1. or 3. of these Regulations.
2. Starts the construction of Operational other installations contrary to § 60 clause (1) in conjunction with clause (10) No. 1.
3. Brings new or modified installations or vehicles into service before their Acceptance [by the Technical Supervisory Authority].

No. 2. applies also to other Project Managers (Chapter 3 Subsection (3) of the Passenger Transport Act) where relevant.

(2) A person will also be in Contravention [*of the Regulations*] within the meaning of § 61 clause (1) No. 4. of the Passenger Transport Act, where he, deliberately or negligently:

1. not being a member of the Operational Staff, enters or uses in any manner Operational Installations or Vehicles contrary to § 58 clause (1) first sentence.
2. being a Passenger, operates outside doors or Passenger Alarm (Emergency Brake) systems, contrary to § 59 clause (2) [*of these Regulations*].

§ 64 [*repealed*]

§ 65 Entry into force and transitional provisions

- (1) These Regulations come into force on 1 January 1988.
- (2) On the same day, the previous regulations of 31 August 1965 (BGBl. I S.1513) as amended last by Article 2 of the Order for the Alteration of Passenger Transport Legal Requirements of 13 May 1981, cease to have effect.
- (3) Where the requirements of these Regulations (subject to which construction of installations or vehicles is in progress) differ from the previous requirements, the installations or vehicles need not be modified to comply with the new requirements. The Technical Supervisory Authority may however require compliance where safety demands such compliance.

- (4) Contrary to the exemptions in clause (3) above, installations and vehicles which exist or are currently under construction, must comply with these Regulation by the following dates at the latest:
1. Signalling systems for single line sections (§ 21 Clause (3) 2.) by 1 January 1990.
 2. Technical Safety arrangements for level crossings, (§ 20 clause (4)), Equipment of Stations and Stopping Places (§ 31 Clause (1) 2.) and Voice Communication Systems (§ 46 Clause (4) first sentence), by 1 January 1996.

Signed at Bonn, 11 December 1987,
The Federal Minister of Transport
Jürgen Warnke

**APPENDICES 1 to 4
of the LRT Construction & Use Regulations
from 11th December 1987**

Appendix 1
(to § 20)

Signage and safety at level crossings

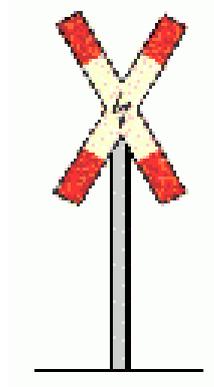


Figure 1: St. Andrews Cross

The lightning flash indicates that the line is electrified with OHLE.

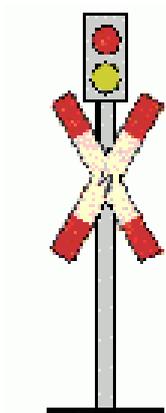


Figure 2: Light indicator

Where restricted clearances exist, St. Andrews Cross may be above or alongside light indicator.

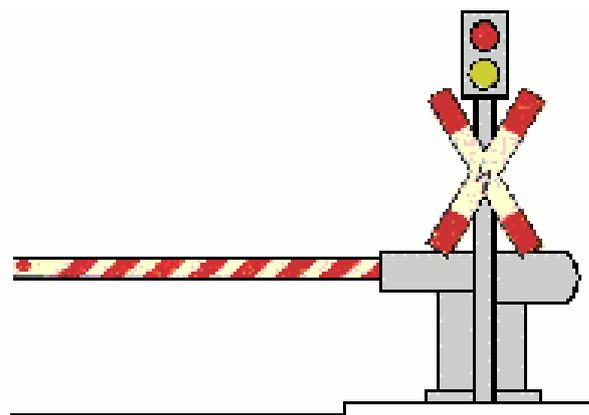


Figure 3: Light indicator with half-barriers

If clearances are restricted and half-barriers are also in use remarks as No. 2 apply.

The half-barriers may also have vertical stripes.

Appendix 2 Braking parameters
(to § 36)

The limiting values for a and s in tables 1 and 2 are valid for empty vehicles on level tangent track.

- a in m/s² = the average minimum braking rate admissible.
- s in m = maximum stopping distance to be achieved from start of brake application.

- v in km/h = speed at commencement of braking.

$$a = \frac{v^2}{3,6^2 \cdot s}$$

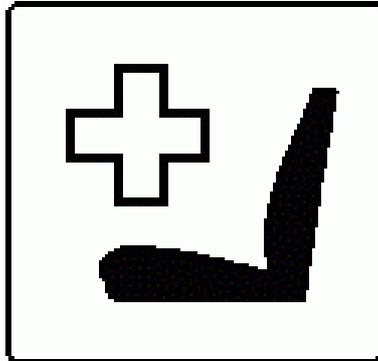
Table 1
 Limit values with
 brake defective (sec 36 Cl 3 & 6)

v	a	s
20	0.77	20
30	0.87	40
40	0.95	65
50	1.03	94
60	1.06	131
70	1.07	177
80	1.07	230
90	1.08	290
100	1.08	355

Table 2
 Limit values for
 Emergency Applications

v	a	s
20	1.71	9
30	2.04	17
40	2.29	27
50	2.47	39
60	2.57	54
70	2.73	69

Appendix 3 **Pictogram for marking seats for the disabled**
(to § 47 Clause (2) No. 2)



Colour of the pictogram and border
Colour of the background

- Black
- White

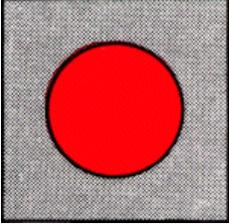
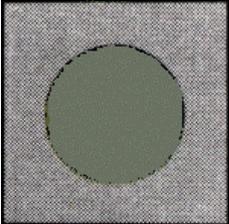
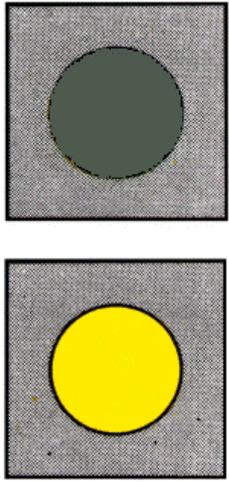
Appendix 4 Signals, Signs and Indicators **(to §§ 21,40, 51)**

Note: The word "Signale" in German includes not only Signals as understood in English but also Signs and Indicators, e. g. Speed Restriction Signs are known in German as Speed Restriction "Signals". The translation has attempted to present the meanings employing English usage.

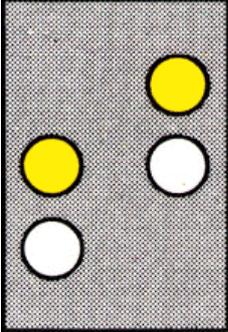
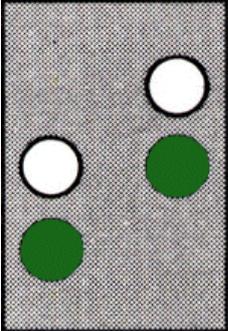
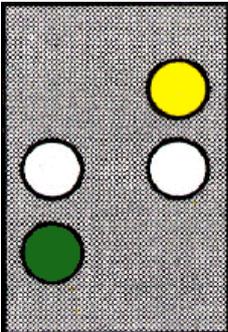
Overview

1	Main (Stop) Signals	H
2	Distant/Repeater/Warning Signals	V
3	Signals for driving on sight (i.e. for street running)	F
4	Despatching Indicators	A
5	Marker, Tail and Direction Indicators on vehicles	Z
6	Speed Restriction Signs	G
7	Protection Signs	Sh
8	Shunt Signals	R
9	Switching (Elec) Signs	St
10	Point Indicators	W
11	Function Indicators for level crossings	Bü
12	Special Signs & Indicators	So

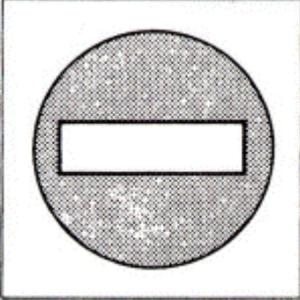
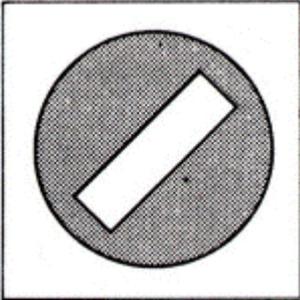
1. Main (Stop) Signals

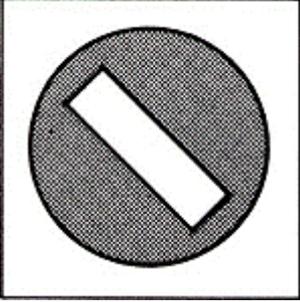
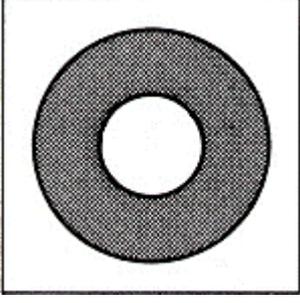
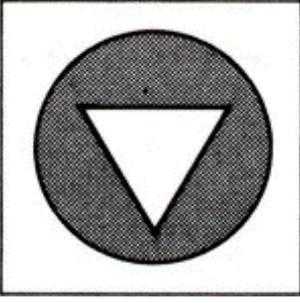
Ref	Description	Meaning	Explanation
H 0	Single red light 	Stop	
H 1	Single green light 	Proceed	Signals H1 and H2 may also be combined with speed restriction signs G2
H 2	Green over yellow 	Proceed at reduced speed	

2. Distant/Repeater/Warning Signals

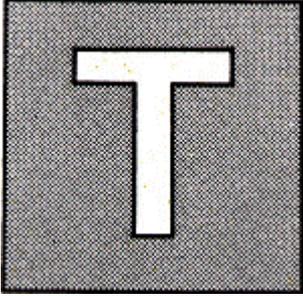
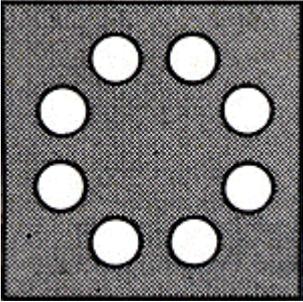
Ref	Description	Meaning	Explanation
V 0	2 Yellows rising to the right 	Next stop signal may be at danger (stop)	
V 1	2 Greens rising to the right 	Next stop signal is clear	
V 2	1 green + 1 yellow rising more steeply left to right 	Next stop signal is clear to pass at reduced speed	

3. Signals for driving on sight

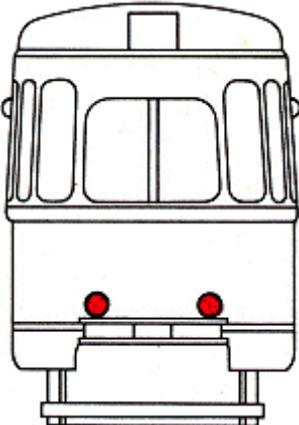
Ref	Description	Meaning	Explanation
F 0	<p>A horizontal white illuminated bar</p> 	<p>Stop</p>	
F 1	<p>A vertical white illuminated bar</p> 	<p>Proceed straight ahead</p>	
F 2	<p>A white illuminated bar inclined to the right</p> 	<p>Proceed only to the right</p>	

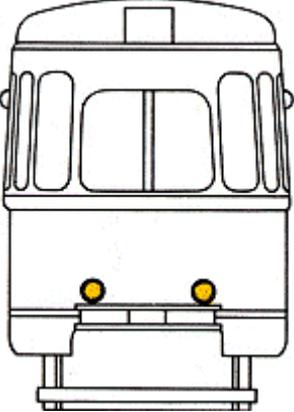
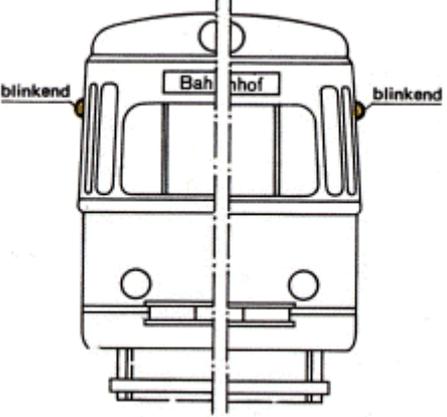
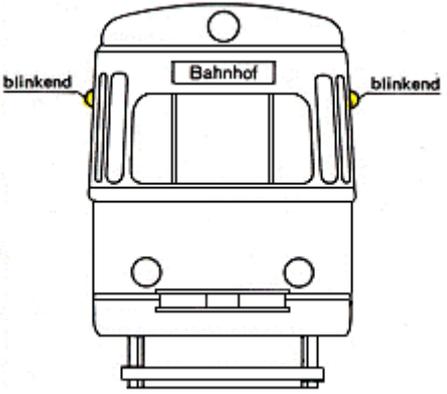
Ref	Description	Meaning	Explanation
F 3	As F2 but to the left 	Proceed only to the left	
F 4	A pin-point white light 	Expect a stop indication	
F 5	A white illuminated triangle point down 	Proceed with caution in accordance with § 9 of the highway code (i.e. having regard to the road traffic	

4. Despatching Indicators

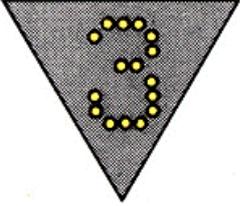
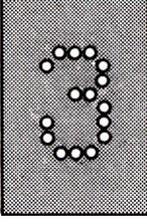
Ref	Description	Meaning	Explanation
A 1	A white or yellow illuminated T 	Close doors	
A 2a	A short sound or a sound + optical sign 	Right away	
A 2b	A white or green ring of lights 	Right away	

5. Marker, Tail and Direction Indicators on vehicles

Ref	Description	Meaning	Explanation
Z 1	3 white headlights 	Front of Train	The top light may include the route number.
Z 2	2 red taillights 	End of train (train complete)	

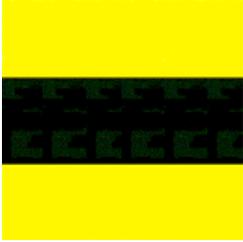
Ref	Description	Meaning	Explanation
Z 3	2 red or yellow lights at the rear 	Brake lights	
Z 4	Yellow flashing light at one side or the other 	Direction indicator	
Z 5	Yellow flashing lights at both sides simultaneously 	Hazard Indicators	Vehicle remaining stationary

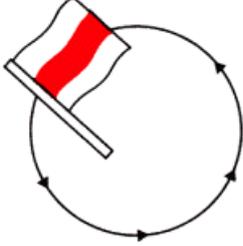
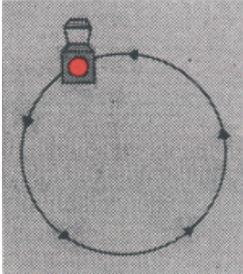
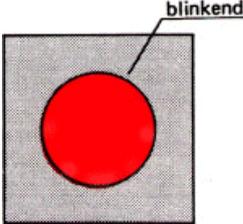
6. Speed Restriction Signs

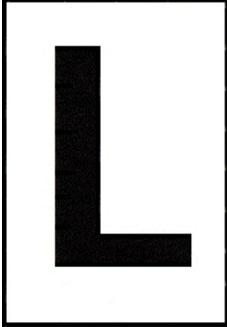
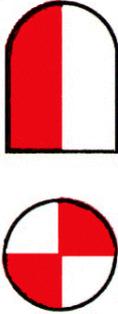
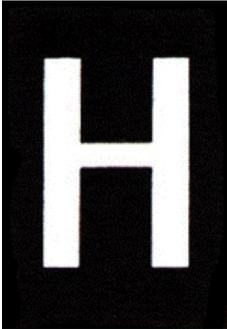
Ref	Description	Meaning	Explanation
G 1a	<p>Point down triangular yellow plate with white and black figure</p>  <p>The sign may be used point up where space is restricted.</p>	<p>Advance warning of speed restriction downwards</p>	<p>The restriction is any change downwards</p>
G 1b	<p>Yellow lights forming the figure</p> 		
G 2a	<p>Rectangular yellow plate with white rim and black figure</p> 	<p>Commencement of speed restriction</p>	
G 2b	<p>White lights forming the figure</p> 		
Ref	Description	Meaning	Explanation

G 3	<p>Rectangular white plate with black letter E</p> 	End of speed restriction	The speed restriction is any change down to the permitted speed.
G 4	<p>White rectangular plate with black rim and black figure</p> 	Commencement of speed restriction	Indicates any increase in the permitted speed. May also be used in place of G3

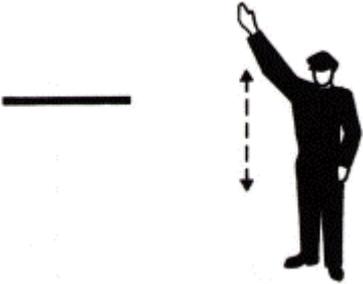
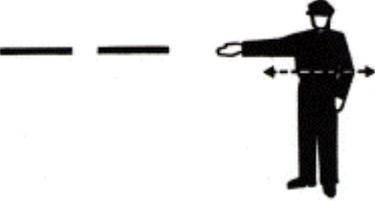
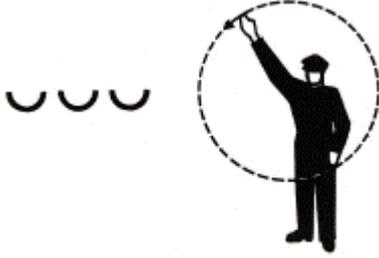
7. Protection Signs

Ref	Description	Meaning	Explanation
Sh 1	Square yellow plate with horizontal green strip 	Compulsory stop	Used where a stop is required when driving on sight
Sh 2	Rectangular red plate with white rim 	Protection stop (e. g. obstruction)	Do not proceed further

Ref	Description	Meaning	Explanation
Sh 3a	3 quick short blasts 	Emergency stop	Train to be stopped in shortest distance possible
Sh 3b	Red-white-red flag or arm waved in a circle 		
Sh 3c	Hand-lamp or any form of light waved in a circle 		
Sh 3d	Red flashing light or lights one under the other 		

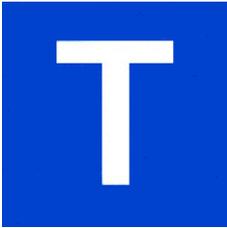
Ref	Description	Meaning	Explanation
Sh 4	Rectangular white plate with a black L 	"Whistle" or "hoot"	Warning signal to be given in accordance with local conditions
Sh 5	A long whistle or hoot 	Warning	Sh5 is a warning to persons
Sh 6	A red and white sign or mark on the track 	Fouling point	Marks the point to which vehicles may proceed on an occupied converging track
Sh 7	A rectangular black plate with a white H or white plate with black H or similar mark on track 	Stop sign	Indicates where the head of the train should stop

8. Shunt Signals

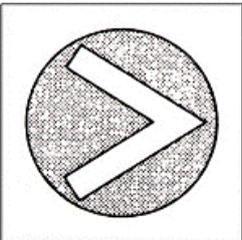
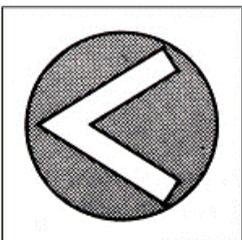
Ref	Description	Meaning	Explanation
R 1	<p>One long blast and vertical movement of the arm, and during darkness, with a white handlamp</p> 	Move away	Shunt movement away from the person giving the hand signal
R 2	<p>Two long blasts with horizontal arm movement + white handlamp in dark</p> 	Come towards me	Shunt movement towards the hand signalman
R 3	<p>Three short blasts and circular arm movement + white handlamp in dark</p> 	Stop shunt movement	

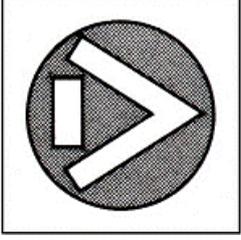
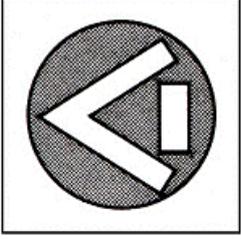
9. Switching (Elec) Signs

Ref	Description	Meaning	Explanation
St 1	<p>A square blue plate with a white S</p> 	Signal plunger	At this sign, the plunger adjacent is to be operated
St 2	<p>A square blue plate with a white W</p> 	Points plunger	At this sign, the plunger adjacent is to be operated
St 3	<p>A square blue lozenge with a black & white rim and a white U with the lower bar detached</p> 	Switch off	Beyond this sign, traction current must be cut off
St 4	<p>A square blue lozenge with a black & white rim and closed white U</p> 	Switching on permitted	Beyond this sign traction power may be restored

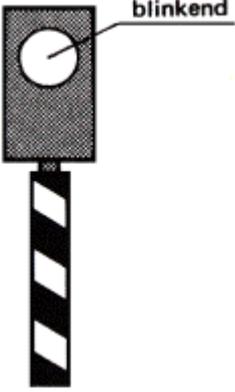
Ref	Description	Meaning	Explanation
St 5	<p>A square blue lozenge with black & white rim and a horizontal white strip</p> 	Drop pantograph	Beyond this sign the pantograph must not be in contact with the overhead wire
St 6	<p>Similar plate with vertical white stripe</p> 	Raise pantograph	Beyond this sign the pantograph may be raised again
St 7	<p>Square blue plate with a white T</p> 	Section insulator	At this sign power must be cut for a short period
St 8	<p>Square blue lozenge with black & white rim, with a white/black hollow interior lozenge and white solid central lozenge</p> 	Vehicles with raised pantographs stop here	Vehicles with raised pantographs must not pass this sign

10. Point Indicators

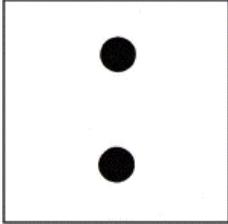
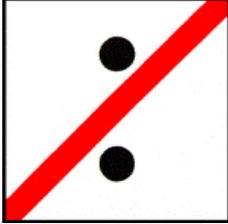
Ref	Description	Meaning	Explanation
W 1	An inverted white lit V 	Points are set normal, speed limit 15km/h	Points are without pointlock <i>Lay is determined by local control or from the vehicle.</i>
W 2	A white lit V pointing right 	Points reversed to right, speed limit 15km/k	Points are without pointlock <i>Lay is determined by local control or from the vehicle.</i>
W 3	A white lit V pointing left 	Points reversed to left, speed limit 15km/h	Points are without pointlock <i>Lay is determined by local control or from the vehicle.</i>
<p><i>NOTE</i> <i>W 4 to W 10 are reserved for additional signs.</i></p>			

Ref	Description	Meaning	Explanation
W 11	<p>A white inverted lit V with a white lit stripe below</p> 	<p>Points are set normal for line speed.</p>	<p>Points are provided with point lock i.e. are locked in set position.</p>
W 12	<p>A white inverted lit V with a white lit stripe below</p> 	<p>Points are reversed to right for line speed.</p>	<p>Points are provided with point lock i.e. are locked in set position.</p>
W 13	<p>A white inverted lit V with a white lit stripe below</p> 	<p>Points are reversed to left for line speed.</p>	<p>Points are provided with point lock i.e. are locked in set position.</p>
W 14	<p>A white V with a horizontal white bar above on a square black plate</p> 	<p>Points may not be traversed (passed).</p>	<p>Points are provided with point lock i.e. are locked in set position.</p>

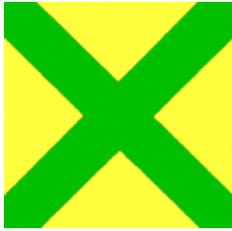
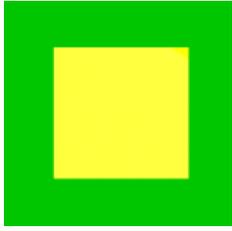
11. Function Indicators for level crossings

Ref	Description	Meaning	Explanation
Bü 0	<p>A mast and plate with black & white inclined stripes</p> 	<p>Stop before level crossing. Proceed only when road traffic permits</p>	<p>Indicates that the safety (warning) system is defective.</p>
Bü 1	<p>A white flashing light above a black & white mast with inclined stripes</p> 	<p>Level crossing may be passed normally</p>	<p>Shows that the safety system is operating</p>
Bü 2	<p>A rectangular black plate with 4 white lozenges one above the other</p> 		<p>Advance warning for level crossing indicators (described above)</p>

12. Special Signs & Indicators

Ref	Description	Meaning	Explanation
So 1	A square white plate with two black dots placed vertically 	Start of signalled section	Signifies the changeover from driving on sight to signalled operation
So 2	As So1 but with diagonal black stripe 	End of signalled section	Signifies changeover to driving on sight

Ref	Description	Meaning	Explanation
So 3	Black and white inclined striped strip 	Location sign	Indicates the location of main (stop) signals
So 4	Yellow and white post or vertical plate 	"Order" sign	Indicates at a stop signal at danger that it may be passed in accordance with special instructions contained in a traffic notice

Ref	Description	Meaning	Explanation
So 5	A square yellow plate with a green diagonal cross 	Start of section with no passing (traffic in the other direction)	Where prohibition applies to particular vehicles or direction of movement, additional signs may be used
So 6	A square yellow plate with a green rim 	End of no passing section	

ANNEX 1

Operational Staff

The problem of defining the meaning of "Operational Staff" (Betriebsbedienstete) is difficult in translation, but has also proved not to be simple in German and Germany itself. It was not until 1989 that an attempt was made in Germany to define the status of this staff more closely and to resolve the problem. A copy of this attempt, in the original text, is appended hereto.

The original conception was simple. Those given the status of "Operational Staff" would be trained as genuine "Railwaymen", with a knowledge of rules and regulations, safety procedures and so on, able to take responsibility for their own actions given that transport staff are frequently in situations where they have to make decisions without being able to ask a supervisor, especially when on the line in traffic.

This was intended to include, among others, anyone working on or competent to work on, (the German word "tätig" has no exact simple equivalent in English), in an operational installation or vehicle, not merely concerned with traffic matters but also in maintenance and repair and RESPONSIBLE for the work done or being done.

The interpretation of this definition has resulted in difficulties. The office of the Union of German Public Transport Undertakings (originally VÖV, now VDV), together with the Federal Ministry of Transport, agreed an interpretation which they accepted at their meeting in Hamburg on 19/20 April 1989, to the effect:

That RESPONSIBLE in the sense of § 1 Clause (6) 3. of the BOStrab, means those Operational Staff who are employed in safety related areas, and therefore exercise personal responsibility, that is either carry out work themselves or check and accept the work of others. This results in Undertakings having to differentiate between workers who are personally responsible for their work, and workers whose work is, after completion, checked and accepted. This enables an Undertaking to limit and control the number of "staff" [as opposed to employees], (with their [extensive] training and other requirements). The determination of what must be regarded as "safety related areas" is a part of the global responsibility of the "Operations Manager" in accordance with § 8 Clause (1) of BOStrab.

Thus the number of Operational Staff may in this way be limited. But this interpretation results in conflict with § 58 Clause (1) of BOStrab where it is laid down that only Operational Staff may enter and work on or in installations and vehicles other than those generally available to the travelling public. That means that company or administration employees who are not of the status of Operational Staff are not generally permitted to enter or work on or in installations and vehicles even carrying out work which they have been instructed to do. This would require their transfer to Operational Staff status and would therefore negative the goal of limiting the numbers of such staff.