A Probabilistic Approach to Safeguard Cross Wind Safety of Passenger
Railway Operation in Germany: The new DB Guideline Ril 80704

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Abstract

In April 2006, DB Netz AG (the infrastructure branch of Deutsche Bahn AG) set into force the new
cross wind guideline Ril 80704. This guideline covers the entire passenger traffic and contains
methods and requirements for rolling stock and for infrastructure. Compliance with guideline Ril 80704
is needed for technical network access to the railway infrastructure of DB Netz AG. Moreover, the
German railway authority EBA declared the guideline Ril 80704 as national state of the art for cross
wind assessment. Thus, to fulfil Ril 80704 is mandatory for all rolling stock homologation in Germany
and for all railway undertakings, which fall under the surveillance of EBA.

The guideline Ril 80704 is founded on the well-accepted main principle that existing railway operation
in Germany is safe. The mission and basic idea of Ril 80704 is to ensure that future railway operation
will exhibit the same safety level. Thus, the overall safety target set was derived by probabilistic
analysis of so-far cross wind safety in Germany. On this basis, comprehensive and consistent
requirements for the subsystems “rolling stock” and “infrastructure” had been established.

The various methodological procedures within Ril 80704 and their underlying assumption generally
refer back to former DB-internal, national and European research projects and are widely in line with
the principles currently discussed in Europe in reference to future European regulations. The major
merit of Ril 80704 is to link these principles and methods to a comprehensive, consistent and practi-
cable guideline.

1 Background and Motivation

In the end of the nineties, cross wind safety of high speed railway operation gained major importance
for Deutsche Bahn AG (DB) due to the introduction of new ICE 2 and ICE 3 high speed trains which
include light-weight endcars. Intense cross wind studies for high speed railway operation were
launched. Soon, these studies were extended to all kinds of passenger train operation (starting with
140 km/h). In 2001, the work done resulted in the so-called “Handbuch für den Sicherheitsnachweis
bei Seitenwind” (Handbook for the Safety Proof under Cross Wind) [3], which from then on was the
officially accepted guideline for the analysis and the assessment of all new passenger train services
with train speeds above 140 km/h. The application of this guideline led to various cross wind
measures, especially for high-speed train operation and for tilting train operation.

From 2001 to 2004, DB, SNCF and Siemens carried out common research on cross wind effects on
high speed railway operation within the DeuFraKo framework [4, 7]. The jointly developed approach
to assess the cross wind stability of high speed trains became in 2005 the basis for the cross wind
requirements to be incorporated in the European Technical Specifications for Interoperability (TSI).
Partly parallel to the DeuFraKo Cross Wind Project, DB carried out an internal cross wind project
called WODAN (2003-2004). The objective of this project was to revise and to advance the complete
German cross wind method while respecting the results and agreed conclusions of the DeuFraKo
Cross Wind Project. The WODAN project and later the development of the new cross wind guideline
Ril 80704 were intensely accompanied by discussions within the German cross wind forum “AK
Seitenwind”, which comprises representatives of operators, manufacturers and the German railway
authority Eisenbahn-Bundesamt (EBA).

The revision of the cross wind method and the development of a new guideline served various pur-
poses. The main one was that a comprehensive, across-the-board cognition of the cross wind subject
in Germany was missing. The old guideline did not provide a set of consistent methods and targets for
the various classes of passenger operation. In addition, the old method focused on the cross wind assessment of distinct railway services, whereas the situation called for separate while complementary assessment of rolling stock and infrastructure. Another major issue was the need to stream-line and to reduce the effort for the cross wind safety proof in order to allow for a network-wide applicability. Last but not least, DB had the expectation that cross wind measures can be taken more target-oriented and, thus, cost-efficient once a comprehensive and coherent perspective of the overall issue had been established.

The new guideline Ril 80704 [2], which was developed against this background, was set into force by DB Netz AG, the infrastructure branch of DB, in April 2006. Since there are not yet corresponding European directives and standards, the German railway authority EBA declared the Ril 80704 as state of the art for cross wind assessment in Germany. Thus, to fulfil Ril 80704 [2] became mandatory for all rolling stock homologation in Germany and for all railway undertakings, which fall under the surveillance of EBA.

2 Major Principles for Ril 80704

The guideline Ril 80704 [2] implies various basic principles for the assessment of cross wind safety in Germany which had been set consensually by all involved parties and which at present are still considered as axiomatic first principles for the assessment of cross wind safety in Germany:

- The cross wind safety of existing, long-term railway operation in Germany is acceptable and sufficient due to its safe operation record.
- Future railway operation in Germany shall at least respect the level of cross wind safety of existing railway operation.
- Cross wind safety is not just an issue of high speed rail but also of conventional rail.
- It is necessary to control and to monitor the cross wind safety comprehensively in the whole railway network.
- In order to allow a straightforward safety proof and in order to grant easy network access to third parties, analysis and assessment of cross wind safety have to address separately the cross wind stability of rolling stock and the cross wind exposure of railway lines.
- The methods provided shall be as simple, as transparent, as robust as possible, and as detailed as needed. This is also important to grant the possibility to have cross wind studies and safety proofs conducted and counterchecked by a broader number of experts.

Some of these fundamentals had been already part of DB’s first cross wind guideline [3]. Others had been derived or influenced by more recent research and by European standardization activities. Again others had been newly introduced on the basis of perennial application experience with DB’s first cross wind guideline and the very constructive discussions within the German cross wind forum.

It shall be pointed out that during the last years especially practicability and manageability were perceived as more and more important. Partly, this is also due to the rather recent understanding that – at least in Germany – cross wind safety is not just an issue of high speed rail but also of conventional rail. If against this background the conclusion is, that it is more important to get a good and consistent overall picture of cross wind safety in German railway traffic than achieving a very detailed insight in some special high speed train services, practicability and manageability become important premises.

3 Major Concepts and Procedures of Ril 80704

3.1 Interface between Rolling Stock and Infrastructure

Since the aim is a manageable functional split between rolling stock and infrastructure issues, one major procedural requirement of Ril 80704 is that according to [4, 7]

- the cross wind stability of rolling stock can be assessed with the help of Characteristic Wind Curves (CWC),
- the cross wind characteristics of a railway line and its operation can be assessed by considering the cross wind risk a certain, well-defined rolling stock will experience when operating on that line.
Hereby, the CWCs define the wind speed that a train can sustain without exceeding some characteristic running safety parameters (cf. also to [7]). In addition, the modeling of cross wind risk implies as an important parameter the hazard rate which is set to the rate of CWC exceedance (cf. also to [7]). In terms of Ril 80704 conformity this means that

- a vehicle is considered to be Ril 80704 compliant if its CWCs are at least as good as reference curves which thus define the requirement on vehicle stability,
- a line under its operational conditions is considered to be Ril 80704 compliant if the operation of a vehicle with CWCs equal to the reference ones meet the safety target defined in Ril 80704.

Within this model, the safety target thus defines the overall extent of the cross wind issue while the reference curves define the share of responsibility between rolling stock and infrastructure.

This general scheme for cross wind analysis and assessment is illustrated in Figure 1. The figure clarifies the two separate branches for the cross wind assessment of rolling stock and infrastructure. Only in exceptional cases a "mixed" cross wind assessment for a distinct train operation on a distinct line is destined.

![Figure 1: General scheme for cross wind analysis and assessment according to Ril 80704 [2].](image)

### 3.2 Cross Wind Stability of Rolling Stock

The concept for the precise determination of Characteristic Wind Curves (CWCs) of rolling stock is based on low-turbulence wind tunnel tests, a fixed and simple gust model, and on time-dependent multi-body simulation (cf. also to [4, 7]). A simplified, conservative approach based on low-turbulence wind tunnel tests and quasi-static vehicle dynamics is also provided. In any case the characteristic criterion which defines the CWC (depending on train speed, wind angle and uncompensated lateral acceleration) is a 90% wheel unloading.

Hereby, the determination of the aerodynamic coefficients and the computation of CWC refer to just one single reference ground configuration which is sufficient to characterize the general cross wind performance of a vehicle. The chosen reference ground configuration is flat ground since this serves most the target of an accurate and reproducible while also cost-efficient wind tunnel test. The significant state with respect to running characteristics which is described within the CWC is that the unloading at one running gear (one wheelset or average over one bogie) reaches 90% of the static load. This characteristic unloading indicates a beginning hazard of overturning due to cross wind.
3.3 Wind Statistics at the Railway Line

The concept to determine the wind statistics at every point of the line is a wind map approach based on the EUROCODE, which is well accepted in the field of civil engineering. Within Ril 80704, the effects of embankments, cuts and bridges are accounted for by according corrections on theses wind statistics and, thus, are not accounted for by the CWCs which always refer to flat ground.

One main advantage of the chosen wind map approach is its wide acceptation, its reproducibility and its simple applicability and manageability. The latter is actually a precondition when aiming for a network-wide cross wind hazard cognition. Detailed information on the meteorological approach implemented within Ril 80704 is provided in [5].

3.4 Risk Analysis

The concept to characterize the cross wind risk is based on perceived collective risk which can be expressed the following way:

\[ R_\alpha = HR \cdot N \cdot E \cdot C \cdot F \cdot \alpha \]  

Hereby, \( R_\alpha \) is the perceived collective cross wind risk per train km, HR is the hazard rate (rate of CWC exceedance), N is the number of affected persons (passengers within one train), E is the interval length of exposure of persons to the cross wind hazard (travel time or travel km, respectively), C is the criticality (probability of a cross wind accident in case of a CWC exceedance), F is the fatality (probability to be killed in case of a cross wind accident) and \( \alpha \) is a risk aversion factor.

The guideline Ril 80704 comprises the underlying assumption that all these parameters can be modeled with sufficient accuracy just depending on the train speed v. This approach appears to be extraordinarily charming, since it accounts for the immanent differences between various types of passenger railway operation while keeping the required simplicity and robustness. Against this background the following modeling had been decided:

\[ HR = H_{CWC} \]  

where \( H_{CWC} \) is the rate of CWC exceedance related to train km.

The number of people potentially affected by a cross wind accident is considered to be limited to the number of passengers within the train. This passenger number is considered to be independent of train category and train speed. This might appear quite crucial at the first look, but is surely not implausible when considering passenger numbers of high speed trains (e.g. ICE 3, one unit), IC trains and regional trains (e.g. double-decker trains). Thus, it is:

\[ N \neq F(v) \]  

In a similar pragmatic way the duration of exposure of passengers to a cross wind hazard is considered to be constant; the underlying assumption is that the duration of a typical train ride is independent of train speed. Thus, if E is expressed in terms of travel km, it is:

\[ E \sim v \]  

Regarding the criticality, it can be concluded that C is independent of train speed since the concept of Characteristic Wind Curves ensures that aerodynamic and vehicle dynamic effects are accounted for without making any quality differences for various train speeds. Also for trains running in tilting mode, the criticality shall remain unchanged since the effects of running in tilting mode are accounted for by the CWC concept. Thus, it is:

\[ C \neq C(v) \]  

When the fundamentals of Ril 80704 had been derived, it was addressed and intensely discussed if criticality depends on the “height” of CWC exceedance and, thus, had to be modeled with more complexity. In principle, there is surely a dependence of criticality with respect to the difference
between the wind speed $v_w$ and the characteristic wind speed $v_{CWC}$ given by the Characteristic Wind Curves. However, since the occurrence probability of strong winds in the considered wind speed interval approximately yields an exponential distribution, the height of CWC exceedance can be considered – due to the special characteristics of an exponential function – as first-order solely depending on the rate of CWC exceedance $H_{CWC}$ and, thus, already being accounted for in the decided concept for risk indication.

The fatality is considered to be solely dependent on train speed. A momentum approach would lead to a proportionality with train speed; an energy approach would lead to a proportionality with the squared train speed. After intense discussion with risk experts it had been agreed to strike a balance between these two approaches and model fatality in a pragmatic way:

$$F \sim v^{1.5}.$$  \hfill (6)

For the risk aversion factor, literature provides quite a few approaches which partly show substantial differences. To set up Ril 80704, an approach at apparently medium level was decided:

$$\alpha \sim F^{0.5} \sim v^{0.75}.$$  \hfill (7)

Equations (1) to (7) lead to the following relation between perceived collective risk $R_\alpha$ and the rate of CWC exceedance $H_{CWC}$:

$$R_\alpha \sim H_{CWC} \cdot v^{3.25}.$$  \hfill (8)

3.5 Risk Assessment

The concept for risk assessment states that the tolerable perceived collective cross wind risk shall be independent of train type and train speed (perceived risk already includes the risk aversion). It is

$$R_{\alpha, \text{tol}} = \text{const.}$$  \hfill (9)

and, thus, the tolerable rate of CWC exceedance $H_{CWC}$ becomes:

$$H_{CWC, \text{tol}} \sim v^{-3.25}.$$  \hfill (10)

Hereby, it shall be clearly pointed out that Equations (8), (9) and (10) deal with an interrelationship between perceived cross wind risk and the rate of CWC exceedance. This link must not lead to the misconception that the rate of CWC exceedance displays the rate of a cross wind accident. The CWCs just represent a characteristic and significant state and do not represent the overturning limit. Thus, the rate of CWC exceedance is just some risk indicator but not the rate of a cross wind incident. The absolute probabilities for an exceedance of the CWC and for an incident of overturning are linked by the criticality which in this case is hidden in a proportionality factor.

Based on the described basic principles, the prominent risk indicator within Ril 80704 is the rate of CWC exceedance which has to be equal or smaller than the tolerable rate of CWC exceedance:

$$H_{CWC} \leq H_{CWC, \text{tol}}.$$  \hfill (11)

Within Ril 80704 this prominent parameter $H_{CWC}$ is defined as a rather “local” parameter, namely the CWC exceedance rate averaged over a line section length of 2 km. The approach was chosen since this interval length is small enough to identify and to weight adequately typical line sections with increased cross wind risk like viaducts, bridges, embankments or curves. On the other side, a 2 km interval is big enough to smoothen out potential effects of minor inconsistencies due to the limited resolution of line data. Another argument not to choose a too short averaging interval is that risk assessment shall necessarily refer to a line interval which is larger than the typical extension of a gust and which is larger than the characteristic length linked to a potential overturning of the vehicle.

Different to corresponding work in England and France [6, 1], the German guideline Ril 80704 [2] is based on a relative, non-absolute safety target. Generally, a relative approach incorporates as well advantages and disadvantages:
One major disadvantage of a relative approach is that it requires an appropriate reference case which is well established and which does not lead to “too safe” requirements and thus to “unnecessary” countermeasures or restraints for future innovation. A second major disadvantage of a relative approach is that it does not perfectly support the potential countermeasure of a wind alert system which usually is based on absolute wind speed forecast.

One principle advantage is that a comparative safety proof can be considered as more robust, since potential bias within the whole modeling process is partly compensated. This allows to keep the modeling simple and robust and, thus, allows to introduce and to accept conscious simplifications in the model. Another important motivation to use a comparative approach might be the missing capabilities to decide on agreed absolute safety targets whereas the fundamental statement that so-far train operation is safe might be complete consensus.

In Germany, the relative approach was already established within the first German cross wind guideline [3]. The appropriateness of the relative approach for the German case is firstly founded on the long-term German operational experience also of cross wind-sensitive (regional) rolling stock. Further, the opportunity of model simplification which is linked to a relative approach was considered as very appealing (E.g. it was decided for Ril 80704 to carry out wind tunnel tests rather in “clean laboratory environment” using a block profile and a “true flat ground” than trying to achieve the best match of reality which might require atmospheric boundary layer wind tunnel testing and, perhaps, more complex ground configurations).

4 Cross Wind Safety Target for Passenger Railway Operation as set by Ril 80704

As stated before, Ril 80704 comprises a relative safety proof: the overall cross wind safety target was established on the basis of existing cross wind safety of so-far, long-term, cross wind-sensitive but safe passenger railway operation. Thus, to define the cross wind safety target the new methodology was applied to numerous, rather cross wind-sensitive passenger train services (10 train types) on more than 6,000 line-km within the railway network of DB. The investigated 6,000 line-km include all German high-speed lines, all lines which support active train-tilting and all cross wind-exposed conventional lines. This way a comprehensive “risk map” of cross wind safety of so-far, long established passenger railway operation in Germany was derived. Figure 2 displays an excerpt of this risk map.

![Figure 2: Excerpt of the “risk map” for German passenger railway transportation under strong winds as determined by the procedures provided in Ril 80704 [2].](image)

Due to the developed approach for cross wind risk characterization outlined before, all these data – even if gathered for various train services with different train speeds – yield to comparable information with respect to perceived collective cross wind risk and, thus, contributed to the derivation of the overall cross wind safety target for passenger railway operation in Germany.
The tolerable rate of CWC exceedance as displayed in Figure 2 obeys Equation (10). This functional approach was then suspended on DB’s so-far cross wind safety record. This means, the tolerable rate of CWC exceedance was oriented at the highest cross wind risk, which had a long-term operational record and which, thus, had proven to be acceptable. It appears noteworthy that this reference risk is actually linked to the operation of a regional train near the coast. Consequently, the studies carried out clearly document that – at least under German conditions – cross wind safety is not just a subject of high-speed rail but needs to be addressed also for conventional rail.

On this basis, the guideline Ril 80704 fixes the safety target for German passenger railway operation above 140 km/h – expressed in terms of rate of tolerable CWC exceedance – as

$$H_{CWC} \leq H_{CWC,tol} = 16,400 \cdot (v_{nom} / \text{km/h})^{-3.25} \cdot (1/a)$$

Hereby, the rate of CWC exceedance $H_{CWC}$ is the 2 km gliding average of the local CWC exceedance which refers to the operation of one daily train couple passing through a 100 m long interval. The nominal train speed $v_{nom}$ is the risk weighted average of permissible train speed within the 2 km averaging interval.

5 Requirements on Passenger Rolling Stock and Infrastructure as set by Ril 80704

The reference CWCs which actually fix the share of responsibility between rolling stock and infrastructure had been defined for 5 vehicle classes.

The defined classes for passenger rolling stock are given in Table 1; the defined categories for infrastructure are given in Table 2.

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Vehicles (non-tilting / non-active tilting mode) with a design speed of $v &gt; 230$ km/h</td>
</tr>
<tr>
<td>B</td>
<td>Vehicles (non-tilting / non-active tilting mode) with a design speed of $230 \text{ km/h} \geq v &gt; 200$ km/h</td>
</tr>
<tr>
<td>C</td>
<td>Vehicles (non-tilting / non-active tilting mode) with a design speed of $200 \text{ km/h} \geq v &gt; 160$ km/h</td>
</tr>
<tr>
<td>D</td>
<td>Vehicles (non-tilting / non-active tilting mode) with a design speed of $160 \text{ km/h} \geq v &gt; 140$ km/h</td>
</tr>
<tr>
<td>E</td>
<td>Vehicles (active tilting mode) with a design speed of $160 \text{ km/h} \geq v \geq 140$ km/h</td>
</tr>
</tbody>
</table>

Table 1: Classes for passenger rolling stock as defined in Ril 80704 [2].

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>α</td>
<td>Line sections (non-tilting / non-active tilting mode) with a design speed of $v &gt; 230$ km/h</td>
</tr>
<tr>
<td>β</td>
<td>Line sections (non-tilting / non-active tilting mode) with a design speed of $230 \text{ km/h} \geq v &gt; 200$ km/h</td>
</tr>
<tr>
<td>γ</td>
<td>Line sections (non-tilting / non-active tilting mode) with a design speed of $200 \text{ km/h} \geq v &gt; 160$ km/h</td>
</tr>
<tr>
<td>δ</td>
<td>Line sections (non-tilting / non-active tilting mode) with a design speed of $160 \text{ km/h} \geq v &gt; 140$ km/h</td>
</tr>
<tr>
<td>ε</td>
<td>Line sections (enabling active tilting) with a design speed of $160 \text{ km/h} \geq v \geq 140$ km/h</td>
</tr>
</tbody>
</table>

Table 2: Categories for infrastructure as defined in Ril 80704 [2].

These vehicle classes and line categories reflect special attributes of the German railway system: In Germany, the maximum speed of tilting trains running in tilting mode ($a_q \leq 2.0$ m/s²) is 160 km/h. Whereas customary non-tilting or non-active tilting mode train operation comprises design speed of up to 300 km/h with uncompensated lateral acceleration of up to 1.0 m/s². Further, DB operates lines with design speed of up to 160 km/h which allow different speeds for tilting and non-tilting trains. Thus, a line section might also be assigned to two categories, namely δ and ε. On the DB network, various tilting trains are operated which in analogy are assigned also to two classes, namely e.g. D and E (design speed of 160 km/h in both tilting mode and non-tilting mode) or even B and E (design speed of 230 km/h in non-tilting mode).

As already stated, the requirements for the various vehicles classes are expressed with the help of reference curves. If the Characteristic Wind Curves of the vehicle under investigation exceed the reference curves of the corresponding vehicle class, the vehicle complies with the requirements of Ril 80704 for that vehicle class in question. For tilting trains, compliance with two requirements (for two
vehicle classes) needs to be shown. The requirements for vehicles with customary operation are established in such a way that a vehicle which complies with the requirements for vehicle class A would automatically also fulfil the requirements for the vehicle classes B, C and D. In an analogous way, the compliance with requirements for vehicle class B include those for C and D and the compliance with requirements for vehicle class C include that for class D.

In Germany, railway lines are usually designed to enable operation of all kind of trains. Thus, usually a given line section has to fulfil the following requirements:

- A line section of category α has to meet the various safety targets for vehicles incorporating Characteristic Wind Curves equal to the reference curves of vehicle classes A, B, C and D.
- A line section of category β has to meet the various safety targets for vehicles incorporating Characteristic Wind Curves equal to the reference curves of vehicle classes B, C and D.
- A line section of category γ has to meet the various safety targets for vehicles incorporating Characteristic Wind Curves equal to the reference curves of vehicle classes C and D.
- A line section of category δ has to meet the safety target for vehicles incorporating Characteristic Wind Curves equal to the reference curves of vehicle class D.
- A line section of category ε has to meet the safety target for vehicles incorporating Characteristic Wind Curves equal to the reference curves of vehicle class E.

This way it is ensured, that all kind of railway operation with vehicles compliant to Ril 80704 (e.g. also regional train service on high-speed lines) fulfil the safety targets on the corresponding line sections.

In terms of categories and in terms of stated threshold values, the arrangements made [2] show an optimum split of responsibility between operators and infrastructure. This well balanced split was based on the extensive risk-map studies on existing vehicles and existing infrastructure.

6 Overview over Content of Ril 80704

The guideline Ril 80704 comprises several modules (807.0401 to 807.0449) which generally contain requirements and procedures for cross wind assessment of passenger rolling stock and infrastructure.

For the cross wind assessment of new passenger rolling stock the technical requirements itself are expressed by a pre-assessment procedure and with the help of the provided reference CWCs. Additional requirements on documentation and on technical procedures are also contained. Furthermore, Ril 80704 provides methodological procedures, e.g. for wind tunnel testing, for CWC determination with a quasi-static approach, for CWC determination with a time-dependent MBS approach and for the stability proof for vehicles at standstill.

For the cross wind assessment of new infrastructure, the technical requirements itself are also expressed by a pre-assessment procedure and with the help of the provided safety target and the provided reference CWCs. Additional requirements on documentation and on technical procedures are also contained. Furthermore, Ril 80704 provides methodological procedures, e.g. for line study, for the meteorological study, for the determination of the CWC exceedance rate and recommendations for the planning of infrastructure.

7 So-far Application Practice of Ril 80704 and Outlook

The guideline Ril 80704 is in force since April 2006 and became also part of the homologation of passenger rolling stock in Germany. The incorporated requirements for high speed railway operations are in line with the current drafts for the Technical Specifications for Interoperability resulting from European directives on the interoperability of the European railway system. Major methodological parts of Ril 80704 had been transferred into a European draft standard on cross wind (prEN 14067-6: 2007).

So-far application experience with Ril 80704 is very positive: numerous cross wind safety proofs had been carried out by DB experts and also by specialists of manufacturers, other operators and engineering consultants. Apparently, the requirements and test procedures are transparent and robust enough to be applied also by third-party specialists. Thus, the guideline Ril 80704 with its clear and
balanced regulations also supports private and foreign operators when aiming for access to the DB infrastructure.

Due to the introduction of Ril 80704, DB was able to re-assess and to partially suspend the necessity of existing operational restrictions due to cross wind. For the new high-speed line Nuremberg-Ingolstadt which went into operation in 2006, several km of already planned wind barriers could be set aside. Beside the benefit of reduced costs for cross wind measures, Ril 80704 did also generate an economic benefit due to the reduction of costs for carrying out the cross wind safety proof. Here, the clear split between rolling stock and infrastructure assessment as well as the newly arranged meteorological approach led to a substantial cut of costs and process time. It should be clearly stated that these benefits had not been attained at the prize of reduced safety: The guideline Ril 80704 with its consistency and comprehensiveness safeguards in the best way that the so-far cross wind safety level in German passenger railway transportation is kept.

Currently, the development of an analogous methodology to assess cross wind safety of cargo railway operation is in progress. It is scheduled to have corresponding requirements and procedures for cargo railway operation included in the first revision of Ril 80704.

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