RK/bg

M. CHÂTEL
Chef du Service Locomotives
Cie des Ateliers et Forges
de la Loire
12, Rue de la Rochefoucauld
PARIS 9^e , France

DVL. 6008/1180 May 2, 1955   144/L-Div.   May 11, 1955

Dear Sir,

I thank you for your letter of May 2 and wish to make the following statement.

The discussion at C.E.L.T.:s meeting in Paris April 21, 1955 indicated, I think, the different subjects which should be taken up at the meeting in Utrecht May 20 and 21, among which I would like to mention:

1. Licence. Our firm is not in a position to, without reservation grant a construction licence to any other competing European firm asking for it.

2. Drawings. We are prepared to let the railroads use the drawings for maintenance and repairs only, but not for building new locomotives.

3. Proposals. It should be clearly understood that only firms belonging to C.E.L.T. would be allowed to send in proposals.

4. O.R.E.-Railroads. A statement should be made to the effect that railroads belonging to the O.R.E. are prepared to accept O.R.E:s decision regarding the proposals.

M. CHÂTEL, Cie des Ateliers et Forges de la Loire, Paris
_____

5. <u>Number</u> of locomotives of each type of submitted proposals should be agreed upon.

6. <u>Duty.</u> Accepted locomotive proposals should be duty-free.

7. <u>O.R.E:s decision.</u> The O.R.E. should be compelled to submit to the C.E.L.T a thorough statement of the reason why a certain proposal has been accepted. The C.E.L.T. or a committee chosen by C.E.L.T. should then have the right to examine and make comments before the final decision is made.

        I remain,

           Yours faithfully,

NYDQUIST & HOLM A.G.

TROLLHATTAN

(Suède)

C E L T   PARIS LE   9 Août   19 55

Messieurs,

CONSULTATION GENERALE

A la demande de plusieurs d'entre vous, nous invitons par la présente, au nom de M. DUE-PETERSEN, chacun des Participants CELT à se faire représenter à une Réunion Plénière CELT qui aura lieu le

Mardi 13 SEPTEMBRE 1955 à 10 Heures

à DUSSELDORF à l'Hôtel Breitenbacher Hof

Veuillez trouver en annexe à la présente :

1) - l'Ordre du Jour proposé de la Réunion Plénière

(Document 449)

2) - A titre d'information la liste (Document 447) des 20 Constructeurs généraux non invités par l'O.R.E. à la première Conférence avec l'Industrie le 1er Mai 1953 à Utrecht, et qui ne participent donc pas à la CELT, mais consultés par l'O.R.E. en vue de leur éventuelle soumission de propositions de Locomotives Diesel Standard.

Nous prions chacun des Participants CELT de bien vouloir nous confirmer avant le 1er Septembre 1955 sa participation à cette Réunion en précisant le nom et le titre de son Délégué.

Les réservations d'Hôtel devront être effectuées d'urgence directement par chaque Délégué. Outre l'Hôtel Breitenbacherhof (- Téléphone : 86 - 01 à Düsseldorf
Télégramme : Breitenbacher - Düsseldorf)
où se tiendra la réunion, nous recommandons également

-le Park Hotel (Téléphone 89 - 81)
- le Savoy - l'Eden

Veuillez agréer, Messieurs, l'expression de nos sentiments distingués.

Annexes   144 - 123 - 158   Le Secrétaire Général,

ASSOCIATION INTERNATIONALE DES CONSTRUCTEURS DE MATERIEL
ROULANT

Paris den 9 augusti 1955

Nydqvist & Holm AB
Trollhättan

ALLMÄN KONSULTATION

På begäran av många bland Er inbjuda vi härmed å herr
DUE-PEDERSENS vägnar var och en av deltagarna i CELT
att låta representera sig vid en plenar-församling CELT
som skall äga rum

<p style="text-align:center;">tisdagen den 13 SEPTEMBER 1955 kl. 10</p>
<p style="text-align:center;">i DUSSELDORF   på Hôtel Breitenbacher Hof</p>

Närslutet översändes:

1) Dagordning   föreslagen för plenar-församlingen
(dokument 449)

2) För Eder ledning:listan (dokument 447) över de 20
allmänna tillverkare icke inbjudna av O.R.E. till
den första konferensen med Industrin den 1 maj 1953
i Utrecht och vilka alltså icke deltaga i CELT,
men konsulteras av O.R.E för att de eventuellt skola
inlämna anbud på standard diesellok.

Vi be var och en av deltagarna i CELT att
godhetsfullt vilja bekräfta före den 1 september 1955
sitt deltagande i detta sammanträde och att precisera
namnet och titeln på sin delegerade.

Hotellbeställningar böra ske snarast direkt
av varje delegerad. Utom Hôtel Breitenbacher (-telefon:
86 - 01 i Düsseldorf),
där sammanträdet skall äga rum, rekommendera vi likaså
- Park Hotel (telefon 89 - 81)
- Savoy - Eden

Högaktningsfullt
Generalsekreteraren

Bilagor

Översättning OH

CONSTRUCTEURS EUROPEENS DE LOCOMOTIVES A MOTEURS THERMIQUES

c/o A.I.C.M.R.   4, Avenue Hoche - Paris 8

PLENAR-FÖRSAMLING   CELT

tisdagen den 13 september 1955 kl. 10
i DUSSELDORF Breitenbacher Hof

DAGORDNING

Granskning av eventuella iakttagelser (anmärkningar) av de
firmor som ha för avsikt att besvara den allmänn konsultation
som O.R.E. gjort hos industrin, särskilt vad beträffar följande
punkter:

1) Betydelsen för tillverkarna att erhålla meddelande om
    programmet för Europeiska Administrationen -erna för Järnvägarna
    vad beträffar, för de 5 närmaste åren, deras order av
    standard disellok för de fastställda typerna.

2) Undersökning av möjligheten att bilda grupper av till-
    verkare för insändandet av förslag till O.R.E.

3) Studerande av principen för överföring av licensrättigheter
    och patent (Se punkt A - 3 av dokument I).

4) Undersökning av de närmare omständigheterna beträffande
    notifikationen till tillverkarna om resultaten av den första
    konsultationen vid Internationella Järnvägsunionens
    direktionskommittés sammanträde (Se brev från O.R.E. av
    den 20 juli 1955 sid. 3 - 6 - b).

5) Diverse frågor.

CONSTRUCTEURS EUROPEENS DE LOCOMOTIVES A MOTEURS THERMIQUES

c/o A.I.C.M.R   4, Avenue Hoche - Paris 8

REUNION PLENIERE C E L T

Mardi 13 SEPTEMBRE 1955 à 10 Heures

à DUSSELDORF Breitenbacher Hof
==========

ORDRE DU JOUR

Examen des observations éventuelles des Firmes se proposant de répondre à la Consultation générale de l'Industrie par l'O.R.E., notamment en ce qui concerne les points suivants :

1) - Importance pour les Constructeurs de recevoir communication du programme des Administrations Européennes de Chemin de fer en ce qui concerne, pour les 5 prochaines années, leurs commandes de locomotives Diesel Standard pour les types retenus.

2) - Examen de la possibilité de constituer des groupements de constructeurs pour la remise de propositions à l'O.R.E.

3) - Etude du principe de transferts des droits de licences et brevets (Voir point A - 3 du Document I).

4) - Examen des modalités de notification aux Constructeurs des résultats de la consultation préalablement à la Réunion du Comité de Gérance de l'Union Internationale des Chemins de fer (Voir lettre de l'O.R.E. du 20 Juillet 1955 page 3 - 6 - b).

5) - Questions diverses.

CONSTRUCTEURS EUROPEENS DE LOCOMOTIVES A MOTEURS THERMIQUES

LD N° 447   4 Av. Hoche - Paris 8e

LISTE DES   Lista över
CONSTRUCTEURS GENERAUX NON-CELT   allmänna till-
                                             verkare icke-CELT
CONSULTES PAR L'ORE POUR LA   som tillfrågats
REMISE DE PROPOSITIONS DE LOCOMOTIVES DIESEL STANDARD   av ORE för
                                             insändande av
                                             anbud på
Tillverkare från länder redan representerade i CELT   standard diesel
I - Constructeurs de Pays déjà représentés à la CELT   lok.

ALLEMAGNE

- Maschinenfabrik GMEINDER & Co   Mosbach/Baden

GRANDE-BRETAGNE x)
        Tillverkare-medlemmar av LMA
a) Constructeurs Membres de la LMA

- BRUSH BAGNALL Traction Ltd.   Loughborough
- The DREWRY CAR C° Ltd.   London E.C.
- The HUNSLET ENGINE C° Ltd.   Leeds
- The VULCAN FOUNDRY Ltd.   Newton-le-Willows
                                             (Lancashire)
- ROBERT STEPHENSON &   Darlington
  HAWTHORNS Ltd.
        Tillverkare-icke medlemmar av LMA
b) Constructeurs non-Membres de la LMA

- W.G. BAGNALL Ltd.   Stafford
  Castle Engine Works
- The GENERAL ELECTRIC C° Ltd.   London W.C.2.

ITALIE

- SAVIGLIANO S.p.A.   Torino
- TECNOMASIO ITALIANO   Milano
  BROWN BOVERI S.p.A.
- O.C.R.E.M., Officina Costruzioni   Napoli
  e Riparazioni Elettromeccaniche
  S.p.A.
- BADONI, Ditta Badoni   Lecco (Milano)

SUEDE

- SVENSKA JÄRNVÄGSVERKSTÄDERNA   Linköping
- AB MOTALA Verkstad   Motala V

. . . . . .

---

x) NOTA: D'autre part, la LMA a fait parvenir un jeu des Documents
         de la Consultation à sa Firme-Membre = RUSTON & HORNSBY

   OBS.: Dessutom har LMA låtit utsända en sats av dokumenten från för-
         frågningen hos dess medlemsfirma RUSTON & HORNSBY

Tillverkare från länder som icke äro representerade i CELT

II - <u>Constructeurs de Pays non représentés à la CELT</u>

<u>ESPAGNE</u>

- Sen. José Manuel BERNAR,
  Ingeniero Industriel,   Bilbao
  Compania EUSKALDUNA

- La MAQUINISTA TERRESTRE
  y MARITIMA SA.   Barcelona

- La CONSTRUCTORA NAVAL   Madrid

<u>NORVEGE</u>

- A/S THUNES Mek. Verksted   Oslo

<u>YOUGOSLAVIE</u>

- Tvornica lokomotiva
  strojeva i mostova   Slavonski Brod
  DJURO DJAKOVIC

Tillverkare som ha sin adress i Paris

III - <u>Constructeur ayant son adresse à Paris</u>

- INTERNATIONAL GENERAL
  ELECTRICAL COMPANY   Paris

International Union of Railways
UIC
OFFICE FOR RESEARCH AND EXPERIMENTS
ORE

Utrecht, 15th September 1955.
Moreelsepark 1
Tel. 15871/1483

ORE/C9c/12.446e

3 enclosures

To all persons concerned with the
competition opened by ORE on the
problem of hunting.

Dear Sir,

As indicated on page 3, item II.1, of the Conditions of
the Competition, I have pleasure in sending you herewith circular
letter No. 1.

This circular letter takes into account some modifications
and additions to the Conditions of the Competition, together with
questions put forward by participants and the replies of the
Adjudicating Committee.

Yours sincerely,

Dr. Ir. F.Q. den Hollander,
President.

International Union of Railways
    UIC
OFFICE FOR RESEARCH AND EXPERIMENTS
    ORE

MR.

Enclosure to letter ref.
ORE/C9c/12.446e of 15.9.1955.

Question C 9c: Competition for a solution
            of the problem of hunting

2 enclosures

Circular letter No. 1
to all persons who have
asked for the conditions of the competition

The Adjudicating Committee of the competition met in Utrecht on 15th June 1955, and decided to send this circular letter, through the medium of the ORE bureau, to all persons who have asked for conditions of the competition, in order to furnish them with the following information:

I. Modifications or additions to the Conditions of the Competition.

1) Drawing attached to appendix 1

Owing to an error in drawing, the curve entitled "rail profile" should be replaced by a new curve, the numerical values of which (in mm) are as follows:

abscissa	ordinate	abscissa	ordinate	
20	0.08	10	0.78	
18	0.04	12	0.93	
16	0.02	14	1.10	
14	0.01	16	1.29	The
12	0	18	1.51	abscissae
10	0.01	20	1.77	are
8	0.03	22	2.09	recorded
6	0.06	24	2.47	from
4	0.10	26	2.94	left to
2	0.16	28	3.53	right.
0	0.23	30	4.39	
2	0.31	32	5.70	
4	0.40	34	7.58	
6	0.51	36	10.58	
8	0.64	37	13.75	

The curve "inclination of the rail profile" remains unchanged.

2) Appendix 1. Page 1 of the English text only.
   Line 31: Replace "4.5 tonne/sec./m." by 4.5 tonne sec /m."

3) Appendix 2. Page 10 of the German text only.
Replace the first sentence of the third paragraph by the following text:
"Es wird empfohlen, für den Fall des Beharrungszustandes die Beziehung zu suchen zwischen
1) einem die Stärke der Bewegungen charakterisierenden Parameter,
2) der Fahrgeschwindigkeit,
wenn die übrigen Parameter bestimmte Werte haben."

4) Appendix 2. Page 10 (English and French texts),
Page 9 (German text).
The foot-note*should be struck out and replaced by:
"These contacts in fact are very complex, not only they are not holonomous but they cause forces which are not derived from a potential."

5) Appendix 2. Chapter V.
By way of notification, the enclosed notice (appendix 1) is sent for information purposes.

6) Appendix 3. Bibliography, Page 3.
Add the following 3 articles:
MINDLIN, R.D. Compliance of Elastic Bodies in Contact.
Journ. Appl. Mech. 16, 1949, p. 259-268;
HEINRICH, G. Zu L. Föppls Theorie der rollenden Reibung.
Österreich. Ing.-Archiv 4, 1950, p. 363-375;
PORITSKY, H. Stresses and Deflections of Cylindrical Bodies in Contact with Application to Contact of Gears and of Locomotive Wheels. Journ. Appl. Mech. 17, 1950, p.191-201, 465-468.

II. Questions put forward by the competitors and answers of the Adjudicating Committee.

Letter No. 1

"As I presume you are interested in a solution for passenger coaches, and as my thesis will be with these vehicles chiefly in mind, could you please tell me:

1) The overall length of a coach

2) The distance between bogies, i.e. between centres

3) The outline of the end portion of a coach to see what is the greatest wheel diameter possible

4) The plan view of a coach on a maximum curve in a station platform to see that no fouling of the centre of the coach will take place with the edge of the platform

5) The maximum bogie loading for a passenger coach."

Reply:

The object of the Competition, set out in detail in Chapter I of the Conditions, indicates that the study will essentially be made on the comparatively simple case of a two-axled vehicle rolling on straight track. As a secondary matter, it is desirable to mention in what way the method can be extended, i.e. to bogie vehicles and to travelling in circular curves.

So there is no reason to give numerical answers to the questions put forward in letter No. 1

Letter No. 2

"1) Quel est le rayon du bombement, au moins dans la partie centrale, du champignon du rail, à l'état neuf?

2) Quel est le rayon de l'arrondi des parties terminales du champignon à l'état neuf ?

3) Quelle est l'inclinaison du profil du boudin, à l'état neuf ?

4) Quelle est la flexibilité verticale de la voie, entre les limites d'élasticité, en mm/tonne ?"

Translation:

1) What is the radius of curvature, at least in the central part, of the rail-head, in new condition ?

2) What is the radius of the rounded portion of the end parts of the head in new condition ?

3) What is the inclination of the flange profile, in new condition ?

4) What is the vertical flexibility of the track, between the limits of elasticity, in mm/tonne ?

Reply:

1 and 2. New rail. Enclosed rail profile 54 kg/m standardized by UIC (see appendix 2).

3. Approximately 60°.

4. The order of magnitude of the vertical deflection of the track can be put at 0.1 mm under an axle-load of 1 tonne (i.e. 0.5 tonne per wheel).

Letter No. 3

"Je désirais connaître:

a) Coefficient de flexibilité torsionnelle du châssis du véhicule spécial (Annexe 1) selon l'axe longitudinal (radiants/tonne x m.).
Cette flexibilité torsionnelle, dans l'étude du lacet de pivotement, donne un effet analogue à la flexibilité des roues et des rails, dont le coefficient est de 0,7 mm/tonne.

b) Coordonnées (hauteur par rapport aux rails, distance horizontale au centre du véhicule) du point d'application de l'effort de traction.
Ces données sont nécessaires pour l'étude du lacet du véhicule spécial en cas de traction. "

Translation.

I should like to know:

a) Coefficient of torsional flexibility of the frame of the special vehicle (Appendix 1) in accordance with the longitudinal axle (radiants/tonne x m).
This torsional flexibility, in the study of pivot hunting, gives an effect similar to the flexibility of wheels and rails, the coefficient of which is 0.7 mm/tonne.

b) Coordinates (height with respect to the rails, horizontal distance to the centre of the vehicle) from the point of application of the tractive effort.
This information is necessary for the study of hunting of the special vehicle in the case of traction.

Reply:

a) The coefficient of torsional flexibility of the body of the special vehicle mentioned in appendix 1 can be put at zero.

b) Average height of the traction axle above the top of the rails for the special vehicle mentioned in appendix 1: 1000 mm.
Horizontal distance from the point of application of the tractive effort to the transversal plane of symmetry of the vehicle: 0 mm.

Letter No. 4

"Eine Schwierigkeit ist, dass wir die Arbeit in fremden Sprachen machen müssen. Es ist ja klar, dass ein jeder der dem Konkure teilnehmen will, einige fremde Sprachen, wie Deutsch, Französisch, Englisch, Russisch usw. spricht. Es ist aber ein grosser Unterschied ob man Bücher - obwohl auch Fachbücher - liest, plaudert, Briefe schreibt usw., oder an einem weltberühmten Konkure teilnehmen will. Das Urteil ist von dem Stile der Arbeit sehr beeinflusst! Wenn ich auch von jemand übersetzen lasse, ist es nicht sicher, dass er auch in Sprache und auch in Fachkunde vollkommen perfekt sein wird und die Übersetzung auch stilistisch meinem Stile konvenieren wird.

Und nicht in der letzten Reihe wird er 500-600 Ft. als Lohn verlangen. Das ist ein grosser Nachteil den deutschen und französischen Konkurrenten gegenüber !

Ich hatte gehofft, dass es einer so grossen weltinteressierten Kooperation wie Ihnen den fremden Text übersetzen zu lassen keine Schwierigkeiten machen wird.

Anlage 4, Seite 1, Zeile 11:
1: als Formelzeichen zu brauchen ist nicht günstig weil man mit Schreibmaschine auch das Nummer 1 mit der Buchstabe l bezeichnet.

Seite 2.
Warum bezeichnen wir nicht die Kräfte mit K, und die Längs-
kräfte mit K_L ?
Und den Berührungspunkt mit P und das Energie mit A/Arbeit ?

Anlage 1 - Zeile von unten: 10
Dämpfung: 4,5 t sec/m.
Wie kann das möglich sein ? Bisher wusste ich, dass die Öl-
Dämpfung als Dimension sec^2/m^2 hat, also zweimal grosse Ge-
schwindigkeit viermal so grosse Kraft veranlangt
$/PS = \frac{1}{2} mv^2/$.

In Zeile 17 von oben: 0,07 t/Masse/m^2, dass heisst
700 kg $cm^{-1} sec^2$?

Wir haben vom Geleise keine Auskünfte bekommen. Wenn wir
zahlenmässig arbeiten müssen, muss ich wissen die longitudi-
nale Elastizität der einzelnen Schienen und des Geleises.
Während des Schlingerns ändern sich die Laufkreishalbdurch-
messer und deshalb, weil die Räder mit der Achse zusammenge-
bunden sind, will eine der Schienen sich vorwärts, die andere
sich nach hinten bewegen. Diese Bewegung kann gegenüber der
Torsion der Achse und Elastizität des Geleises stattfinden.

Woraus entsteht das Schlingern, wenn alles unwahrscheinlich
präzis ist ? Wenn die Laufkreise dieselben, wenn der Winkel
der Achse vollkommen rechteckig, wenn das Geleise theoretisch
linear weder in der waagerechten noch in der senkrechten
Ebene eine Krümmung hat, wenn es keine Zug- und Bremskräfte
gibt - ich gebe noch dazu, wenn es keinen Wind gibt und der
Zug in Direktion West-Ost führt, kann man nicht von einer
anderen als nur geraden Bewegung sprechen.

Anlage 2, Seite 11
Ich glaube, es wäre gut wenn diese Gleichungen ein wenig mehr
verstehbar gemacht werden könnten."

Translation

One of the difficulties is that we have to do the study in
a foreign language. It is clear that everyone wishing to
take part in the competition should know some foreign
languages, such as e.g. German, French, English, Russian, etc.
There is, however, a great difference between reading books,
even technical ones, speaking, writing letters etc.,
and taking part in a world-famous competition. Its adjudi-
cation is influenced to a great extent by the style of the
article. If I have it translated, it is nevertheless not
certain that it is perfect as regards language and technical
terminology, and that the style of the translation conforms
to my original style.

It is necessary moreover to pay a fee of 500 to 600 Ft. This
is a great drawback as compared with the German and French
participants.

I had hoped that it would not have been difficult for a
large and renowned association like yours to have the text
translated into a foreign language.

Appendix 4, page 1, line 11
It is not favourable to use "l" as a notation for formulae
because with a typewriter the same symbol is used for the
figure 1.

Page 2
Why do not we indicate:
forces by K, longitudinal forces by K_L ?
the point of contact by P, the energy by A (work) ?

Appendix 1, 10th line from the bottom.
Damping: 4.5 t sec/m.
How is this possible ? Hitherto, I have known that the
dimension of viscous damping is: sec^2/m^2, i.e. that twice
as great a speed needs four times as great a force.
$/PS = \frac{1}{2} mv^2/$

In the 17th line from the top, $0.07t/mass/m^2$, i.e. 700 kg $cm^{-1}sec^2$?

We have not had any information on the track. When working
with a numerical notation, I must know the longitudinal
elasticity of each of the rails and the track. The radii
of rolling are altered during the hunting movement and, conse-
quently, one of the rails will move forward, the other back-
ward, owing to the fact that the wheels are fixed on the axle.
This movement can take place in the opposite direction to
the torsion of the centre line and the elasticity of the track.

How does the hunting movement occur, if everything is
impossibly precise ? When the rolling circles are the same,
when the axle makes a perfect right-angle with the track,
when the track is perfectly rectilinear and has no curvature,
neither in the horizontal nor in the vertical plane, when there
is neither tractive nor braking power and when moreover there
is no wind and the train travels in easterly direction,
one can only speak of the term "movement in a straight line".

Appendix 2, page 11.
I think it would be useful if these equations could be made
a little clearer.

Reply:

The condition that a reply is to be drawn up in at least
one of the three languages: German, English or French, has
been stipulated in order to make the work of the Adjudicating
Committee easier. Such a condition is customary in interna-
tional scientific competitions.

Appendix 4, page 1.
In a typewritten thesis, if there is fear of confusion between
the letter l and the figure 1, the letter "l" can in formulae
always be designated by the hand-written symbol " ℓ ".

Page 2.
A limited standardisation of notations is introduced in order
to make the work of the Adjudicating Committee easier. It
presents a compromise between the standardisations of the German,
English, French and Dutch notations.

Appendix 1

The value 4.5 t sec/m of the damping represents the force per unit speed of the damper and not a power. As is set forth in the Conditions of the Competition under I, it can be admitted that the force of the damper is proportional to the speed of relative displacement, and not to the square of the speed.

In line 17 it does not read "0.07 t/mass/m^2", but "0.07 t(mass)m^2".

As is indicated in appendix 2, an irregular movement of a railway vehicle may occur, due to the phenomenon of creep, even when track and wheels are fully rigid.

Appendix 2

The equations indicated are relations between the reduced tangential force τ and the slip υ , which are implied in these equations. If necessary, it is always possible to write these equations in such a form that, for example, τ is expressly shown.

———

International Union of Railways
UIC
OFFICE FOR RESEARCH AND EXPERIMENTS
ORE

Question C 9c

Note on the values of the coefficient
of friction μ and the creep coefficient κ

In Chapter V of Appendix 2 to the "Conditions of the Competition" no indication is given about the numerical values of the coefficient of friction μ and the creep coefficient κ .

Competitors, who have not carried out research in the field of creep themselves, can use the following values for these coefficients:

a) For the coefficient of friction μ : 0.3 for a dry rail, and
   0.2 for a wet rail.

b) For the coefficient κ : $\kappa = \dfrac{E\,ab}{N}$,

approximate formula, where

E represents the modulus of elasticity of the material of rail and tyre;
N the normal force at the point of contact;
a half the major axis of the ellipse limiting the contact area;
b half the minor axis of this ellipse.

When applying this formula to the vehicle described in appendix 1, in its central position, we have at the point of contact respectively:

- a radius of curvature of the rail, determined by the transversal plane of principal curvature : $\rho_y \approx 255$ mm;
- a radius of curvature of the tyre, determined by the longitudinal plane of principal curvature : $\rho_x^* \approx 500$ mm;
- a radius of curvature of the tyre, determined by the transversal plane of principal curvature: $\rho_y^* \approx 300$ mm.

We find then

for half the major axis of the ellipse: a = 10.2 mm, and
for half the minor axis of the ellipse: b = 4.9 mm;

the direction of the major axis being transversal.

With $E = 2.1 \cdot 10^4$ kg/mm^2 and N = 6000 kg we have:

$\kappa = 174.$

PROFIL UNIFIÉ DE RAIL

à 54 kg/m

STANDARD RAIL SECTION

54 kg/m

EINHEITSPROFIL FÜR SCHIENEN

von 54 kg/m

Caractéristiques du rail: (valeurs approximatives)	Characteristics of the rail: (approximate values)	Technische Daten: (angenäherte Werte)			
Section	Section	Querschnitt	F	$=$	69,34 cm2
Poids théorique par m1	Theoretical Weight per m1 ..	Theoretisches Gewicht per lfd.m	G	$=$	54,43 kg/m
Moment d'inertie par rapport à l'axe neutre X-X	Moment of Inertia X-X	Trägheitsmoment bez. horizontaler Schwerachse X-X	J_x	$=$	2346 cm4
Moment d'inertie par rapport à l'axe vertical Y-Y	Moment of Inertia Y-Y	Trägheitsmoment bez. vertikaler Schwerachse Y-Y	J_y	$=$	417 cm4
Moment de résistance par rapport au champignon	Section Modulus - Top	Widerstandsmoment bez. Schienenkopf ..	W_{x_K}	$=$	279,19 cm3
Moment de résistance par rapport au patin	Section Modulus - Bottom ...	Widerstandsmoment bez. Schienenfuss ..	W_{x_F}	$=$	312,93 cm3
Élancement	Ratio $\frac{height}{width}$	Standfestigkeitszahl		$=$	1,136

(Unités métriques)
(Metric System)
(Metrische Einheiten)

PROFIL UNIFIÉ DE RAIL
à 54 kg/m
STANDARD RAIL SECTION
54 kg/m
EINHEITSPROFIL FÜR SCHIENEN
von 54 kg/m

70
19

r=13
1:20
R=80
R=300
R=300
1:20
r=3
1:2,75
1:2,75
r=8
r=22
R=508
R=508
16

49,4
25,4
79,4

axe neutre
line of centre of gravity
Schwerachse

159

r=16
r=20
1:2,75
1:2,75
1:10
1:10
r=3
r=2

74,97

76,2
30,2
11

140