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Subject: railML 2.3 infrastructure extension proposal tunnel resistance factor

Posted by [Torben Brand](#) on Tue, 20 Dec 2016 17:32:53 GMT

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Dear railML infrastructure forum,

This posting contains the discussion to an extension towards the tunnel

In most runtime calculation software the tunnel resistance factor is calculated. We suggest to indicate a simple tunnel resistance factor (A) for the simple additional tunnel resistance formula:  
 $F(\text{tun}) = A \times V^2$  [V]=km/h

The element <tunnel> is extended with the new attribute @NO:tunnelResistancefactorA [datatype integer].

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Subject: Re: railML 2.3 infrastructure extension proposal tunnel resistance factor

Posted by [christian.rahmig](#) on Mon, 02 Jan 2017 16:30:48 GMT

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Dear Torben,

Am 20.12.2016 um 18:32 schrieb Torben Brand:

> [...]  
> tunnel  
> In most runtime calculation software the tunnel resistance  
> factor is calculated. We suggest to indicate a simple tunnel  
> resistance factor (A) for the simple additional tunnel  
> resistance formula:  $F(\text{tun}) = A \times V^2$  [V]=km/h  
> The element <tunnel> is extended with the new attribute  
> @NO:tunnelResistancefactorA [datatype integer].

railML.org philosophy so far was to primarily model explicit infrastructure parameters and to derive other parameters where possible. The tunnel resistance factor is a secondary parameter that is influenced by:

- \* the ratio of train cross section and tunnel cross section
- \* the length of the tunnel
- \* the roughness of the tunnel wall

The tunnel wall roughness is given by the attribute <tunnel>@kind, where the wall material (natural stone, quarystone, brick, concrete) can be specified. The attribute <tunnel>@length defines the length of the tunnel. The tunnel's cross section area is given with the parameter <tunnel>@crossSection. Taking into consideration that the train's cross section area can be derived from the clearance gauge profile, all parameters that are required for calculating the tunnel resistance factor are available.

However, calculating a tunnel resistance factor remains complex. So, I

see two options for improvement: Either, the formula for calculating the tunnel resistance factor is provided in the railML wiki (see [1]) or an attribute for a calculated tunnel resistance factor is introduced. The latter solution allows for applying different formulas for calculating the tunnel resistance factor while the first solution would unambiguously define the way to calculate the factor.

Dear community, what are your preferences?

[1] <http://wiki.railml.org/index.php?title=IS:tunnel>

Best regards  
Christian

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Christian Rahmig - Infrastructure scheme coordinator  
railML.org (Registry of Associations: VR 5750)  
Phone Coordinator: +49 173 2714509; railML.org: +49 351 47582911  
Altplauen 19h; 01187 Dresden; Germany [www.railml.org](http://www.railml.org)

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Subject: Re: railML 2.3 infrastructure extension proposal tunnel resistance factor  
Posted by on Thu, 19 Jan 2017 18:50:29 GMT  
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Dear Christian and Torben,

> Dear community, what are your preferences?

I can of course not write for all the community... ;-) But possibly you do not expect a consolidated answer. At least, I have considerable experience with tunnel resistance.

As written in both of your posts, the tunnel resistance is (as far as I know) represented by a factor which increases the "normal" air resistance. (The tunnel resistance is a special kind of air resistance.) To be exactly, the air resistance is represented by the formula  $F_{w,air} = 0,5 \cdot \rho \cdot c_W \cdot A \cdot v^2$  and the tunnel resistance raises the  $c_W$  of the vehicles.

I totally agree with Christian that this factor depends on the three named parameters, especially on the ratio of train cross section and tunnel cross section, also by the ration of train length and tunnel length. I am convinced that all necessary values can be modelled in railML 2.x.

I would see no advantage in a rather "empiric" solution like

> resistance formula:  $F(tun) = A \cdot v^2$  [V]=km/h

but if  $F(\text{tun})$  is the (absolute) tunnel resistance ( $F$ =force in kN?), it leads to the question: Does that tunnel resistance replace the air resistance or is it additional?

I think for railML we should leave it by the attributes necessary for the tunnel resistance factor, without any formula.

But this is, of course, my opinion only...

With best regards,

Dirk.

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Am 02.01.2017 um 17:30 schrieb Christian Rahmig:

> Dear Torben,

>

> Am 20.12.2016 um 18:32 schrieb Torben Brand:

>> [...]

>> tunnel

>> In most runtime calculation software the tunnel resistance

>> factor is calculated. We suggest to indicate a simple tunnel

>> resistance factor (A) for the simple additional tunnel

>> resistance formula:  $F(\text{tun}) = A \cdot V^2$  [ $V$ ]=km/h

>> The element <tunnel> is extended with the new attribute

>> @NO:tunnelResistancefactorA [datatype integer].

>

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> The tunnel resistance factor is a secondary parameter that is influenced

> by:

> \* the ratio of train cross section and tunnel cross section

> \* the length of the tunnel

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> the wall material (natural stone, quarystone, brick, concrete) can be

> specified. The attribute <tunnel>@length defines the length of the

> tunnel. The tunnel's cross section area is given with the parameter

> <tunnel>@crossSection. Taking into consideration that the train's cross

> section area can be derived from the clearance gauge profile, all

> parameters that are required for calculating the tunnel resistance

> factor are available.

>

> However, calculating a tunnel resistance factor remains complex. So, I

> see two options for improvement: Either, the formula for calculating the

> tunnel resistance factor is provided in the railML wiki (see [1]) or an

> attribute for a calculated tunnel resistance factor is introduced. The

> latter solution allows for applying different formulas for calculating  
> the tunnel resistance factor while the first solution would  
> unambiguously define the way to calculate the factor.  
>  
> Dear community, what are your preferences?  
>  
> [1] <http://wiki.railml.org/index.php?title=IS:tunnel>  
>  
> Best regards  
> Christian  
>

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Subject: Re: railML 2.3 infrastructure extension proposal tunnel resistance factor  
Posted by [Torben Brand](#) on Fri, 24 Feb 2017 15:01:11 GMT  
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My answer to Christian Rahmig and Dirk Bräuer:  
The correct way would of course be to calculate from the parameters you both describe (but not exhaustively). But all our tools use a simpler approach for calculating runtimes use the described much simpler approach. Thus we need to cater to these tools as we need to fulfill the capacity planning use case in railML. The formula used is the same in all tools used by the Norwegian railway directorate (Opentrack, TRENO, LUKS). But other (more complex) formulas exist. So it's important to uniquely identify the factors and specify for which formula the factor is used. Since we are the first we chose the factor "A". Further factors "B" and so on. This must of course be described in the Wiki. The tunnel resistance factor "A" is used in a formula the forms an additional tunnel resistance to the air resistance. This according to:  
[http://e-collection.library.ethz.ch/eserv/eth:24236/eth-2423\\_6-02.pdf](http://e-collection.library.ethz.ch/eserv/eth:24236/eth-2423_6-02.pdf) page 55 and 56.

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Subject: Re: railML 2.3 infrastructure extension proposal tunnel resistance factor  
Posted by [christian.rahmig](#) on Mon, 16 Nov 2020 14:11:50 GMT  
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Dear all,

let me come back to the topic of tunnel resistance factors in order to decide whether they shall be implemented with railML 2.5:

I had a look at Dr. Hürlimann's PhD thesis, page 55f mentioned by Torben [1]. The tunnel resistance factor shall be used to calculate an additional resistance due to the tunnel parameters based on the equation  $R(\text{tun})=A \cdot v^2$  where  $v$  describes the speed of the train in [m/s] and  $R(\text{tun})$  is given in [N]ewton. Consequently, the tunnel resistance factor  $A$  shall be given in [kg/m]. As described in [1], for a train travelling outside of a tunnel,  $R(\text{tun})=0$  applies.

So, considering that we will put all the required background information (as mentioned in [1]) into the railML wiki, do you have any doubts to add a new attributes

<tunnel>@resistanceFactorPassenger and <tunnel>@resistanceFactorFreight? A Trac ticket #426 [2] has been filed for solving the issue. Your feedback is very much appreciated.

[1] <http://e-collection.library.ethz.ch/eserv/eth:24236/eth-24236-02.pdf>

[2] <https://trac.railml.org/ticket/426>

Best regards  
Christian

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Subject: Re: railML 2.3 infrastructure extension proposal tunnel resistance factor  
Posted by [christian.rahmig](#) on Fri, 21 May 2021 14:45:29 GMT

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Dear all,

as there has been no objecting feedback, I concluded the discussion on this topic. The proposed attributes have been implemented in the schema files of upcoming railML 2.5 as described in Trac ticket #426.

Best regards  
Christian

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