

Discussion of “evaluation of an innovative composite railway 1 sleeper for a narrow-gauge track under static load”

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1 **Discussion of “Evaluation of an Innovative Composite Railway**
2 **Sleeper for a Narrow-Gauge Track under Static Load” by Wahid**
3 **Ferdous; Allan Manalo; Gerard Van Erp; Thiru Aravinthan.**

4
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8 **Sakdirat Kaewunruen¹**

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10 The development of novel material technologies for railway tracks is welcome indeed.
11 The discussor read with interest the paper, which was well written by the authors. It is
12 appreciated that the authors concluded that the study has limitations, and that further
13 research is needed. Thus, the discussor strongly recommends that the authors continue
14 to perform field measurements on the composite sleepers that are currently installed
15 on the tracks. This recommendation stems from the fact that:

- 16 • The authors focused solely on the quasi-static behavior. The ‘design’ rail seat
17 load was determined using a combination of American code and empirical
18 algorithms. As the design method for composite sleepers has not been
19 standardized yet (Silva et al., 2017), the discussor believes that this ‘design’
20 load is based on allowable stresses. Therefore, it is imperative that material
21 reduction factors be identified based on the data collected through field
22 measurements (You et al., 2017). This data would later aid the railway owner

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23 or authority to verify the cost-effectiveness and safety margin of the composite
24 sleepers, as shown in Figure 1. This allowable stress design concept
25 determines the maximum strength of constituent materials, which then cannot
26 be exceeded in the component. Safety and serviceability aspects such as brittle
27 fracture, bursting, fatigue failure and allowable deflections are taken into
28 account in this design method by the determination of safety factor values.
29 The cost-effectiveness can then be evaluated using reliability indices
30 (Kaewunruen and Remennikov, 2009) whether the component is either
31 optimally, overly or under-designed.

32 • The dynamic service load factor (or impact factor) of 1.5 and axle load
33 distribution factor of 0.48 were used in the initial design. These values are
34 slightly different from those presented in other reports with similar track
35 moduli, such as in Leong and Murray (2008). In addition, by inserting a
36 composite sleeper sideways over an existing old foundation, the track modulus
37 could significantly deviate from the originally assumed value of 30 MPa.
38 Therefore, it is important to ensure that such changes due to maintenance
39 operations do not result in longer-term track problems as reported in the past
40 (Kaewunruen et al., 2018).

41 • It is critical to note that narrow-gauge sleepers tend to be damaged from
42 center-binding. Center-binding occurs at the midspan of short sleepers subject
43 to hogging moments, especially as the ballast densifies and deteriorates over
44 time under dynamic loads (Remennikov and Kaewunruen, 2008; You et al.,
45 2018). In many instances, the midspan cross section of a sleeper becomes the
46 most critical section for design, as it is often the case in narrow-gauge sleepers

47 (Standards Australia, 2012). A better insight into this behavior would assist
48 track engineers with devising suitable plans for track inspection.

49

50 The discussor hopes that the field experience and practical notes shared in this
51 discussion are useful and encourage the authors to extend their future research to field
52 measurements.

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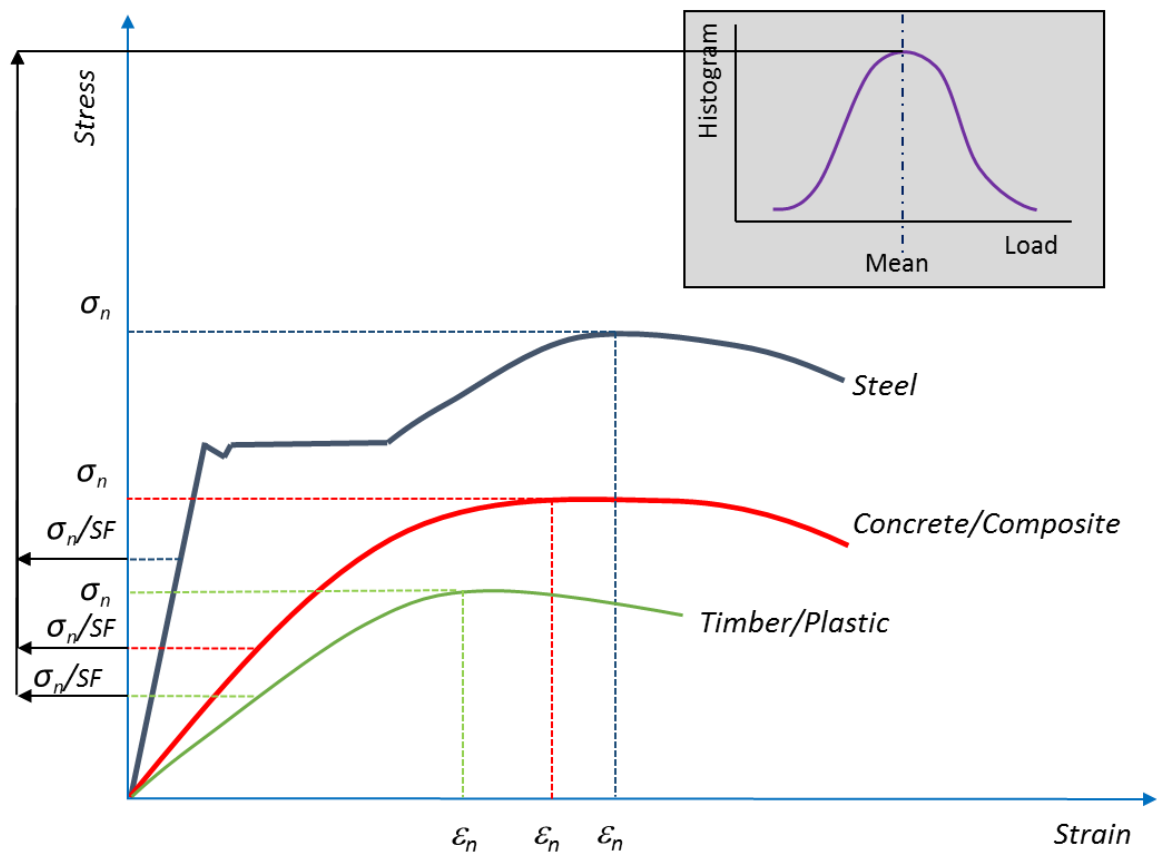
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81 **Figure 1.** Allowable stress design method of each material (SF is safety
82 factor)

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