Two comments are offered herewith:

(1) Is the model configured to incorporate beam bending and head-on-web bending? This question arises from the conclusion of the authors that the TD is open when the wheel passes directly over the defect. If the length of the TD were approximately comparable to that of one-half of the contact width, I’d expect the compression in the railhead resulting from beam bending and head-on-web bending to tend to force the TD closed. But, perhaps the bending compression stresses are small compared to the residual stress plus shear systems tending to open the defect.

(2) The number of cycles for growth shown in Fig. 11 (up to approximately $10^6$ cycles) is very small compared to the actual life of rail to required replacement. What is not included in this analysis is the cycles to initiation. The crack initiation behavior probably weighs more heavily in the decision to replace rail than does the crack growth behavior. However, the growth behavior dominates in considerations about the frequency and needed reliability of periodic non-destructive inspection of rail in-track. In addition, the growth behavior strongly influences the likelihood of service failure (broken rail) occurrence under fixed traffic, track support, and inspection conditions.

I hope this brief commentary will provide some additional insight into the reasons that the efforts of Yu and Keer have value to the railroad industry.

Authors’ Closure

The issue raised by Dr. Steele is concerned with our life calculation. When the wheel passes directly over the defect, he expects that the TD would be closed when its length is approximately comparable to that of one-half of the contact width due to the compression in the railhead resulting from beam bending and head-on-web bending. His remarks are correct, and we take this opportunity to clarify some points. The model presented by the authors does not include beam bending and head-on-web bending effects, but it predicts that the TD is closed when the wheel passes directly over the TD at the ratio nearly one. In the authors’ Result 2.(iii) it is noted that “the TD opens when the wheel is approaching, passing directly over and moving away from the shell/TD, but the range of open TD varies.” This remark may be interpreted as follows: at $l/c<2$ the TD remains closed until the wheel has passed the conjunction of the shell and TD, then it opens as the wheel moves toward the shell tip and moves away from the shell tip; at $l/c≥2$ the TD opens as the wheel approaches the conjunction of the shell and TD, passes directly over the shell and TD defects and moves away from the shell/TD; the $x_0/c$ range of the open TD varies according to the $l/c$ ratio. When the length of the TD is comparable to that of one-half of the contact width, $l/c=1$, from Fig. 9(b) in the paper, it can be verified that the TD is closed at $x_0/c=-1.5$, as the wheel is passing directly over the TD.

The authors have recomputed the shell/TD and the single TD analyses as case II, including the bending stresses based on the beam on elastic foundation theory of Timoshenko and Langer. Also, a new biaxial residual stress field (Fig. 1) provided recently by the Association of American Railroads, together with the bending stresses, has been applied to the analyses as case III. The results are plotted in Fig. II and Fig. III, which give the variations of $\Delta K$ versus $l/c$ for the shell/TD analysis and $l$ versus number of cycles for the shell/TD and the single TD analyses, respectively. When transverse defects are small, the mixed-mode loading growth law appears to be dominated by $K_I$. Inclusion of bending...