

Of Trackdays and Rollover Bars

Joint Trackday Coordinator **James Batchelor** reports on a significant engineering assessment that was recently commissioned by the Club.

Anyone who takes even a cursory interest in the Club's online forum, BlatChat, can't have failed to notice the regular appearance of hotly-debated threads on the subject of the Club's requirement that a 'trackday' rollover bar be used by all participants on our Club trackdays. In my experience, the argument flares-up at least twice a year and, ironically, as I sit to write this article at the end of December 2017, a thread entitled 'Roll Bar Debate 2018' has just been started. There's no doubt that this is a hot topic, with members holding strong views.

At the start of this piece, it's perhaps relevant for me to nail my colours to the mast. Since taking over shared responsibility for the Club's trackday activities at the start of 2016, I have been firmly in the camp of those who have questioned the requirement for the so-called 'trackday' or 'FIA' rollover bar (worth noting here that the FIA certification applies only when the bar is used in conjunction with the bolt-on Petty strut, and that this supplementary part is not a mandatory requirement on Club trackdays). Encouragingly, I found that I was not alone around the Management Team table in holding the view that a challenge to the existing rule would be welcomed.

Although changing to a trackday rollover bar is neither a particularly expensive nor difficult task (viewed as a DIY job for many, and covered in detail in the April 2016 edition of *Lowflying*), I am all too aware that this long-standing rule can be seen as an obstacle to participation in Club trackdays – and a key aim of my role is to look at ways of driving up involvement. This sentiment is particularly relevant for newcomers or trackday novices who, not unreasonably, would like to try a first trackday with the Club without having to commit to fitting a trackday bar. Carrying out a review of this requirement – and hopefully having it changed – seemed an obvious priority to me.

So, in the early months of 2017 I set about reviewing the background to the Club's long-standing rule and gathering evidence to support a change in approach. It soon became clear though that the topic is complex, with many alternative types of rollover bar having been available over time, generally categorised into 'standard' or 'trackday' configuration, but made to different material gauges and specifications as well as to varying physical dimensions including width and height.

Furthermore, the very real importance of some other factors began to emerge, including consideration of 'what has gone before' and the issue of the Club's (and its officers')



HORIBA-MIRA Project Engineer Karl Boak carrying out measurements to create an engineering model of a trackday rollover bar. For those "in the know", the rollover bar geometry was measured using a Faro Platinum 8ft FaroArm for transfer to the modelling team. The models were constructed with Altair Hypermesh and the analysis completed within LS-Dyna.

potential liability in the event of an incident where rollover bar performance might be considered a factor. So whilst technical specification and engineering performance considerations are important, they do not represent all of the factors needed for a rule change to be approved.

The original ruling calling for the use of trackday rollover bars on Club trackdays dates from 1996.

Background

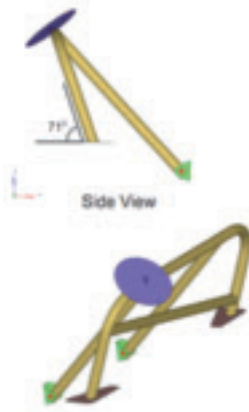
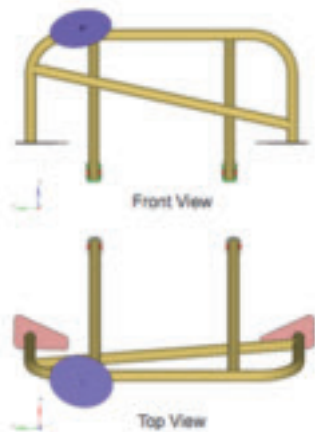
Given the complexity of the picture, it's perhaps appropriate to step back and understand the background to all of this before explaining in more detail the work that has been carried out by the Club during 2017.

The original ruling calling for the use of trackday rollover bars on Club trackdays

dates from 1996. Concerns – both within the Club and from external partners, including officials at one of the Club's trackday venues as well as the third-party trackday operator running the Club's trackday events at that time – were raised about the apparent lack of structural integrity of the then standard bar. The Management Team in office at that time reviewed the situation and agreed that either a rollover bar (or cage) carrying full FIA or MSA certification, or the Caterham Cars reinforced trackday (or FIA) rollover bar – the only alternative bar readily available at that time – should be mandated for Club trackdays.

Although no analysis or formal engineering assessment was available or carried out, the new regulation was viewed as a sensible, pragmatic and important precautionary move. Although there have been several subsequent discussions within the membership and around the Management Team table, in the absence of any hard data to justify a change, the regulation has stayed in place ever since.

However, it's also clear that several changes to the design, material specification and method



An example of the engineering model created by HORIBA-MIRA following the measurement of an actual bar (in this case an 'original 1996-era trackday bar'). The coloured disc represents the load-point, where the compound test load is applied

The same engineering model lifted from one of the simulated test runs, showing areas and degrees of displacement and distortion as load is applied (a 'heat map' approach with red representing the area of highest displacement)

of construction of both standard and trackday rollover bar types have been introduced by Caterham Cars during the intervening period. In particular, an uprated standard rollover bar was introduced in 2001 (the 'post-2001 bar') featuring larger but thinner main hoop tubing produced from a better manufacturing process than was the case with the earlier standard bars. Perhaps this post-2001 bar might be acceptable, if we could establish its performance in objective terms?

Given support for this review right across the Management Team, in early 2017 the Club commissioned a technical investigation to assess whether the post-2001 standard bar might indeed meet the requirements for use on Club trackdays. This enthusiasm though was brought into check by advice provided to the Management Team about the importance of the precedence created by the 1996 rule. This effectively placed the Club and its officers at risk of legal liability claims if an incident were to occur where the performance of a newly approved rollover bar is called into question – unless objective data is available to confirm equivalent, or superior, levels of protection to the already-approved trackday variants.

This is a key consideration to note, and is worthy of further emphasis. In short, whilst publishing the outcome of this programme of investigation, the Club is making no judgement in absolute terms as to the performance or suitability for use on trackday activities of any of the selected rollover bars; it is the relative performance of different bar types that is being assessed, with the Club's 1996 requirement representing the performance threshold – the minimum standard – that any new bar must attain or exceed in order to be approved for use on Club events.

Assessment and Testing at HORIBA-MIRA

With the background understood and in the absence of any prior analysis or programme of testing from other sources, in May 2017 the Club commissioned HORIBA-MIRA – a recognised authority and approval agency for ROPS (rollover protection systems) – to carry

out a comparative study into the performance of four selected types of Series 3 (narrow body) rollover bars, covering standard and trackday specifications from the 1996 and current periods.

Club commissioned HORIBA-MIRA – a recognised authority and approval agency for rollover protection systems - to carry out a comparative study

Pre-test activity included the gathering of technical information on material and manufacturing specifications followed by an exercise to measure examples of each bar type with great accuracy which, in the absence of technical drawings, would enable engineering models to be created for analysis and assessment. Four Club members – Richard Warren (original 1996-era standard bar), Grant Hibbert (post-2001 standard bar), David White (original 1996-era trackday bar) and myself (current trackday bar) participated in this initial stage of the project, bringing their Sevens to HORIBA-MIRA's facilities in Leicestershire during the summer months for measurement of their cars and fitted rollover bars.

The test method adopted by HORIBA-MIRA follows the Motor Sports Association ROPS guidelines, an international motorsport standard. In performing this evaluation, the Club adopted a motorsports test because it is internationally recognised and represents use of best practice. It was also agreed that this approach is directly relevant to a trackday environment, where it is reasonable to expect comparable levels of severity arising from either a trackday or racing incident, even though the probability of the incident happening might be lower on a trackday than in a competitive event.

Under test, the relative performance of each rollover bar type was determined using the newly created engineering models, simulating deformation and structural integrity when subjected to a load that represents the forces created during an accident or impact. Petty struts were not included in any of the models, even on the trackday bars capable of accepting them, to reflect the Club's trackday specification. The load, being a multiple of laden vehicle mass, was applied as a compound force (made up of longitudinal, lateral and vertical components) to a load-point positioned above the driver's head. Performance of the bars was assessed by measuring displacement of the load-point with increasing load through to failure or collapse of the rollover bar structure or until the maximum load, as specified in the guidelines, was attained.

The analysis and test work took place during the late summer months and the final report (totalling 147 pages of results and analysis) was issued to the Club's directors in early November 2017.

On receiving the report from HORIBA-MIRA, the directors and Management Team decided that a Working Group comprising Club members with relevant experience should be formed, tasked with studying the test results and with generating a set of conclusions and recommendations for approval by the Management Team. The group comprised: Mike Scott – a chartered engineer who also represented the Club's area groups; Dr Robert Jacobs – bringing his scientific, research and analytical skills; Guy Foulger – a long-standing member, very experienced senior engineering manager and chartered engineer from the automotive industry whose team at HORIBA-MIRA carried out the technical assessment; Richard Price – another engineering professional who also has considerable experience in preparation and high-speed driving of Sevens and finally me, a chartered engineer with a career spent within the automotive industry and, as one of the Club's two trackday co-ordinators, the project manager for this exercise.

The review carried out by the Working Group was thorough and challenging in nature but produced a set of clear outcomes.

Conclusions

In summary, the Working Group concluded unanimously that:

- The HORIBA-MIRA report provided the required objective data for the Working Group to confirm that both versions of the trackday rollover bar (the original bar from the 1996 era characterised by a single diagonal brace and the current double-braced bar) offer substantially better performance than either type of standard bar (the original bar from the 1996 era as well as the uprated bar introduced in 2001, still fitted as standard equipment by Caterham Cars) under the test conditions.
- The main factors determining this outcome were the specific geometries of the various types of rollover bar (including the different sizing and wall thicknesses used in the main hoop tubes, as well as the addition of one or more diagonal braces within the main-hoop of the trackday bars), and the different material and mechanical properties of the steel used in the trackday rollover bars which proved to be superior to that used in either type of standard rollover bar.

Recommendations

Not surprisingly, in the light of their technical conclusions and being mindful of the minimum performance standard created by the 1996 decision, the Working Group recommended that the Club rule requiring the use of a trackday rollover bar on Club trackdays should not be changed, and that this requirement should remain in full effect.

Following discussion and consideration, the Management Team accepted the findings of the Working Group and confirmed the continued requirement for trackday rollover bars to be fitted on Club trackdays.

Discussion

I think – and it’s a view shared across the Management Team – that this is an important



David White

piece of work that has been carried out by the Club. For the first time we have access to objective data to help guide our decision-making in this area. The Working Group was formed to analyse the results of the test programme carried out by HORIBA-MIRA and the Management Team has acted upon the conclusions that were reached and the recommendations that were presented.

It’s worth repeating the point I made earlier in this article; the Club is making no judgement here in absolute terms but is now in a position to compare performance across a number of rollover bar variants and to assess these results against the threshold requirement as introduced by the Club in 1996. In reaching its decision, the Management Team was mindful not only of the potential for liabilities to arise from a claim being made, but also of the view that a coroner or judge might take in the event of the Club changing its previously held position, to knowingly accept a lower standard of rollover bar performance as confirmed by the HORIBA-MIRA report. In summary, these factors combine to mean that any new type of rollover bar presented for approval by the Club must meet or exceed the performance levels that were effectively approved in 1996 if risk of liability and claims against the Club and its officers (both present and future) is to be effectively mitigated.

So with this programme completed, the Club now intends to draw a line under this

topic. Unless or until there is a significant development in this area – for instance, the availability of further variants of rollover bar that would appear, from inspection of engineering concept and design, to offer comparable or better performance to the existing trackday types – then the topic will not be revisited. This means that Club members can plan for our trackday programme knowing, with certainty, that expenditure on a trackday rollover bar will not be a wasted investment.

In conclusion, it’s perhaps worth reflecting on my own change of outlook through this activity. At the start of the article, I explained that I was in the vanguard of pushing for a review with the hope of opening-up Club trackday regulations to allow a broader range of rollover bars. The fact that my position, as a member of the Working Group that reached unanimous conclusions, has changed completely during this programme will hopefully serve to underline the significance of the Club’s findings and the importance that we should all attach to these results.

We will of course try to the best of our capability to answer general questions and provide clarification about the process undertaken (but stopping short of disclosing specific test results) particularly on BlatChat where a thread will be opened in due course.

Other than this though, it’s a case of “Job done”. Time now to move on! *LF*



Grant Hibbett



James Batchelor



Richard Warren