CHALLENGES INVOLVED WITH DEVELOPING SEAT SLIDE ASSEMBLIES USING ADVANCED HIGH STRENGTH STEELS

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Agenda

– Company Profile
– Track Optimization
  Project Overview
– Initial Evaluations
– Track Optimization
– Conclusions
Dura Automotive Divisions

Control Systems
Milton Kniss
Division President
US$1.40 Billion

Body & Glass Systems
Jurgen von Heyden
Division President
US$740 Million

Atwood Mobile Products
Bob Pickering
Division President
US$220 Million

Dura Automotive Systems

www.autosteel.org
Dura Seating Systems

Bracebridge, Ontario
Stockton, Illinois
Rochester Hills, Michigan
Gordonsville, Tennessee
Seating Systems, Customers
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New advanced high strength steels (AHSS) offer the ability to replace traditional high strength low alloy (HSLA) grades at lighter gauge with minimal impact on:

- Performance
- Cost
- Manufacturability
Utilizing the new AHSS, Dura is developing a next-generation roll formed seat slide assembly that:

- Maintains cost and performance
- Reduces mass 20%
- Reduces the Brinelling effects (denting) during handling and operations
The new slides must also:

- Fit into existing adjuster designs

- Allow for the operation of existing
  - Power Drives
  - Manual Locks
Objectives

- Maintain the current profile performance:
  - Engagement strength
  - Resistance to track peeling
  - Loaded deflections
  - Sliding efforts
Mittal Steel Di-Form T980 (High Yield)

- 650 MPa Min. Yield
- 980 MPa Min. Tensile
- Minimum bend radius of 1 thickness, or 1.6mm for this application
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The development process began by forming 1.6 mm AHSS tracks with existing 2.0 mm HSLA tooling to:

- Determine manufacturability
  - Could the Roll Former form AHSS?
  - Can the existing 2mm tool form an acceptable profile?
– Evaluate performance compared to the:
  • Current production HSLA tracks
  • FEA simulations
The existing 2mm tooling was capable of creating profiles, although:

- The high strength steel spring back results in a “washed out” part
- Material thinning was observed
The initial evaluations indicated that:

- Brinelling effect during handling and operations was reduced
- Hybrid slides did not possess the disengagement strength of the current slides
- Hybrid slides were able to sustain 120% of the peeling load but did not meet the current profile peeling resistance
- Loaded deflections and sliding efforts are dependant on the profile and ball race
- Finite Element Analysis (FEA) to be an effective predictive tool
The initial evaluations were very successful, but new tooling will be necessary to produce the accurate track profiles:

- Existing tooling could not be modified to obtain a 1.5mm hybrid track to the inner dimensions of the current profile
- Exploit the thinner AHSS gauge to reduce the profile dimensions and design for higher spring back rates & minimum bending radii limits
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With the information gathered from the initial evaluations and through a series of FEA, new profiles were designed and 1.5mm roll tooling manufactured.

- Have achieved 23% weight reduction (allowing for steel gauge tolerance)
- Marginal cost reduction
- Reduced Brinelling effects
The FEA simulations were used to optimize the 1.5 mm track profile to:

- Maximize the engagement of the slides during a peeling or track separation loading
- Maximum the clearance around the upper and lower tracks to minimize sliding effort during loading
Roll forming trials established that AHSS are capable of forming tight bending radii profiles without:

- Cracking
- Thinning

Although:

- Significant bowing
- End flare

<table>
<thead>
<tr>
<th>Specification</th>
<th>Current Profile</th>
<th>Current Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>3.5 grams/mm</td>
<td>2.52 grams/mm</td>
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<tr>
<td>Profile Height</td>
<td>37 mm</td>
<td>36 mm</td>
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<tr>
<td>Profile Width</td>
<td>55.2 mm</td>
<td>52 mm</td>
</tr>
<tr>
<td>Material thickness</td>
<td>2.0 mm</td>
<td>1.5 mm</td>
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</table>
The FEA models used during the profile design stage, predict a maximum engagement strength which were higher than the maximum measured in testing. Correlation studies were undertaken to identify the major factors contributing to the slide assemblies’ structural performance and develop better track failure prediction methodology. The correlation studies indicated that:

- Out of Print and End Flaring
  - The prototype tracks rolled are out of print and flared enough to significantly weaken the slides

- True Plastic Stress Strain Curve
  - Changes to the TPSS curve resulting from roll forming must be accounted for in the FEA simulations

With the above factors included in the correlated FEA model, simulations and test results correspond well.
All Modification included
- TPSS from Coupon Testing
- Friction (0.4, 0.08)
- End Flare
- 10 Deg Load Angle

Optimized Slide, Correlation
FEA predictions of the peeling performance that included:

- Out of Print and End Flaring
- True Plastic Stress Strain Curve corrected for work hardening

Predict a peeling load of 24.1kN compared to a measured load of 23.85kN.
Optimized Slide, Correlation
To further improve the roll formed slide, roll tool modifications have been developed and roll tooling FEA was completed to develop tooling that is capable of producing production quality parts.

- Roll tool re-cuts are underway to create a more even strain between roll passes to remove the bowing
- Anti-flaring fixtures are under construction to control flaring after the tracks are cut
While still under development, many conclusions are drawn from this work:

- AHSS enable the production of lightweight, high performance seat slides for future platforms
- Part redesign is necessary to fully maximize the benefits AHSS provide when substituting for HSLA steel
- FEA simulation is an effective tool to predict and optimize part performance and part manufacturability
Thank You

Questions