

Technical Charge to External Peer Reviewers

Contract No. EP-C-12-017

Work Assignment 2-05

July 2014

External Peer Review of EPA's Draft Report, "Vehicle Mass-Reduction and Cost Analysis - Light-Duty Pickup Truck"

WRITTEN COMMENTS ARE DUE TO ERG NO LATER THAN WEDNESDAY, AUGUST 20, 2014

BACKGROUND

As EPA's Office of Transportation and Air Quality develops its programs to reduce greenhouse gas (GHG) emissions from light-duty highway vehicles, there is a need to evaluate the safety of light weighted automotive designs as well as the methods and costs of proposed technologies to achieve this design. The current FEV, Inc. report "**Mass-Reduction and Cost Analysis Light-Duty Pickup Trucks**" provides a design and cost analysis for light weighting a light duty truck. The report evaluates the computer-aided engineering (CAE) models (using LS-Dyna) for the baseline- and light-weighted designs under several safety crash simulations from NHTSA's Federal Motor Vehicle Safety Standards (FMVSS) and the Insurance Institute for Highway Safety (IIHS). The design portion of the project consists of implementing best practices of vehicle design including incorporating and extrapolating trends in the industry for material, joining and design. The cost part of the project is a bottom-up approach, based on the specific technologies and accounting for details of every cost factor going into the direct manufacture cost.

PURPOSE

You are being asked to review and provide expert comments on the FEV report (or portions thereof), which you will be able to access via ERG's secure FTP site (instructions below). The report contains a vehicle part by part analyses for lightweighting as well as a CAE model of the baseline and light weighted designs along with a comparison including NVH and crash. The cost part of the project is a bottom-up approach based on the specific vehicle systems including BIW, brakes, suspension, closures, and engine, and accounting for details of every cost factor.

EPA is seeking your expert opinion on the technologies utilized, methodologies employed and validity of findings in areas for this mass reduced design. FEV has analyzed the Silverado 1500 in a number of systems, sub systems, and sub sub-systems and has chosen a number of areas for mass reduction. FEV presents a breakout of the mass within each system, the ideas considered and the ideas chosen in the system, use of the technologies in industry today, and their cost impact on vehicle production. FEV has approximately 4,000 cost spreadsheets containing details of the costing process. Although the report includes only a summary of these spreadsheets within an appendix, the spreadsheets themselves are available for review should you choose to do so. In addition to performing detailed cost breakout, FEV has also contacted suppliers to verify some of the cost estimates.

For the reviewers who will be reviewing the CAE model, you will have access to the model and will also be provided the input/output files via USB thumb drive (will be sent overnight via FedEx). The model is to be reviewed to ensure that the CAE code represents the information presented in the report, and related AVI files to allow you to review the modeling results. The written report supplies charts and figures of

the results. If you have the FMVSS and IIHS crash setups, then you may choose to run the unencrypted model in those scenarios; however, you are not required to do so. You will also review the design and cost portions of the model.

EPA is seeking from the reviewers of the CAE model your expert opinion on the technologies utilized, methodologies employed, and validity of findings regarding the CAE analyses. The CAE modeling portion of the FEV report, written by EDAG, begins by comparing the baseline Silverado 1500 model crash results with the actual Silverado FMVSS crash results, and also compares the bending and torsional stiffness values with actual vehicle experimental data from Ford. The report next presents the results of the CAE model when EDAG ideas are implemented, along with the corresponding NVH results. EDAG then takes on a new material design for the BIW, utilizing its optimization program for components development given loads and other parameters, and presents NVH data and full vehicle crash simulation as well as manufacturing cost estimation.

In your review of the report, EPA asks that you orient your comments, to the extent of your expertise and experience, toward the following five areas:

1. assumptions and data sources;
2. vehicle design methodological rigor;
3. vehicle crashworthiness testing methodological rigor (CAE only);
4. vehicle manufacturing cost methodological rigor;
5. conclusion and findings; and
6. other areas of comment.

You should provide your responses in the comment template that is attached to this peer review charge (see Attachment A), adding additional comments, as necessary, at the end of each section of the table. The comment cells should expand as you type, or feel free to insert additional rows to separate your individual thoughts.

This broad span of technical areas suggests that reviewers may well have much deeper technical expertise and experience in some areas and a working knowledge in others. As a result, the level of detailed technical review to be given by each reviewer might vary significantly across the general category areas. Although EPA is requesting response to the areas specified above as well as to general issues set out in section 6 of the comment template (additional comments area), you are strongly encouraged to identify additional topics or depart from these examples as necessary to best apply your particular area(s) of expertise in review of the overall study.

GENERAL INSTRUCTIONS

- Maintain strict confidentiality with all review materials provided. **Please do not disclose any of the material provided until EPA has responded to your comments and posted this material for public review.**
- Read ERG's Letter of Instruction.
- Read the technical charge questions.
- Organize your comments using the comment template provided in Attachment A
- Explain and justify the rationale for your responses to the charge questions (a simple yes or no response is not acceptable).
- If a question is outside your area of expertise, please indicate this as your response.
- Please follow the *Review Guidelines* and *Formatting Instructions* on page 6 of this charge.

REVIEW MATERIALS PROVIDED ON ERG'S SECURE FTP SITE

- FEV's Report (Silverado Mass and Cost Analysis_Master_071714_PRR.pdf), approximately 52 MB in size
- Technical Charge to Reviewers

ADDITIONAL MATERIALS (to be sent via FedEx - also available on ERG's FTP site)

- USB with model and input/output files (2 reviewers only will receive these via FedEx)
- USB with costing files (3 reviewers only will receive these via FedEx)

CHARGE QUESTIONS

Each reviewer is to focus on their area of expertise and provide an indepth review and comment on the related areas below. You are welcome to provide additional comments on other areas as long as the timeline is within the period of performance. If you have any concerns in regards to receipt or review of documents then please feel free to contact Laurie Waite at ERG. Please use the comment template in Attachment A of this charge to insert your comments.

1. ASSUMPTIONS AND DATA SOURCES (CAE BIW and Vehicle)

- a. Please comment on the validity of any data sources and assumptions embedded in the study. Such items include material choices, technology choices, vehicle/component design, crash validation testing, and cost assessment that could affect its findings.
- b. If you find issues with data sources and assumptions, please provide suggestions for available data that would improve the study.

2. VEHICLE DESIGN METHODOLOGICAL RIGOR CAE BIW and Vehicle)

- a. Please describe the extent to which state-of-the-art design methods have been employed and the extent to which the associated analysis exhibits strong technical rigor. You are encouraged to provide comments on the information contained within the technologies chosen by FEV; the unencrypted model provided by EDAG; and the resulting final vehicle design.
- b. Please comment on the methods used to analyze the technologies and materials selected, forming techniques, bonding processes, and parts integration.
- c. If you are aware of better methods employed and documented elsewhere to help select and analyze advanced vehicle materials and design engineering rigor for 2020-2025 vehicles, please suggest how they might be used to improve this study.

3. VEHICLE CRASHWORTHINESS TESTING METHODOLOGICAL RIGOR (CAE only)

- a. Please comment on the methods used to analyze the vehicle body structure's structural integrity (NVH, etc.) and safety crashworthiness.

- b. Please describe the extent to which state-of-the-art crash simulation testing methods have been employed as well as the extent to which the associated analysis exhibits strong technical rigor.
- c. If you have access to FMVSS crash setups to run the model under different scenarios in LS-DYNA, are you able to validate the FEV/EDAG design and results? In addition, please comment on the AVI files provided.
- d. If you are aware of better methods and tools employed and documented elsewhere to help validate advanced materials and design engineering rigor for 2020- 2025 vehicles, please suggest how they might be used to improve the study.

4. VEHICLE MANUFACTURING COST METHODOLOGICAL RIGOR (CAE BIW and Vehicle)

- a. Please comment on the methods used to analyze the mass-reduced vehicle body structure and/or vehicle component manufacturing costs.
- b. Please describe the extent to which state-of-the-art costing methods have been employed as well as the extent to which the associated analysis exhibits strong technical rigor.
- c. If you are aware of better methods and tools employed and documented elsewhere to help estimate costs for advanced vehicle materials and design for 2020-2025 vehicles, please suggest how they might be used to improve this study.

5. CONCLUSION AND FINDINGS

- a. Are the study's conclusions adequately backed up by the methods and analytical rigor of the study?
- b. Are the conclusions about the design, development, validation, and cost of the mass-reduced design valid?
- c. Are you aware of other available research that better evaluates and validates the technical potential for mass-reduced vehicles in the 2020-2025 timeframe?

6. OTHER POTENTIAL AREAS FOR COMMENT

- a. Has the study made substantial improvements over previous available works in the ability to understand the feasibility of 2020- 2025 mass-reduction technology for light-duty vehicles? If so, please describe.
- b. Do the study design concepts have critical deficiencies in its applicability for 2020-2025 mass reduction feasibility for which revisions should be made before the report is finalized? If so, please describe.

- c. Are there fundamentally different lightweight vehicle design technologies that you expect to be much more common (either in addition to or instead of) than assessed in this report?
- d. Are there any other areas outside of the direct scope of the analysis (e.g., vehicle performance, durability, drive ability, noise, vibration, and hardness) for which the mass-reduced vehicle design is likely to exhibit any compromise from the baseline vehicle?

WRITTEN COMMENTS ARE DUE TO ERG NO LATER THAN WEDNESDAY, AUGUST 20, 2014

GUIDELINES FOR CONDUCTING AND SUBMITTING YOUR REVIEW

Maintain strict confidentiality with all review materials provided. Upon receipt of the review materials, you should have no communications with colleagues, members of the public, EPA, EPA's contractors (EDAG and FEV) or other federal agencies on the materials under review. If you are contacted in person or in writing on the draft review materials by anyone other than ERG, you should immediately inform Laurie Waite at laurie.waite@erg.com or call 781-674-7362.

If you have any questions on the review materials or need any further clarification, please contact ERG only and ERG will work with EPA to get a reply back to you and the other reviewers.

Your comments will be submitted to EPA as received (i.e. unedited). ERG may, however, format your comments as needed for consistency in the final peer review report. If EPA requires any clarifications on your comments, you will be contacted by ERG with a request to provide such clarifications.

At the completion of the review, please do not disclose the material provided until EPA has responded to your comments and posted this material for public review.

FORMATTING INSTRUCTIONS

Please prepare your comments addressing the issues and questions as stated in the *Technical Charge*. To assist you in preparing your comments, ERG has provided you a comment template in table format in which to insert your comments (See Attachment A).

Please send your comments inserted into the comment template provided (.docx) to Laurie Waite at laurie.waite@erg.com, or if submitting on a CD, please use an overnight service and mail to:

Laurie Waite
ERG
110 Hartwell Avenue
Lexington, MA 02421-3136
781-674-7362

Additional format recommendations are as follows:

- Please use a header with your name in the upper right-hand corner of each page of your comments.
- Organize your comments using the comment template provided. Be sure to provide a response to each question or reason why you are unable to answer the question (e.g., question is outside my area of expertise, etc.). Please provide a justification for your rationale, a simple yes or no response will not be accepted.
- Remember to spell out acronyms when first used.
- Avoid incomplete sentences, abbreviations, and terms that might confuse the reader.
- Run spell check.
- If illustrations or tables are included, be sure that they are suitable for reproduction.

Attachment A – Comment Template

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External Peer Review of EPA’s Draft Report, “Vehicle Mass-Reduction and Cost Analysis - Light-Duty Pickup Truck”

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If you find issues with data sources and assumptions, please provide suggestions for available data that would improve the study.	
ADDITIONAL COMMENTS:	

2. VEHICLE DESIGN METHODOLOGICAL RIGOR CAE BIW and Vehicle)	COMMENTS
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<p>unencrypted model provided by EDAG; and the resulting final vehicle design.</p>	
<p>Please comment on the methods used to analyze the technologies and materials selected, forming techniques, bonding processes, and parts integration.</p>	
<p>If you are aware of better methods employed and documented elsewhere to help select and analyze advanced vehicle materials and design engineering rigor for 2020-2025 vehicles, please suggest how they might be used to improve this study.</p>	
<p>ADDITIONAL COMMENTS:</p>	

<p>3. VEHICLE CRASHWORTHINESS TESTING METHODOLOGICAL RIGOR (CAE only)</p>	<p>COMMENTS</p>
<p>Please comment on the methods used to analyze the vehicle body structure's structural integrity (NVH, etc.) and safety crashworthiness.</p>	
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<p>you able to validate the FEV/EDAG design and results? In addition, please comment on the AVI files provided.</p>	
<p>If you are aware of better methods and tools employed and documented elsewhere to help validate advanced materials and design engineering rigor for 2020- 2025 vehicles, please suggest how they might be used to improve the study.</p>	
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<p>Please comment on the methods used to analyze the mass-reduced vehicle body structure and/or vehicle component manufacturing costs.</p>	
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5. CONCLUSION AND FINDINGS	COMMENTS
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Are the conclusions about the design, development, validation, and cost of the mass-reduced design valid?	
Are you aware of other available research that better evaluates and validates the technical potential for mass-reduced vehicles in the 2020-2025 timeframe?	
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<p>different lightweight vehicle design technologies that you expect to be much more common (either in addition to or instead of) than assessed in this report?</p>	
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