

UPDATE TO GTR7 IG ON CERTIFICATION & DRAWINGS

02/05/14

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Agenda

- Drawings for UN
- Goal – reminder
- Status of certification test development
- Bumper work update
- Finishing dummies for Injury Criteria Development
 - VRTC dummies
- Test Documentation Discussion

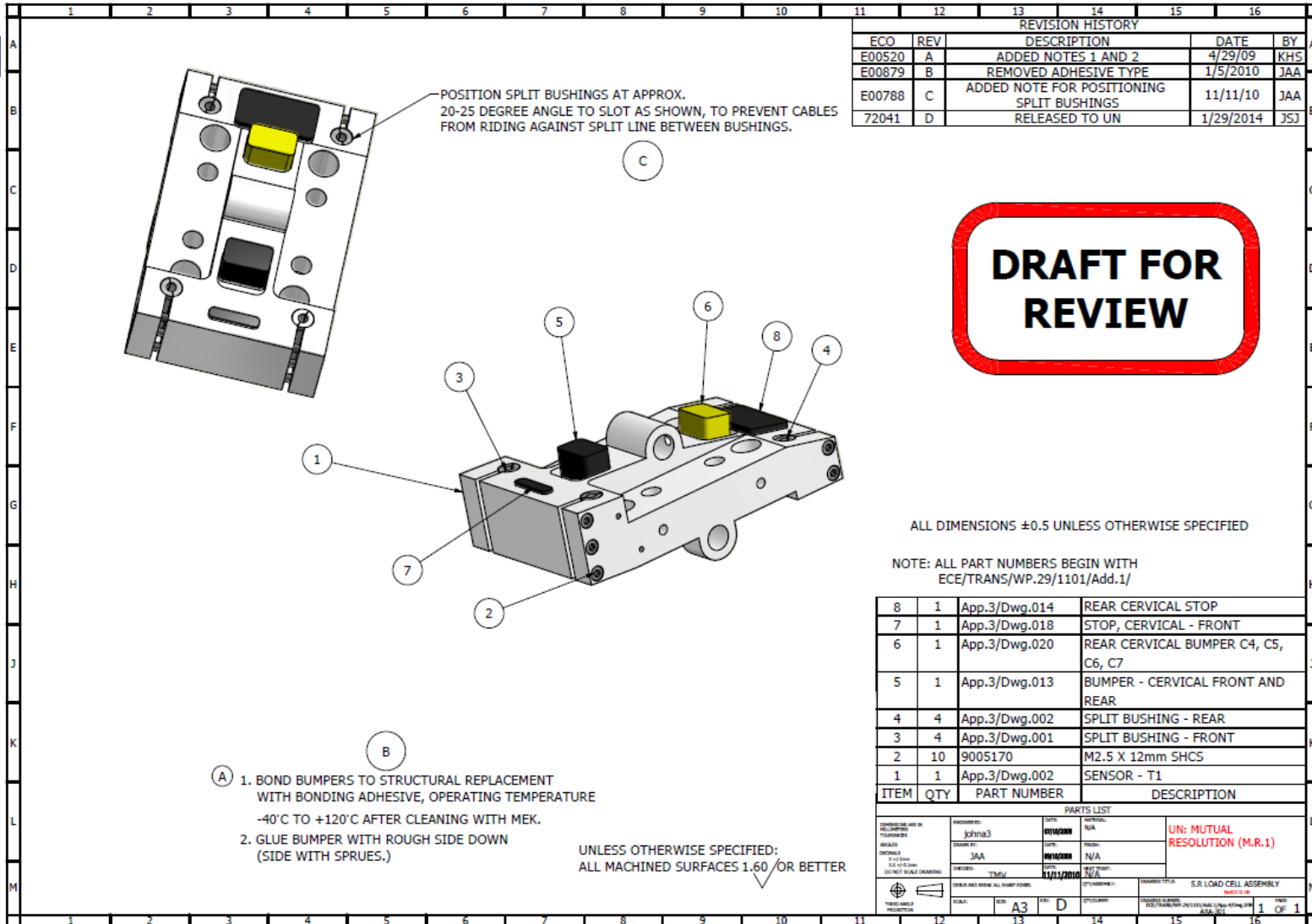


Drawings for UN

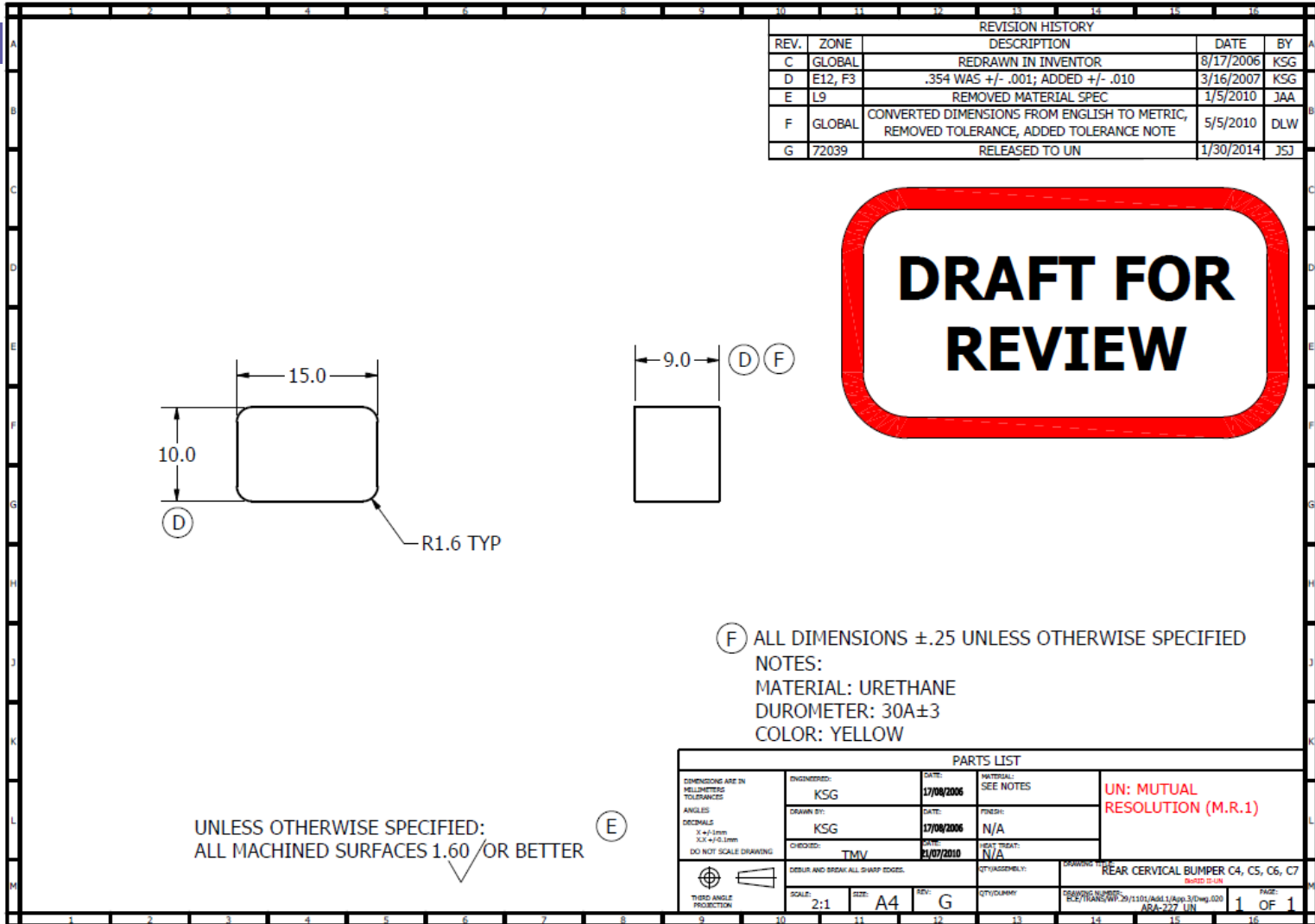
- Need to update all drawings to UN standard
- Incorporate comments from GTR7 IG reviewers
- Have samples for discussion
 - Title block ok?
 - BOM and PN handling ok?
 - REV block ok?
 - Weldment handling?
 - Other comments?



Drawings for UN



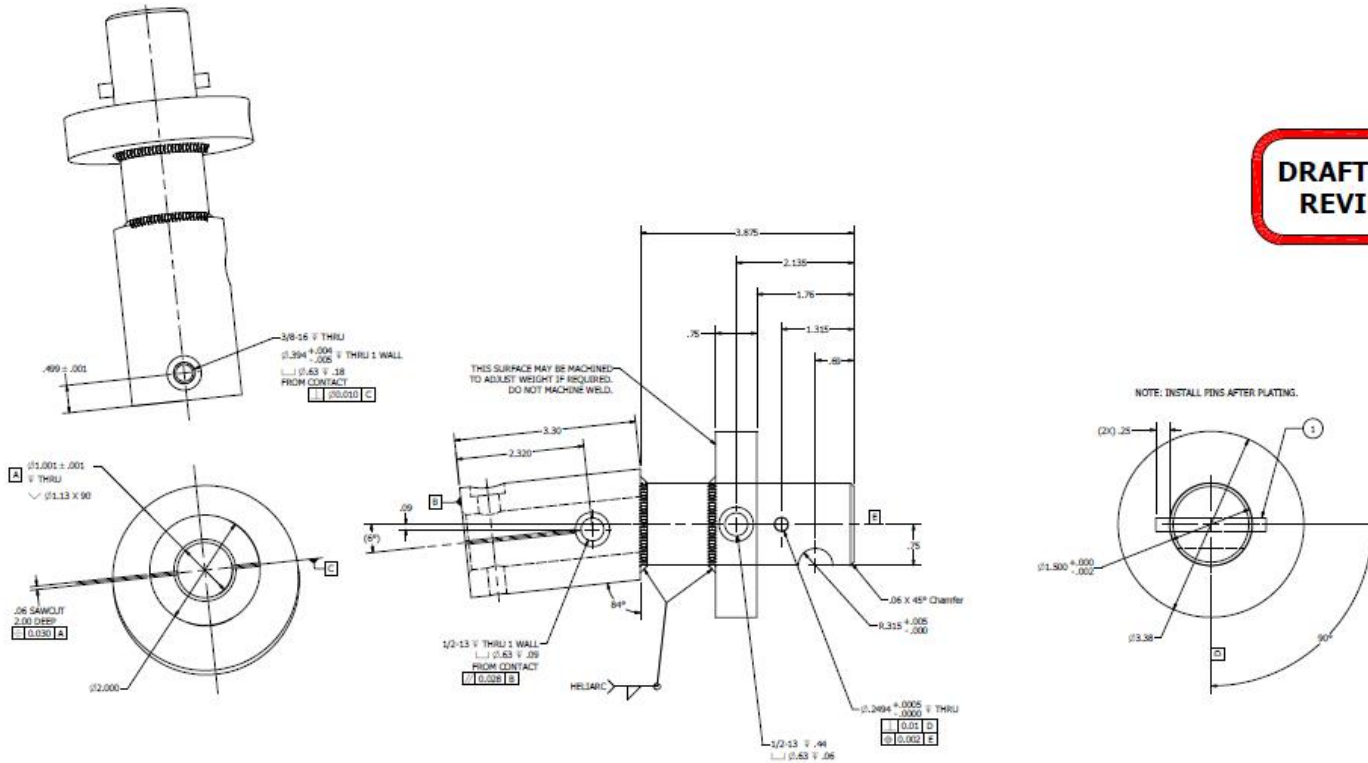
Drawings for UN



Drawings for UN - Weldment

REV #	REV	DESCRIPTION	DATE	BY
7353	E	78051-43W WAS 78051-252, 23, 24	3/15/2007	TMV
7446	F	REV WELD DATA, DISCARD IN INVENTOR	5/20/2007	TMV
	G	REV 78051-46W, ADD 78051-262,23,24	8/21/2014	TMV
	H	RELEASE TO UN	8/21/2014	TMV

DRAFT FOR REVIEW



- NOTES:
1. HELIARC OPTIONAL.
 2. PART CAN BE MADE FROM COMPONENTS OR SOLID STOCK.
 3. FINISH: ELECTROLESS NICKEL PLATE .0003 MAX THK.

NOTE: ALL PART NUMBERS BEGIN WITH ECZ/TRANS/REV-2971301/ADD.1

- UNLESS OTHERWISE SPECIFIED:
1. ALL DIMENSIONS ARE IN INCHES.
 2. BREAK ALL SHARP EDGES.
 3. ALL MACHINED SURFACES 125 / OR BETTER.

ITEM	QTY	PART NUMBER	REV	DESCRIPTION
1	2	9000045-0N	REV. 001	FIN. BOMEL - 1/4 X 1/2

Goal - reminder

- Develop certification tests which can control dummy reproducibility
 - Must control setup of neck muscle substitutes and damper
 - Must detect critical differences between dummies found in vehicle seat R&R work
 - ▶ Spine bumper stiffness
 - ▶ Jacket stiffness
 - ▶ Pelvis stiffness



Test to Finalize Documentation

- Spine quasi-static setup *(In Mutual Resolution draft)*
 - Set springs and thorax/lumbar shape adjustment
- Jacket only impact *(in 1/27/14 draft)*
 - Control jacket stiffness
- Pelvis only impact, bottom *(in 1/27/14 draft)*
 - Control pelvis stiffness
- Dummy without head restraint *(in 1/27/14 draft)*
 - Set damper, verify correct spring & shape adjustments
 - Need to discuss and finalize corridors



Test Documentation

- Generic procedure for UN MR
 - Draft 1/27/14 provided for review
 - ▶ Tried to make generic for regulation
 - ▶ Only necessary information
 - ▶ Not limit future improvements
 - ***Need review and comment on what should be in doc***
 - ▶ Procedures themselves
 - ▶ Appropriate level of information
- We will do update with comments to provide for inclusion into MR
 - Will leave thorough formatting for after put into MR



Tests Under Development

- Dummy with head rest (*corridors TBD*)
 - Check complete system performance
 - Trying to detect differences in Thorax/lumbar bumpers
 - Test & procedures under development
 - *Need to resolve bumper issues first*
- Pelvis shape verification (*corridors TBD*)
 - Make sure shrinkage is not too large
 - Test & procedures under development
- Bumper compression on spine (*corridors TBD*)
 - Check change in bumper stiffness
 - Test & procedures under development



Tests Under Development

- Steps to complete
 - Resolve bumper control issue
 - Finish testing R&R and VRTC dummies
 - Run testing varying thorax/lumber bumper stiffnesses to confirm we can detect differences
 - Pick headrest test version (with or without back)
 - Establish corridors around R&R and VRTC dummies
 - ▶ Make sure can detect large variation in bumpers
 - Finalize test procedure documentation



Bumper Update

- Why are we discussing
 - TRL/BAST R&R work indicated thorax/lumbar bumpers might be source of problem
 - Rebuild 2 PDB dummies which were problem for years made them match in TRL/BAST testing
 - Rebuild 4 dummies for BAST R&R series with new dummies provided acceptable R&R
- What was different?
 - Bumpers manufactured at one point in time!
 - ▶ Standard production process but only 1 batch material
 - Indicates inadequate control of bumpers



Bumper Update

- How are bumpers controlled?
 - HIS orders urethane from suppliers based on durometer specifications
 - HIS manufactures bumpers
 - ***HIS checks every bumpers to print durometer specifications***
 - Durometer targets have not changed



Bumper Update

- Why use durometer?
 - ASTM, ISO, and other national standards available
 - Gives indication of material stiffness property
 - Common tool with elastomers to talk about material stiffness
 - ▶ This is always the first property discussed when picking a material
 - Very simple, inexpensive, and quick test to do



Bumper Update

- Why not use durometer?
 - Surface indentation test
 - ▶ Affected by surface skin and tension
 - ▶ Testing a cube on sides, top, bottom will typically give different readings
 - ▶ Surface preparation changes readings
 - Poor R&R relative to a tight corridor
 - ▶ ASTM R&R study: repeatability 1.92, reproducibility 5.72
 - › Differences greater than these numbers are assumed to come from different population
 - ▶ Durometer is highly equipment and operator dependent
 - Gage calibration can vary up to +/- 2 points
 - ▶ We have seen this with 2 identical gages giving consistent differences of about 2 durometer points



Bumper Update

- Why not use durometer?
 - Most bumpers don't meet ASTM material size requirements
 - ▶ Minimum 6 mm thick
 - ▶ Readings must be taken at least 12 mm from edge of part
 - Bumpers don't test same as material poured from same mix with correct size requirements



Bumper Update

- Why look at compression test?
 - More closely indicates material modulus
 - Closer to how bumpers are used in a dummy
 - Test stand is more automated => less operator influence

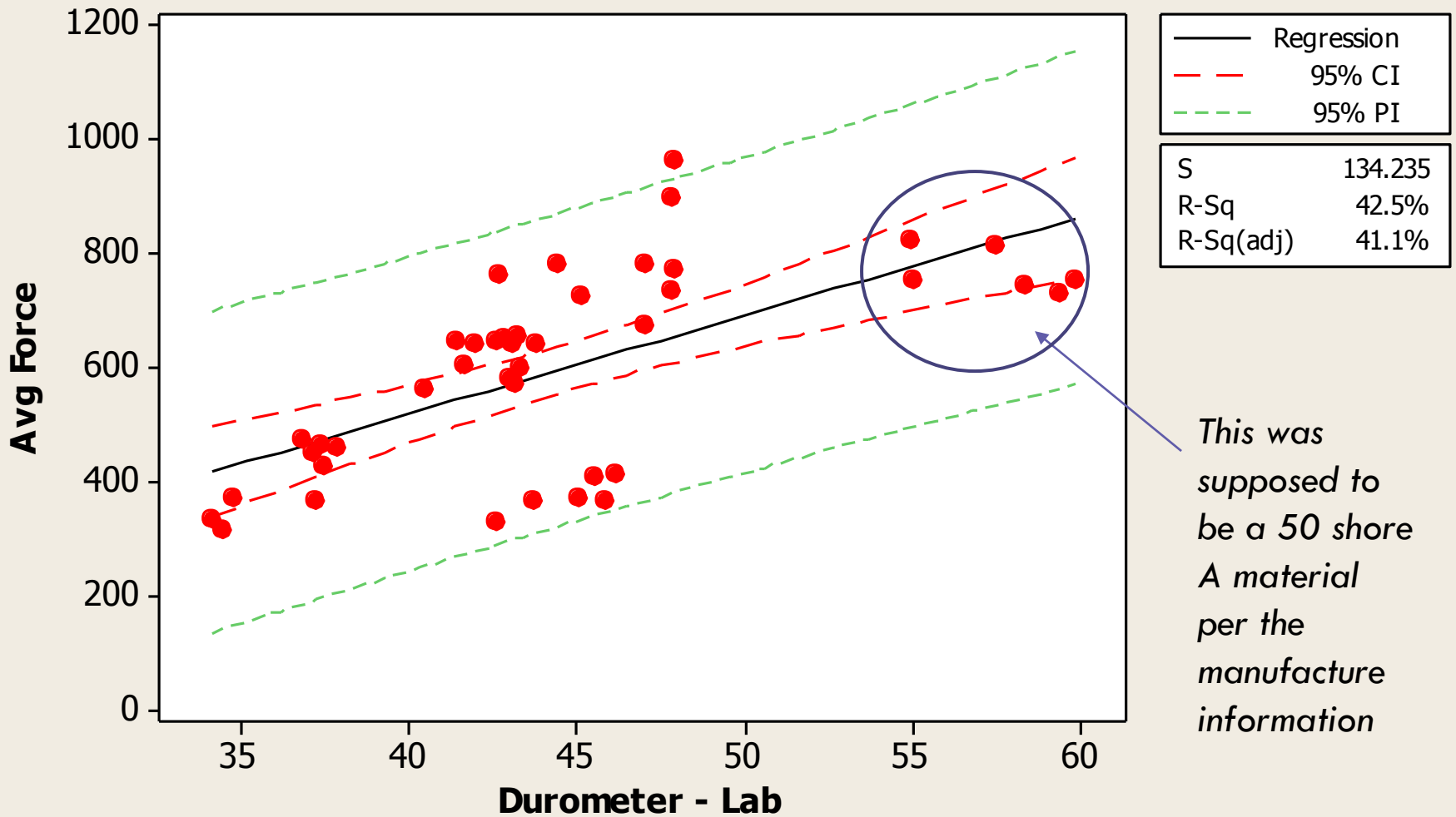
- Do durometer and compression indicate same answer?
 - They are related



Bumper Update

ARA-521

$$\text{Avg Force} = -175.1 + 17.36 \text{ Durometer - Lab}$$



Bumper Update

- Compression testing
 - There is correlation, but wide spread in comparison of data (low R^2)
- Status of compression testing
 - Started with R&R dummies
 - Only done on engineering samples
 - Not used at this time for production control



Bumper Update

- Status of compression test usage
 - Set targets based on R&R dummy bumper test data
 - Tried making bumpers to match
 - Ran into material reproducibility issues
 - Discovered material stiffening over time
 - ▶ Still investigating source of this and when it started
- Did R&R dummy bumpers stiffen?
 - Sample of 10 of each bumper part number removed from 2 dummies for retest

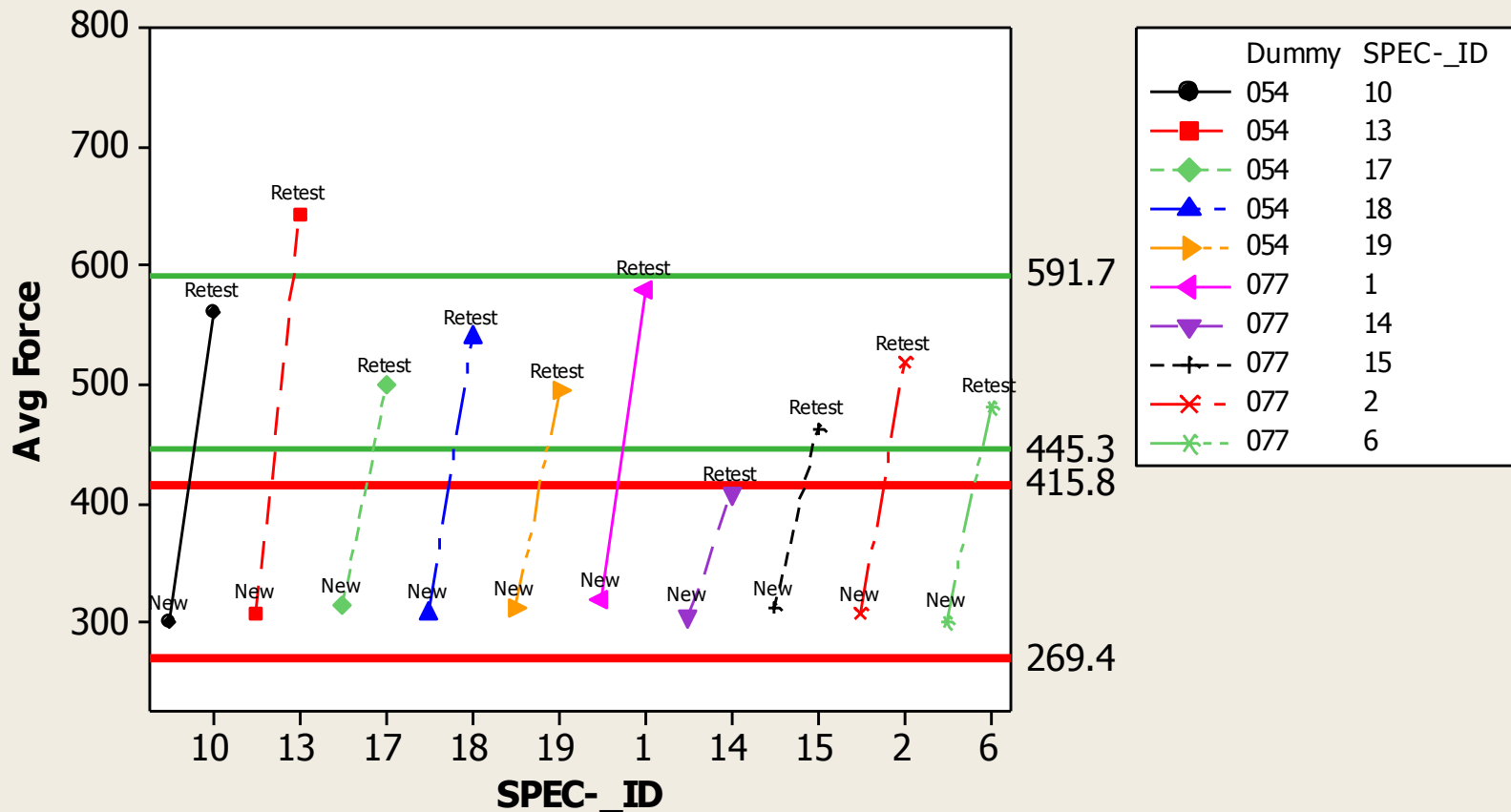


Bumper Update – R&R dummy bumper testing

Plot of Avg Force Change

ARA-521

Retest of R&R Bumpers

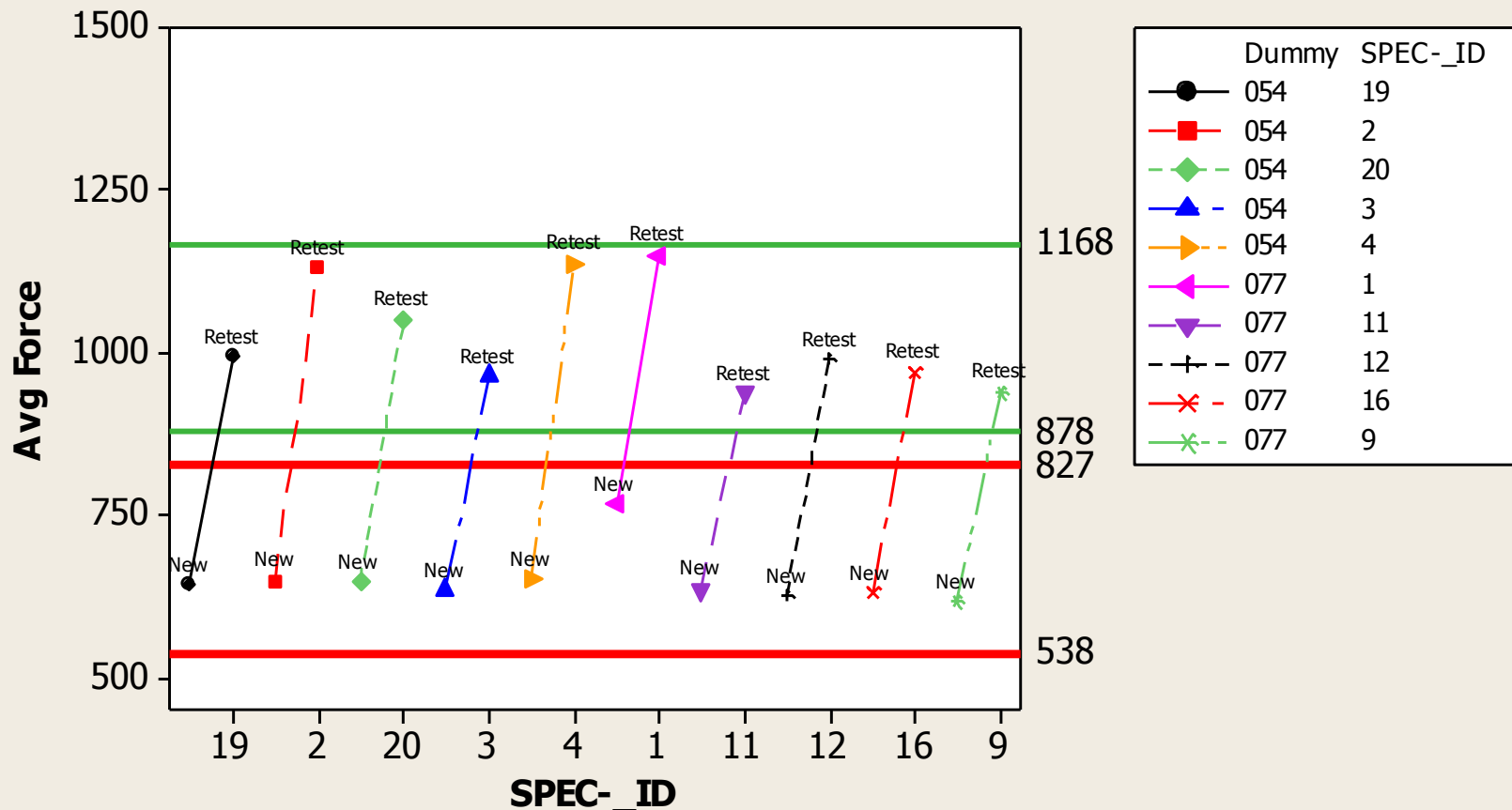


Bumper Update – R&R dummy bumper testing

Plot of Avg Force Change

ARA-520

Retest of R&R Bumpers

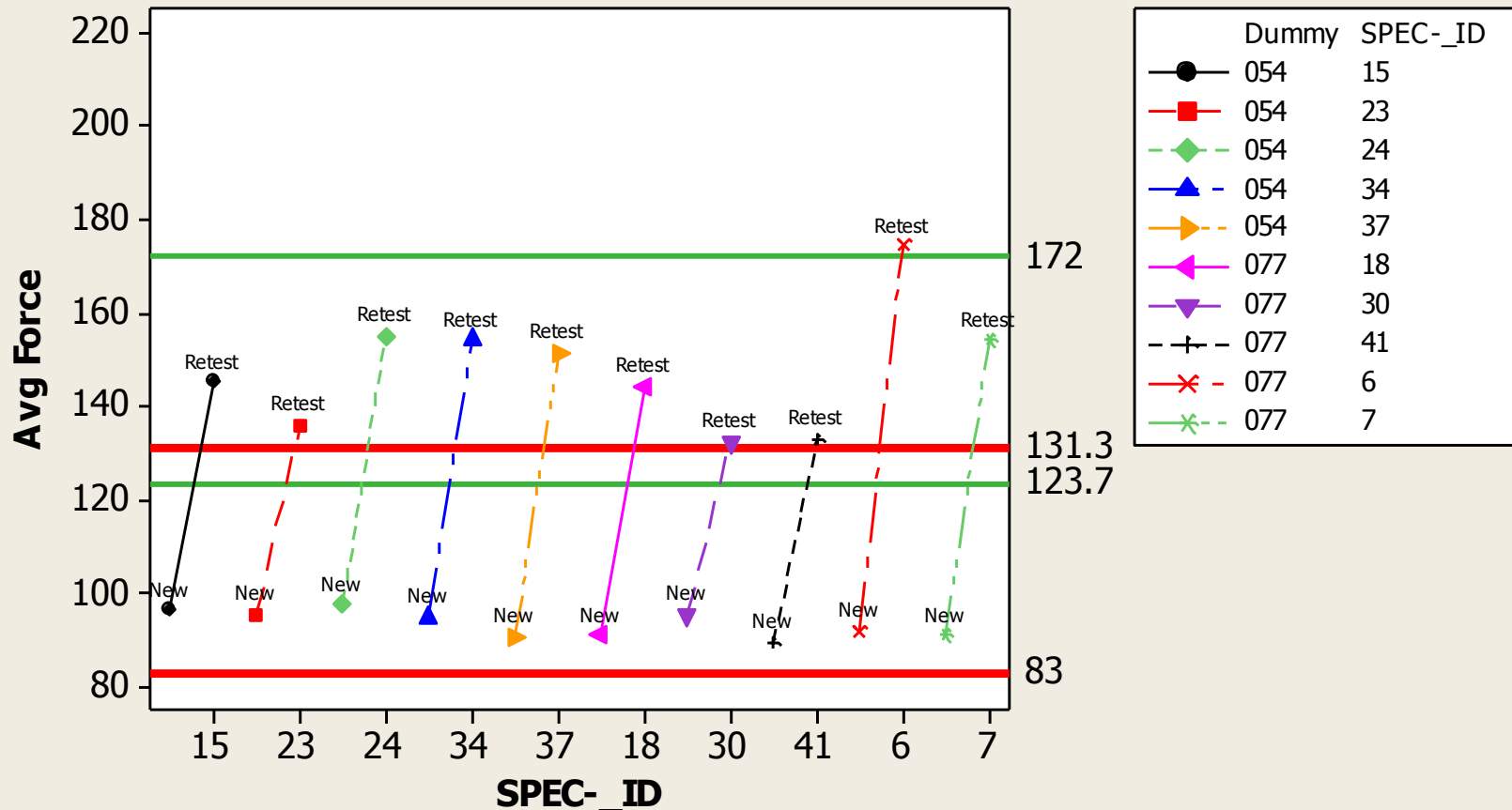


Bumper Update – R&R dummy bumper testing

Plot of Avg Force Change

ARA-381-37

Retest of R&R Bumpers

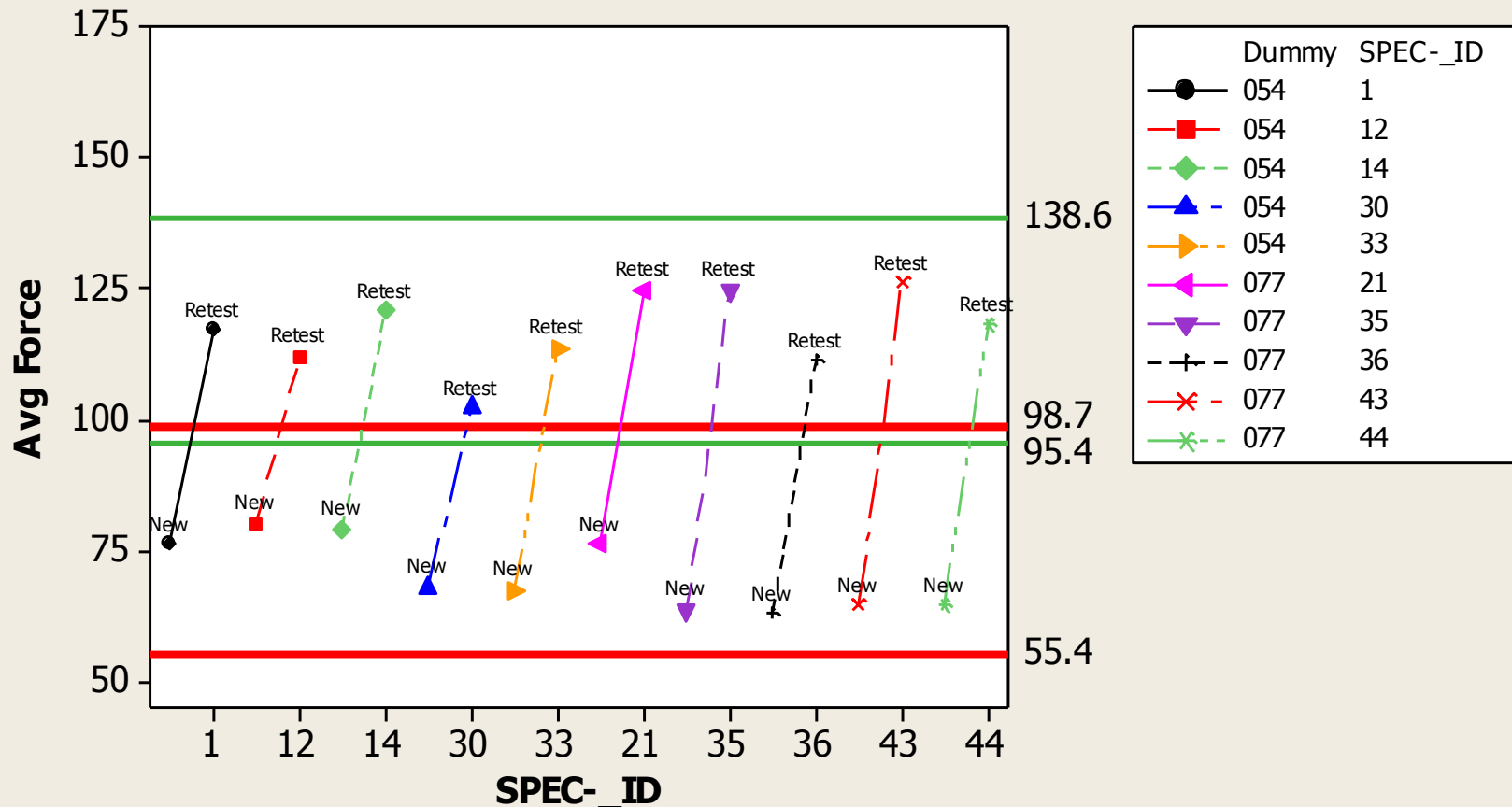


Bumper Update – R&R dummy bumper testing

Plot of Avg Force Change

ARA-381-30

Retest of R&R Bumpers

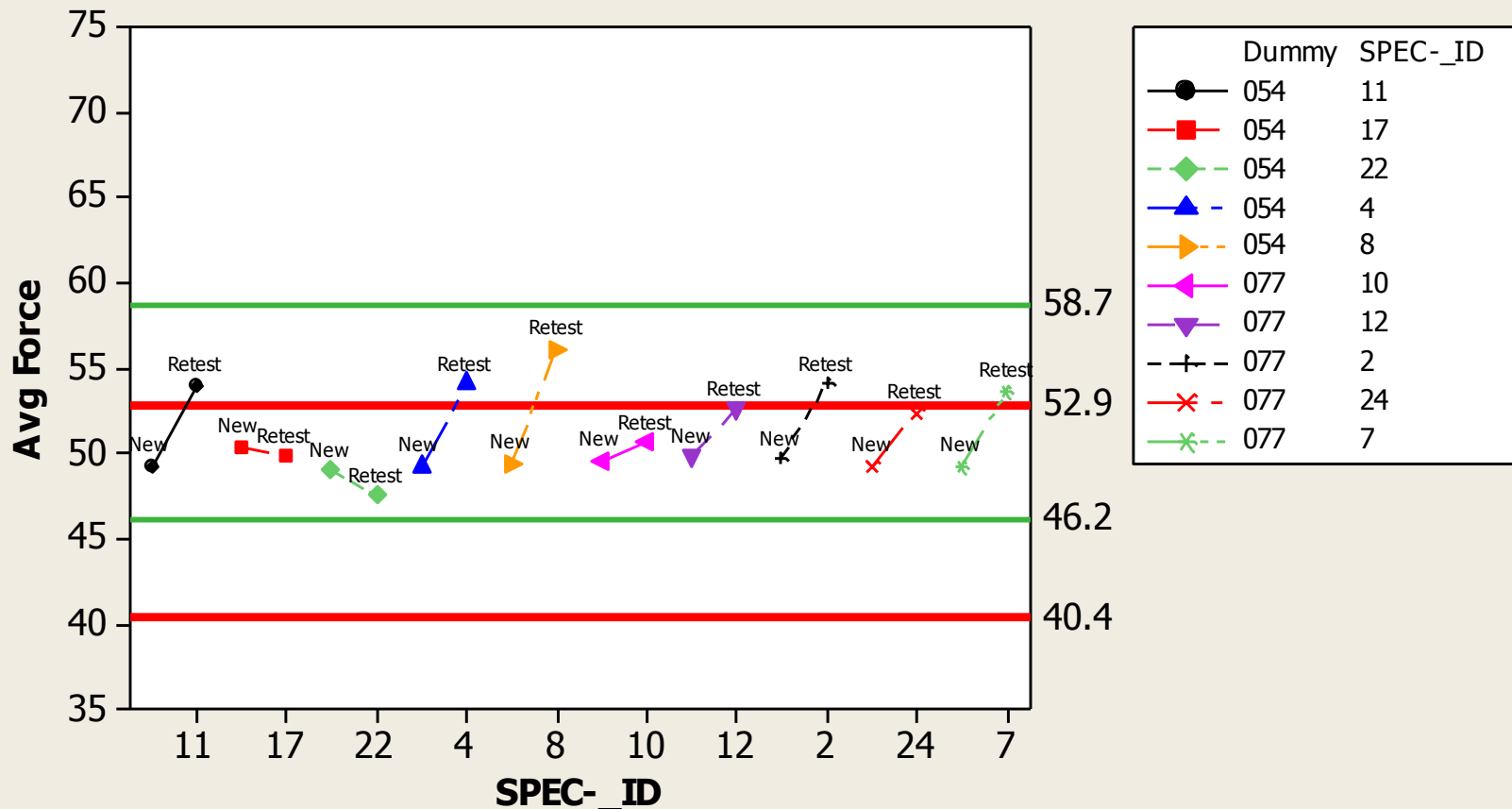


Bumper Update – R&R dummy bumper testing

Plot of Avg Force Change

ARA-227

Retest of R&R Bumpers

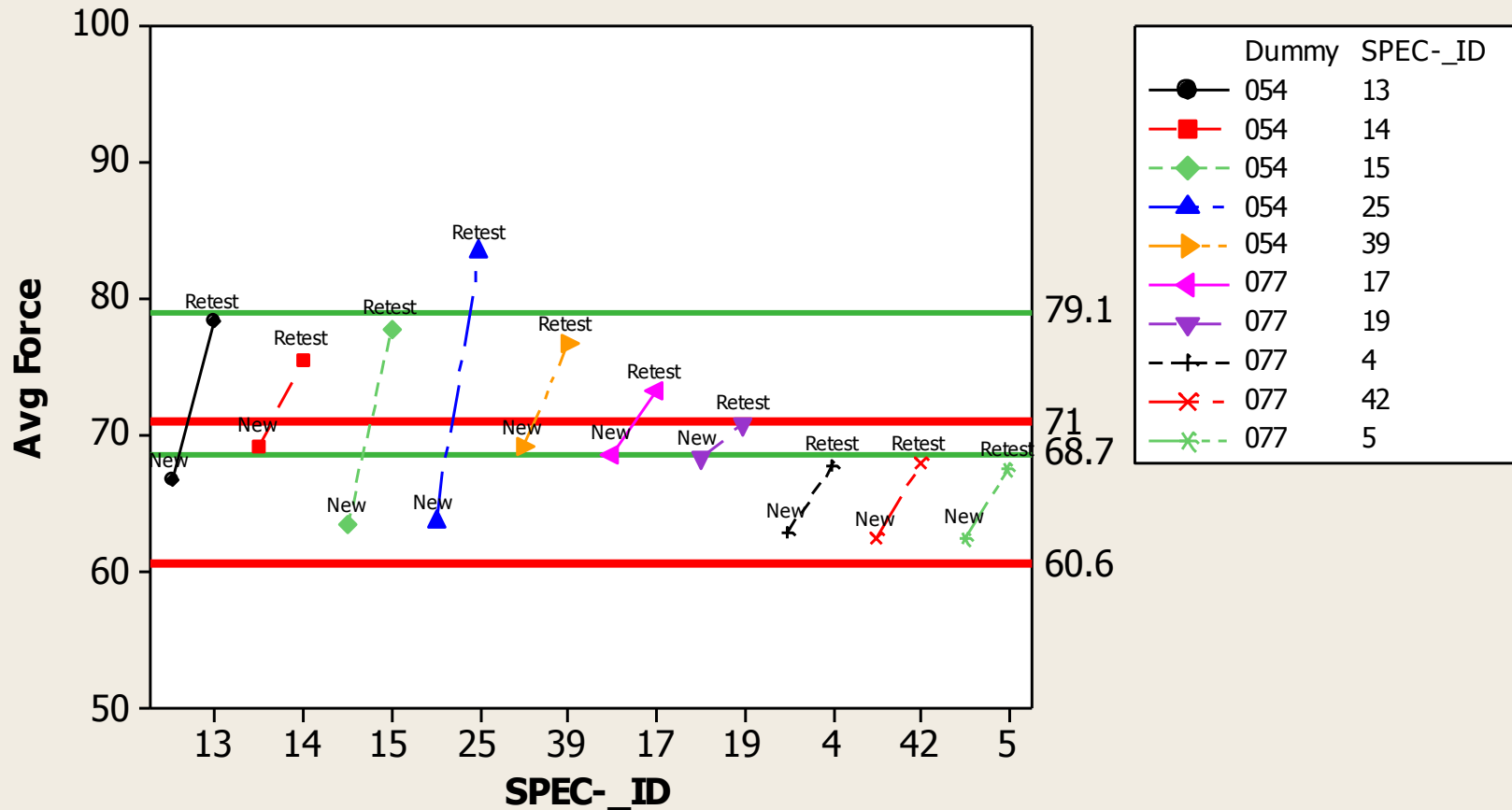


Bumper Update – R&R dummy bumper testing

Plot of Avg Force Change

ARA-220

Retest of R&R Bumpers



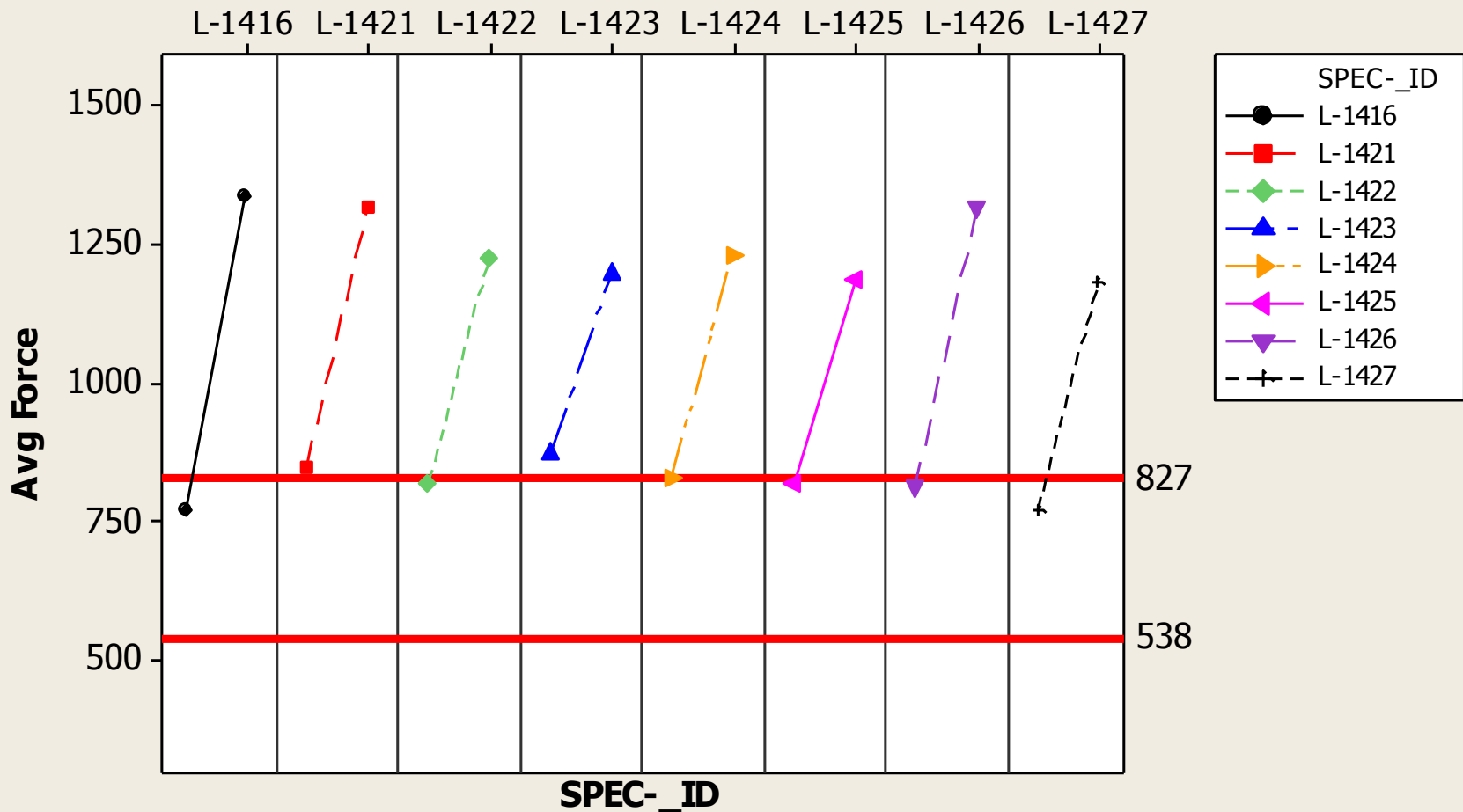
Bumper Update

- R&R dummy bumpers did stiffen
 - Before or after R&R test series?
 - How long does stiffening take?



Bumper Update

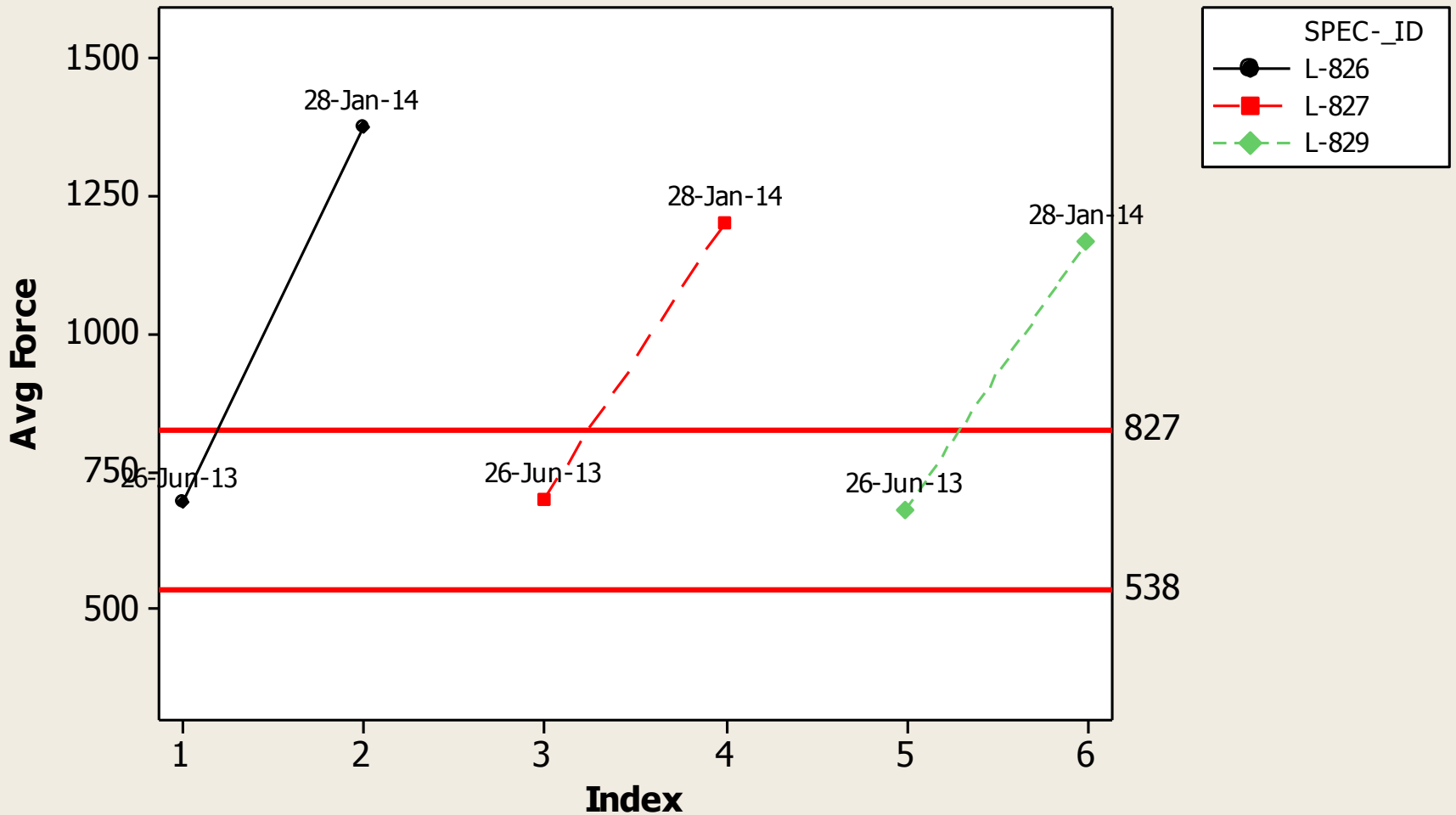
Bumper Stiffness Gain
ARA-520 "standard" @ ~60 days



Bumper Update

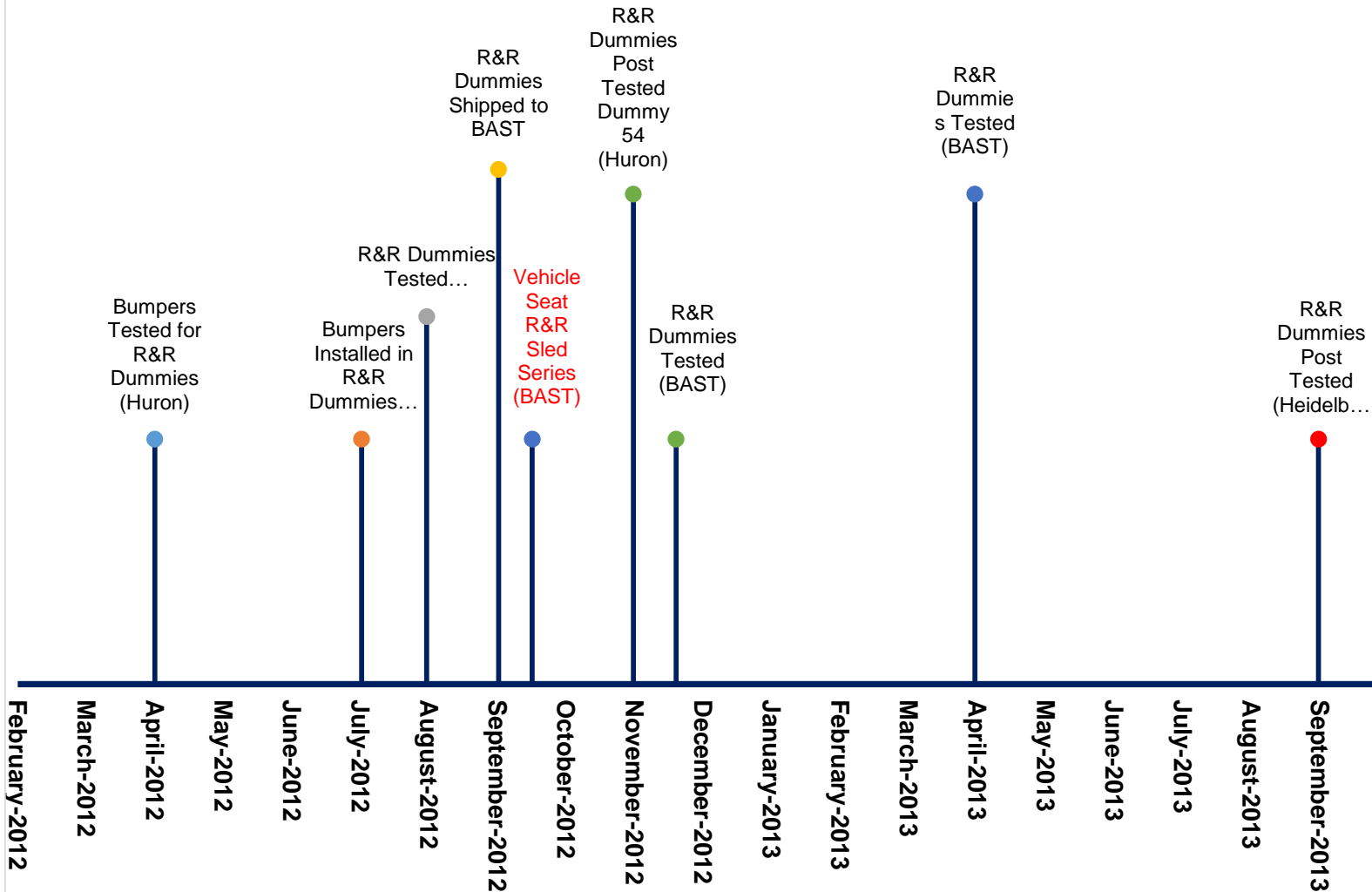
Plot of Avg Force Change @ 7 Months

ARA-520 Standard



Bumper Update

R&R Dummies Bumper and Testing Timeline



Bumper Update

- Using retest compressions to reset corridors
 - Think from timeline bumpers stiffened between original compression and BAST sled series
 - Using Green corridors as targets for aged bumpers
- VRTC dummies
 - Looking for aged bumpers that meet green corridors



Bumper Update

- Still in progress
 - Comparing durometer to compression
 - Can durometer indicate stiffening
 - ▶ Data not ready to present (maybe tomorrow)
 - Investigating material stiffening
 - More conclusive proof of best method for control
 - ▶ R&R studies on durometer and compression
 - Process to assure stable parts for installation into dummies



Bumper Update

- Might have more info by tomorrow
 - Durometer vs compression on a variety of batches
 - Aging studies on a variety of batches
 - Plan for R&R studies
 - Detailed plan for finishing test development by April
 - Selection of bumpers for VRTC dummies
- R&R studies durometer & compression
 - Shooting for end next week



Finishing dummies for Injury Criteria Development

- VRTC dummies
- Need to get bumpers right
 - Looking for aged bumpers hitting aged R&R bumper targets right now
- Finish testing to certification tests and proposals
- Try to get dummies complete end next week
 - Assuming we find enough bumpers hitting new targets



Test

Documentation Discussion

Discuss 1/27/14 Draft?

Questions?