



Quality.Together

SPIB TECHNICAL COMMITTEE

APRIL 24, 2018

UPDATE ON SOUTHERN PINE DESIGN VALUES

HISTORY

- Original IGT Published: 1991
- Monitoring: 1994-2010
- Destructive Testing: 2011
 - #2 2x4
 - MOE, MOR, UTS
- Significant decreases observed

2012

- Reduced 2x4 #2 & lower design values
- Conducted New IGT
 - 2 grades, 3 sizes
 - MOE, MOR, UTS, UCS

RECENT HISTORY

- New design values published (2013)
- Monitoring:



INGRADE TESTING STANDARDS

- Two main standards written during original IGT process to document procedures as they evolved.
- Extensive collaboration from FPL, FPIinnovations (previously Forintek), industry technical experts, and North American grading agencies

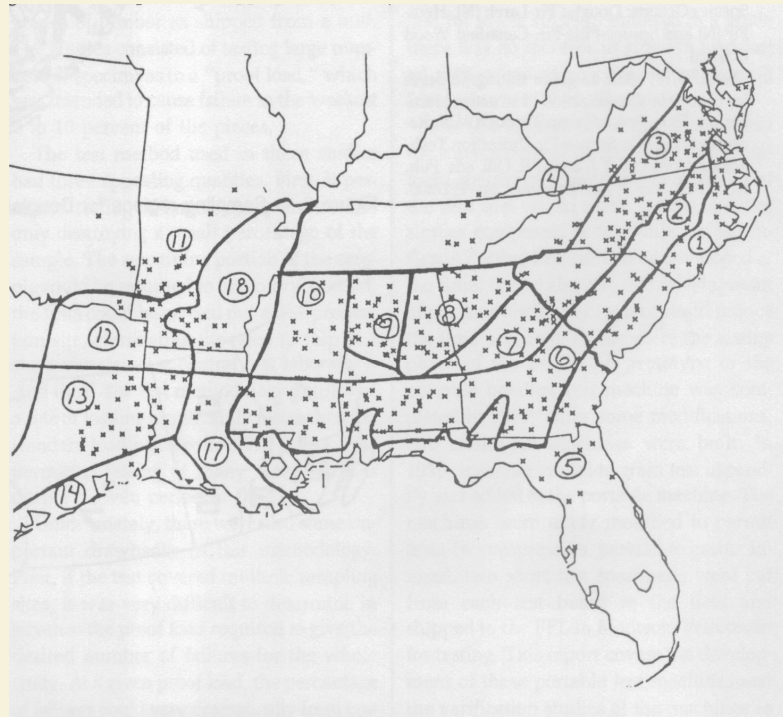
INGRADE TESTING STANDARDS

- ASTM D4761- testing procedures for a mill environment
- ASTM D1990 – data adjustments, modelling procedures, design value development

SAMPLING

- Mills assigned to one of 16 homogeneous Southern Pine growing regions
- Includes SPIB and TP mills
- Randomly select mills in proportion to regional production
- Target sample size: 360 pieces per “cell”
- Test 10-12 pieces from each selected mill

SOUTHERN PINE REGIONS



NONPARAMETRIC STATISTICS

- We do not assume a “normal” (or any other) statistical distribution.
- Use “order statistics” to estimate values of interest.
- Permits analysis without actually breaking every piece.

5TH PERCENTILE

- Rank order all data from lowest to highest.
- $(5\% * \text{sample size})$ is approximately the order statistic of the 5th percentile “point estimate”.
- Example: 100 pieces broken in bending. Use the 5th weakest piece to estimate the 5th percentile.

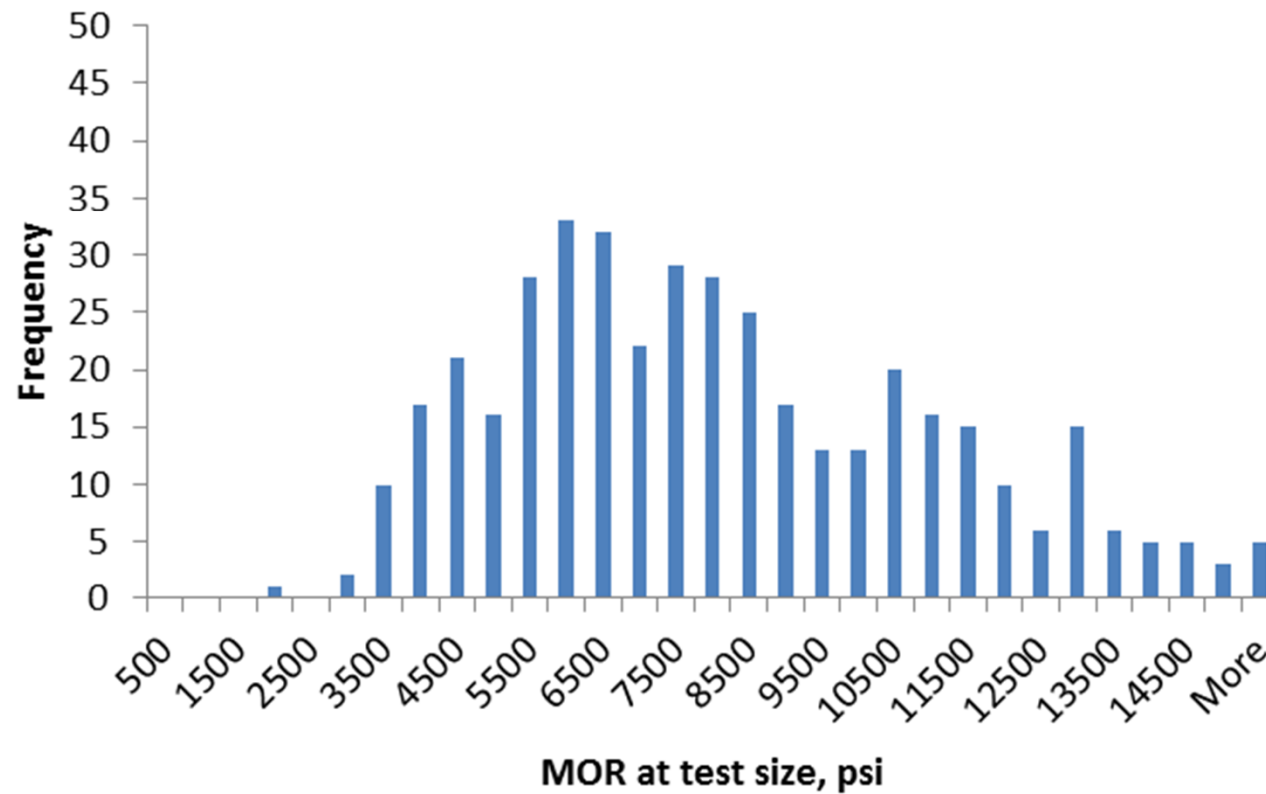
TOLERANCE LIMITS

- ASTM D1990 uses the 75% confidence tolerance limit on the 5th percentile.
- Uses data from a piece weaker than actual 5th percentile “point estimate”.
- Provides increased confidence that true 5th percentile is equal to or greater than our estimate.

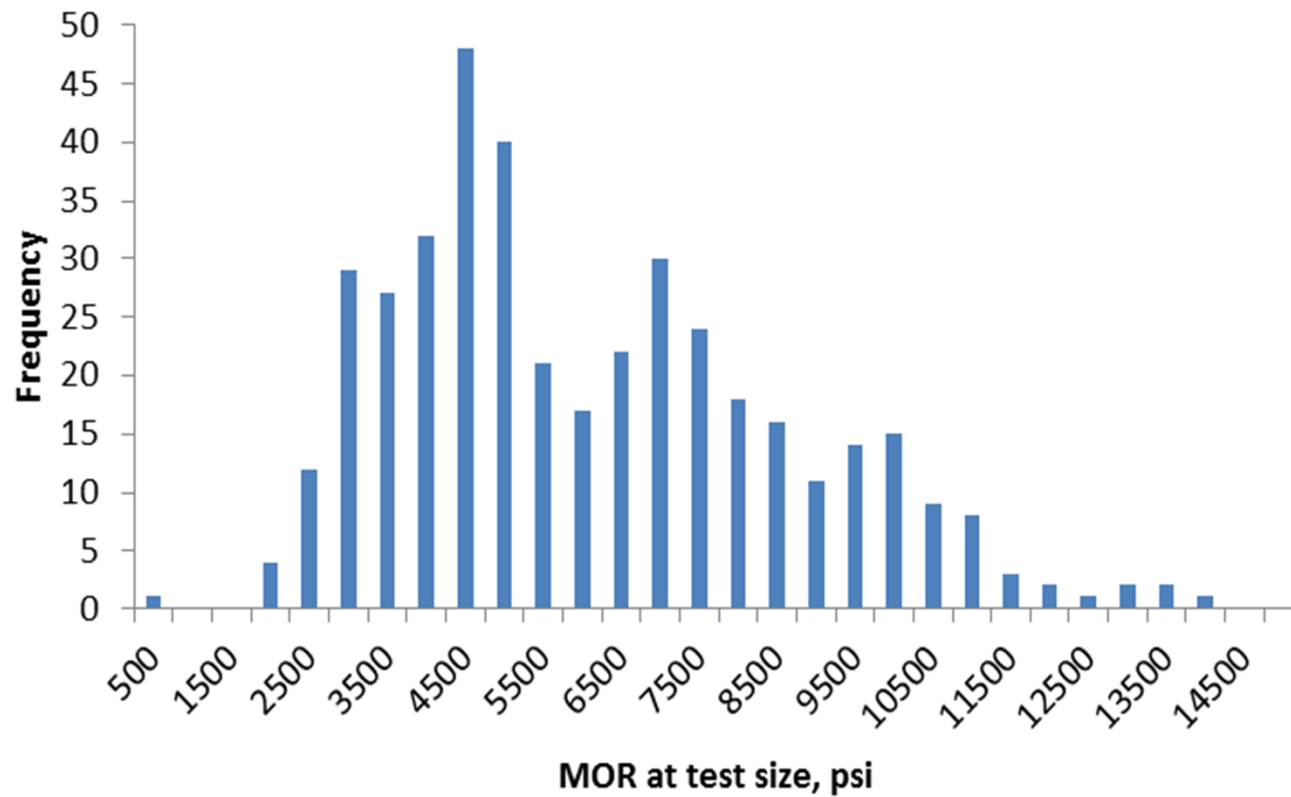
2X4 RESULTS

MOR RESULTS

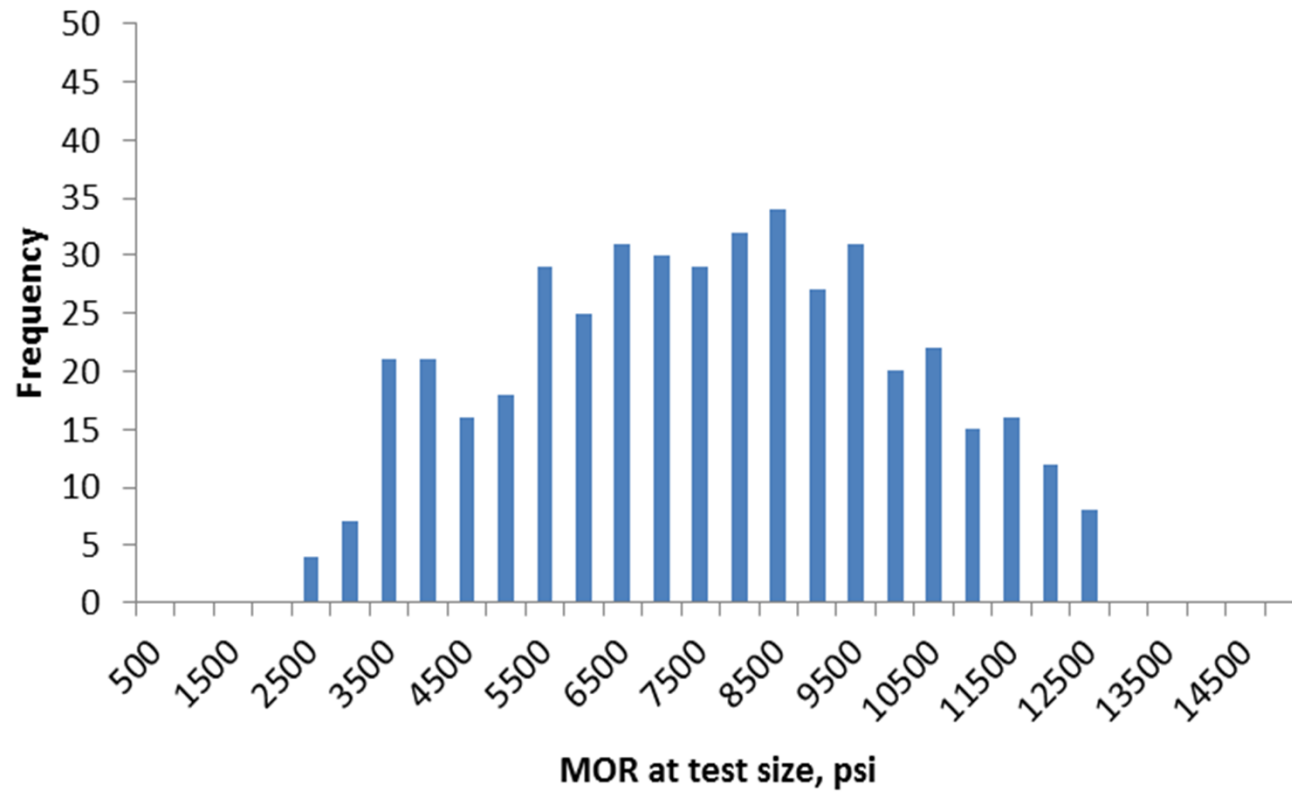
#2 2x4 Original IGT



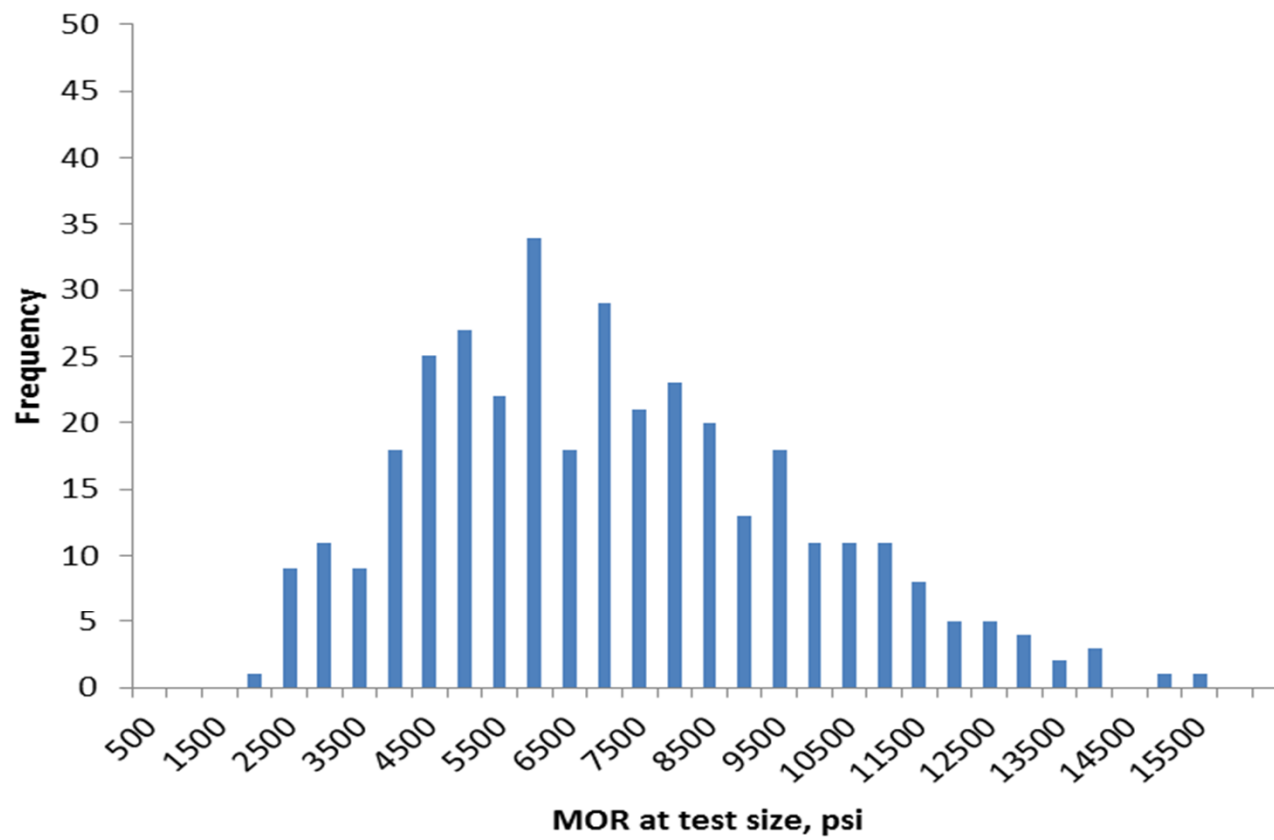
#2 2x4 - 2011



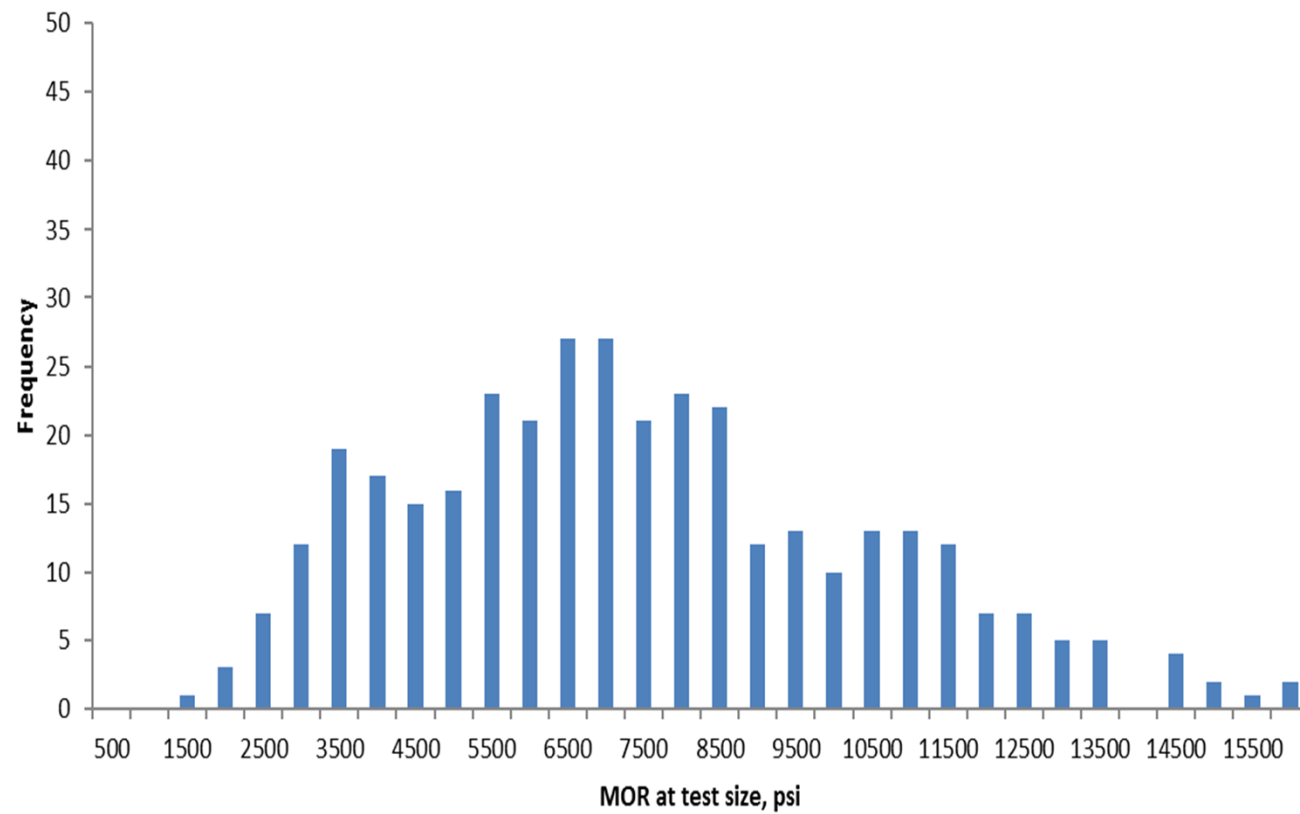
#2 2x4 - 2014



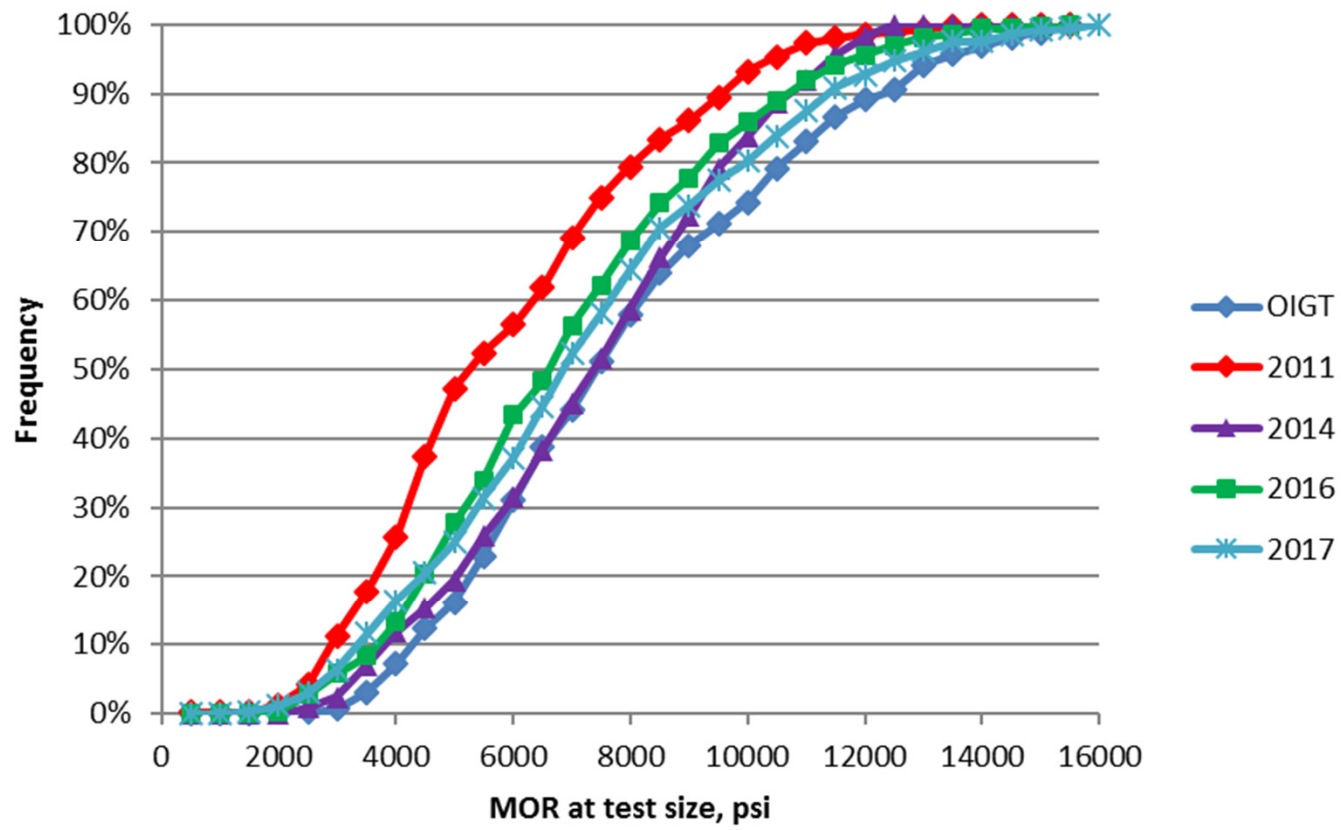
#2 2x4 2016 MOR



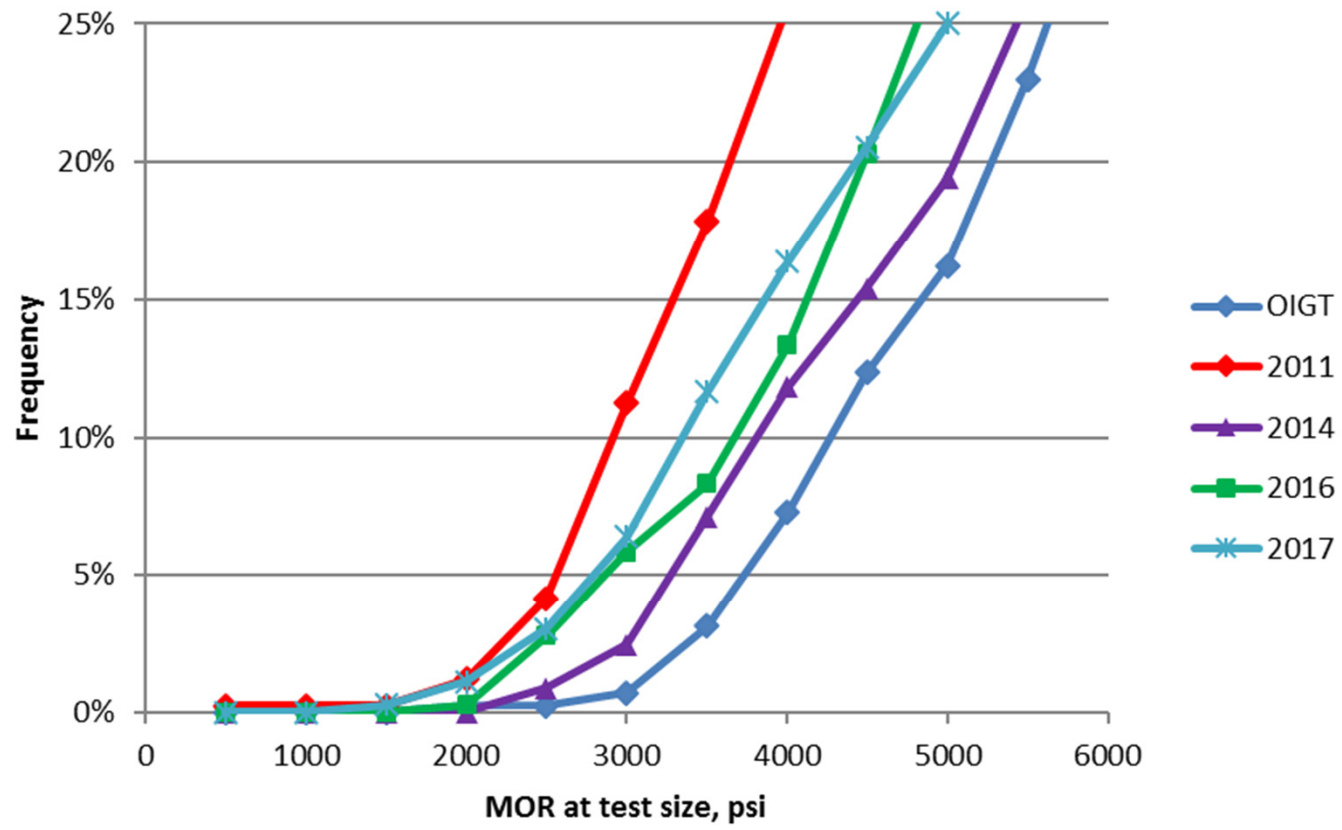
#2 2x4 2017 MOR



CFD #2 2x4 MOR

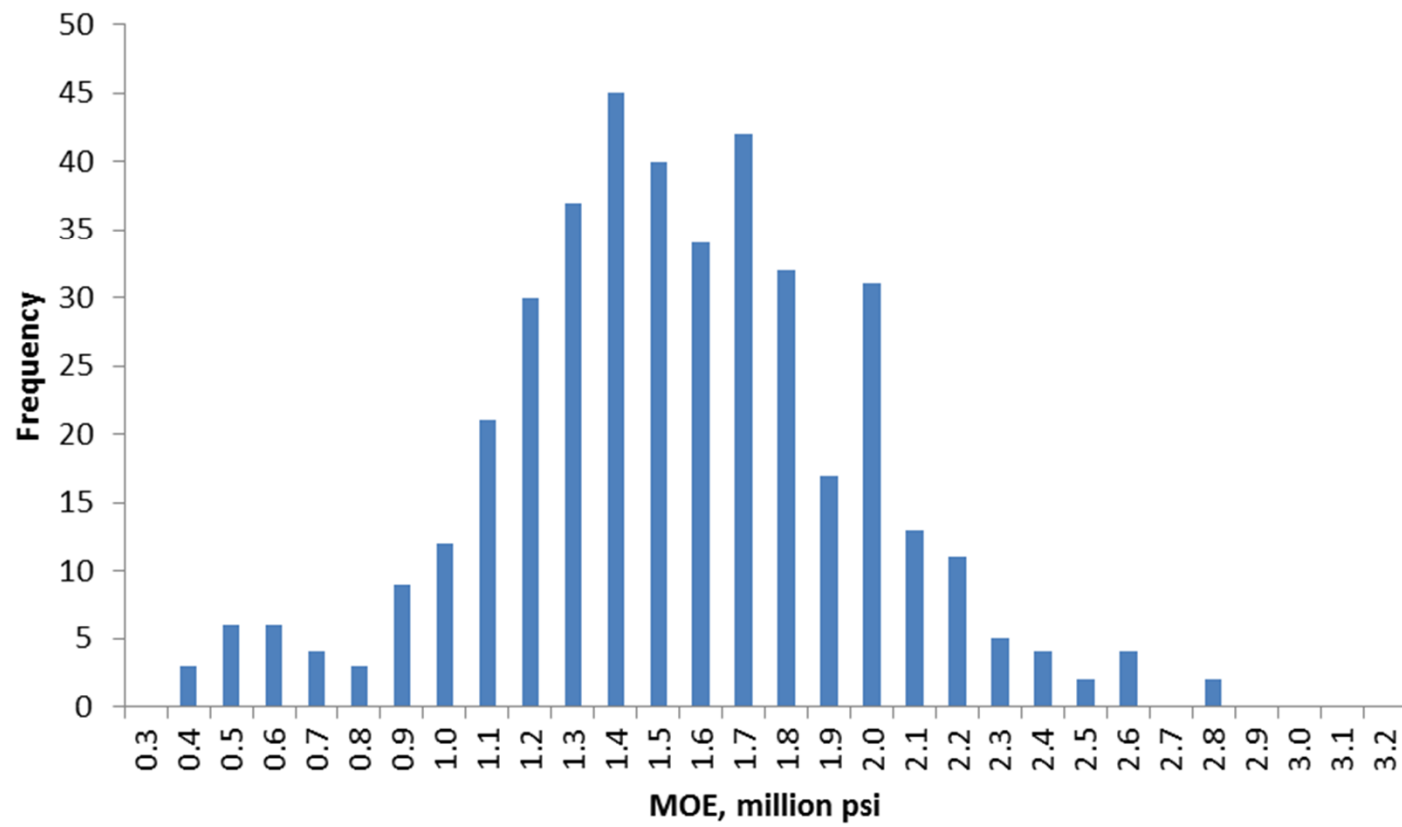


CFD #2 2x4 MOR - Lower Tail

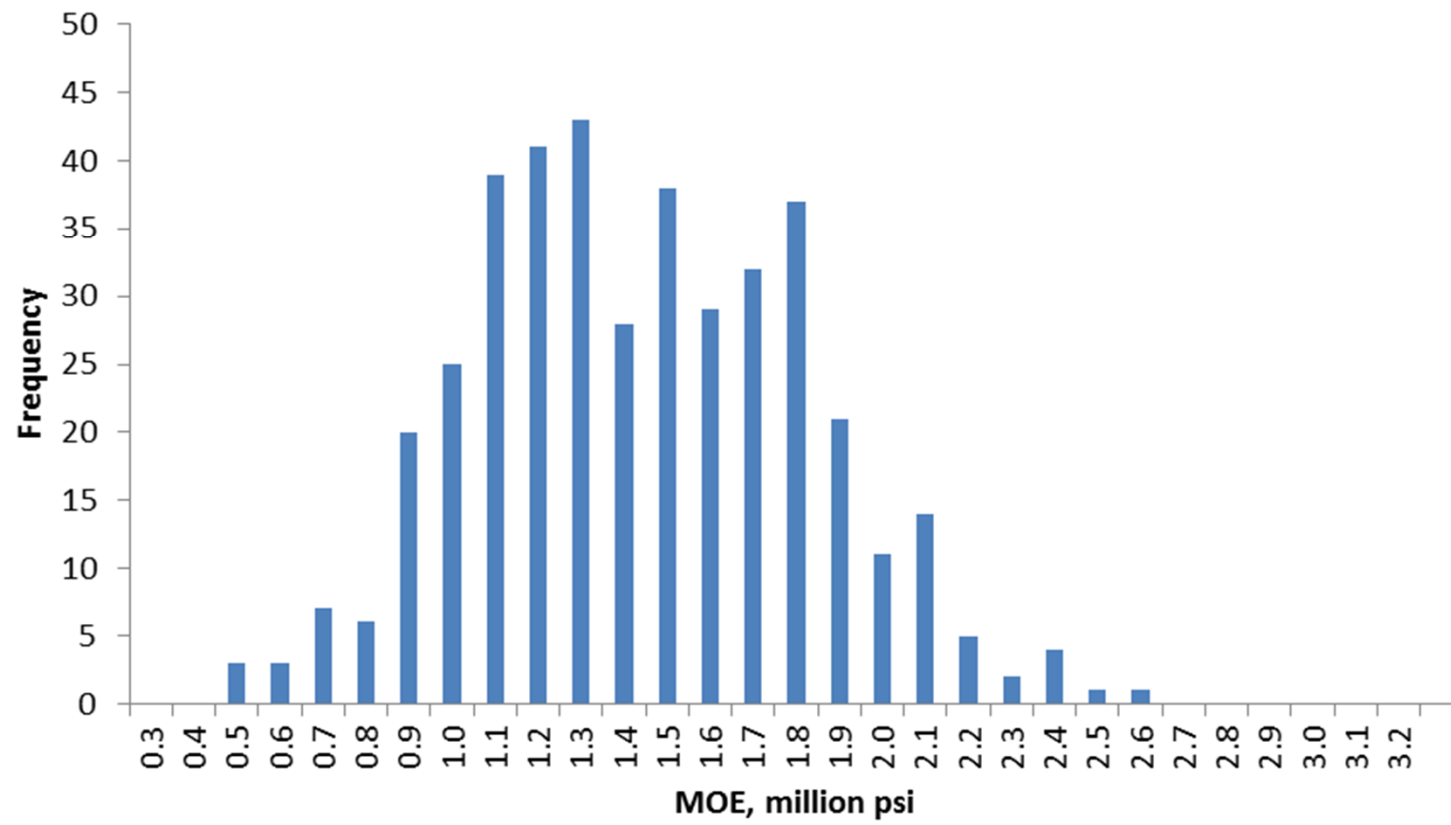


MOE RESULTS

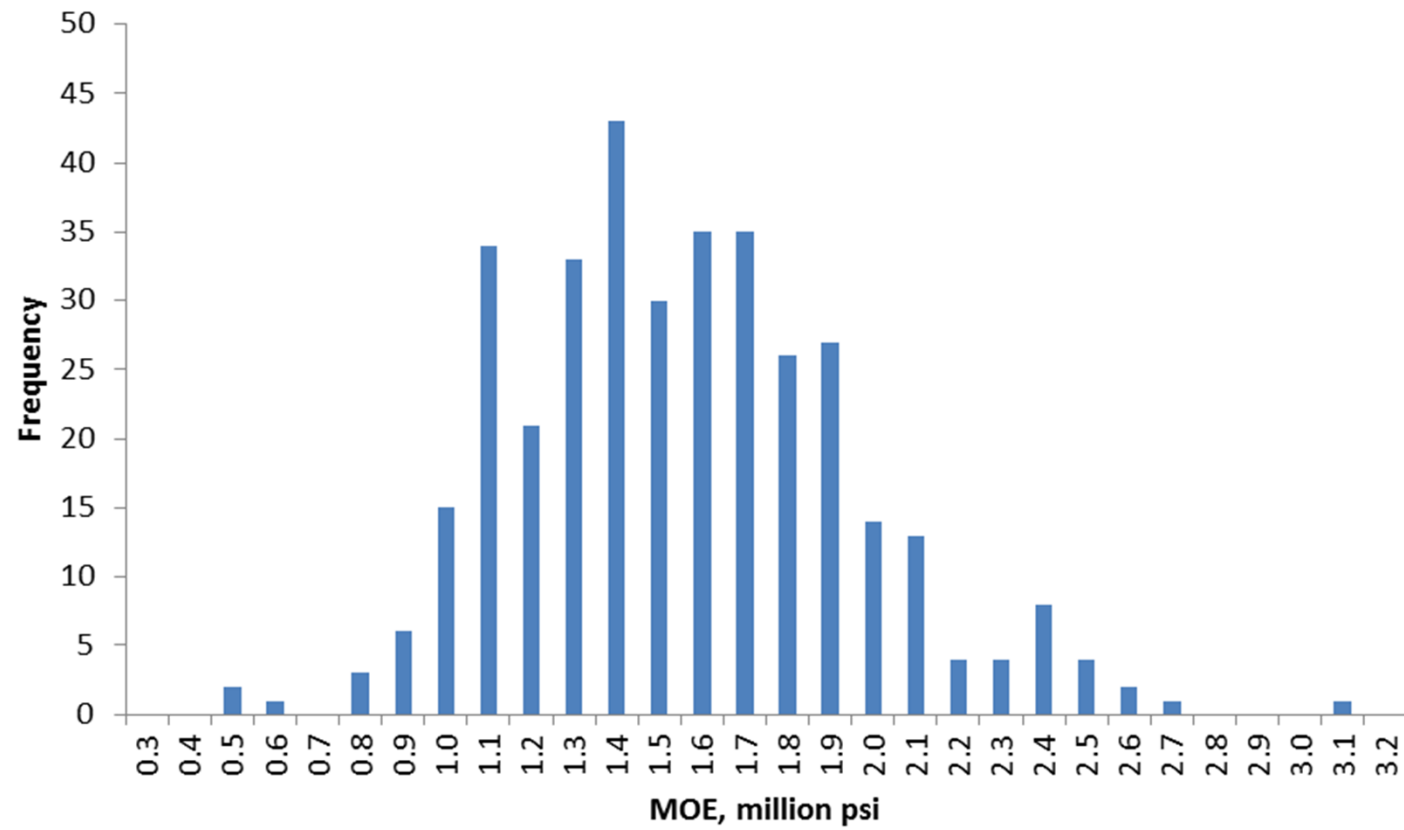
#2 2x4 Original IGT



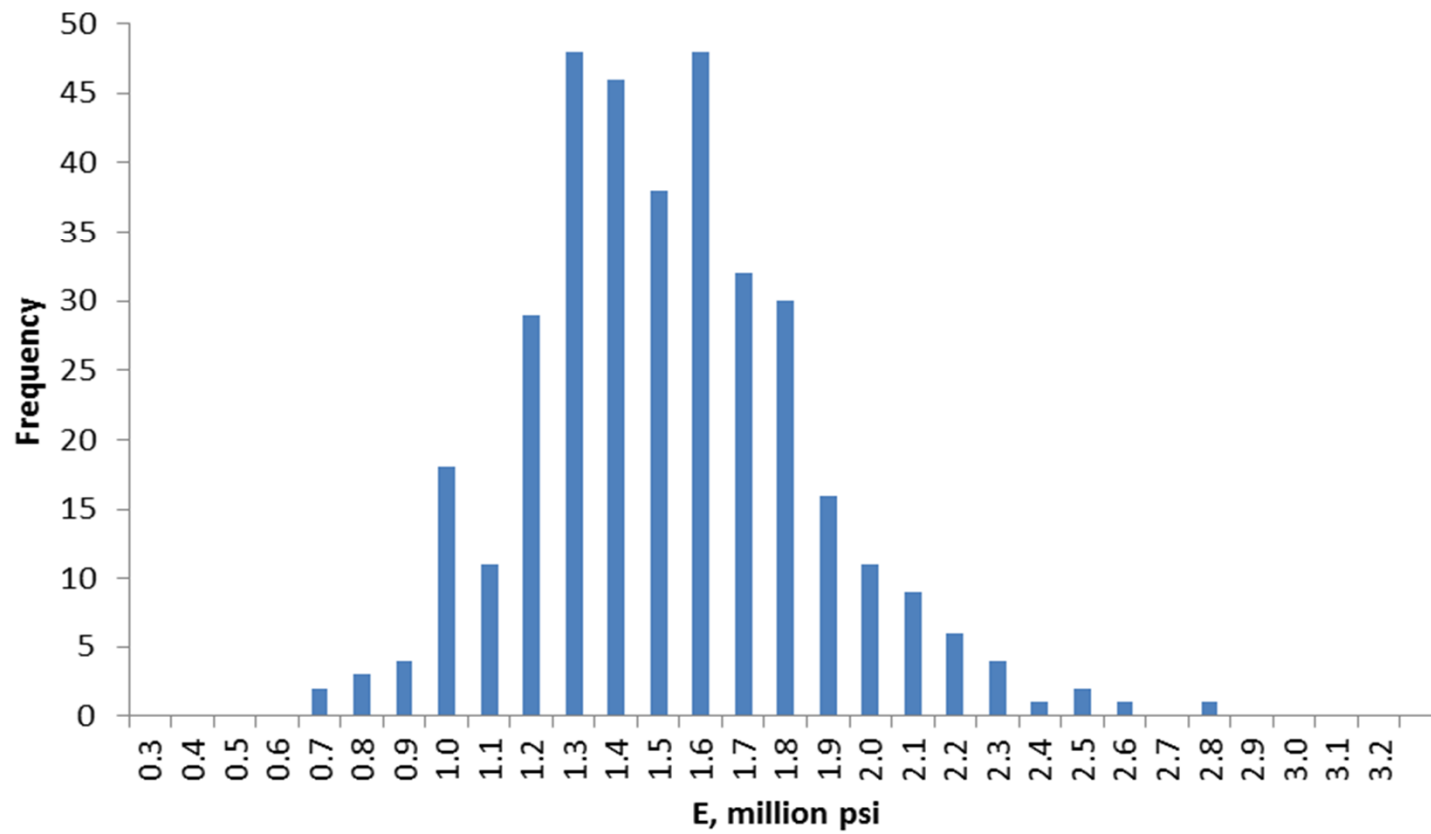
#2 2x4 2011



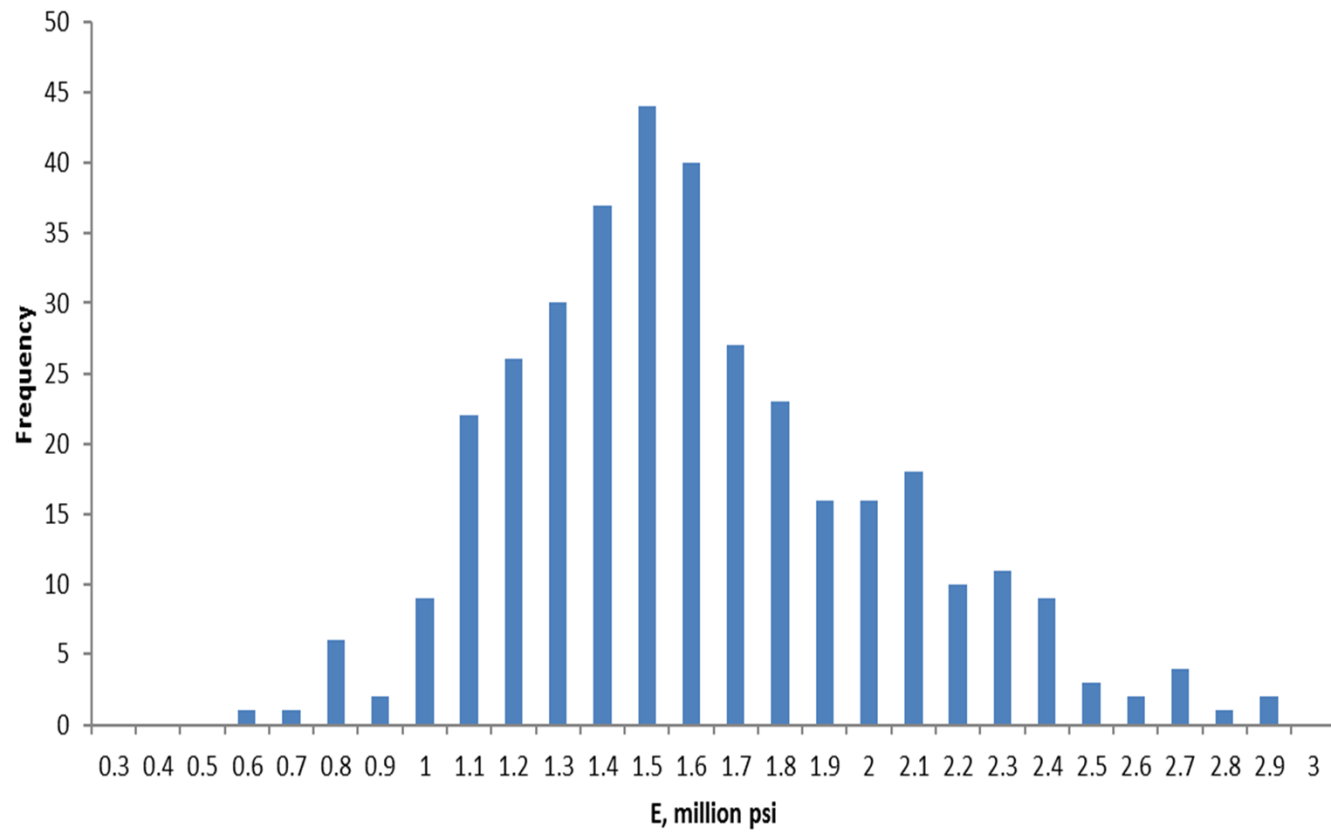
#2 2x4 2015



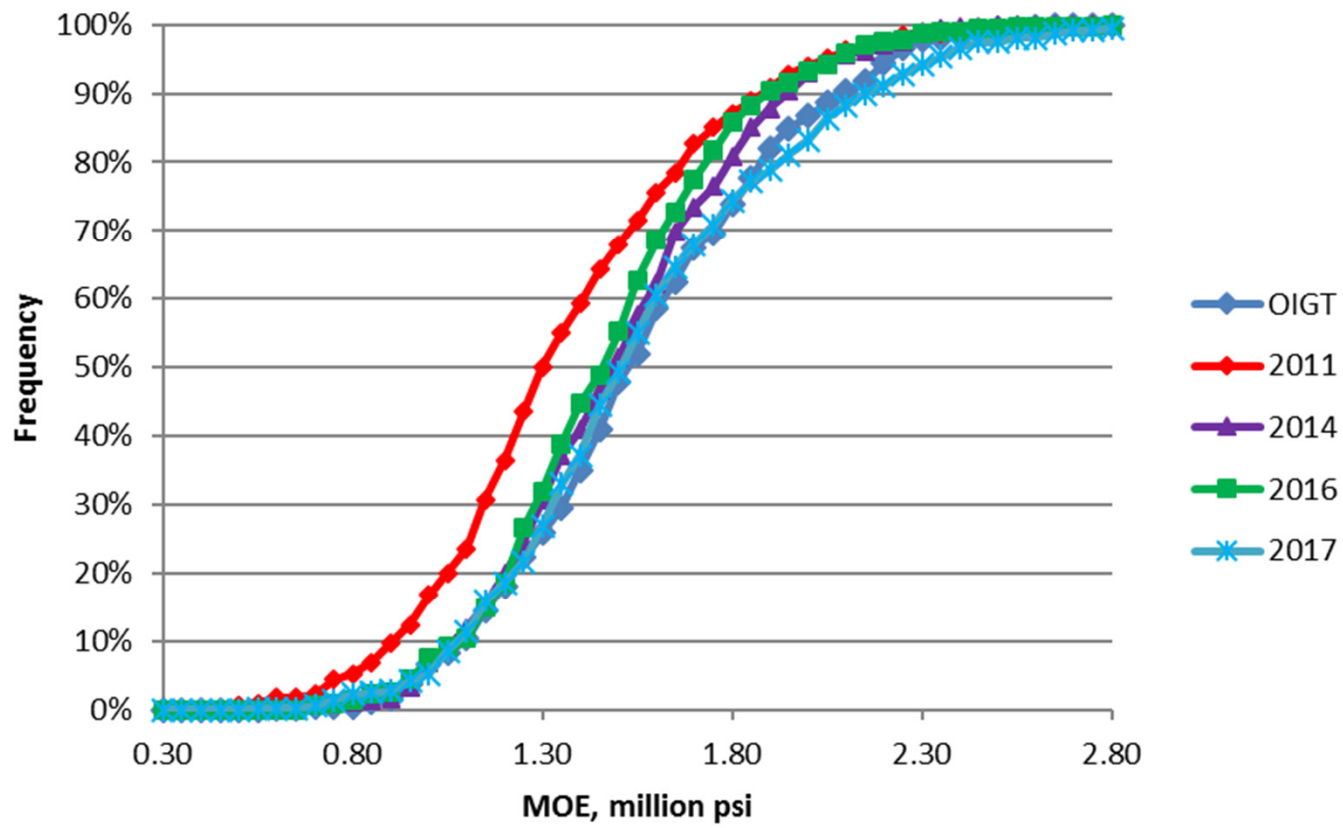
#2 2x4 2016 MOE



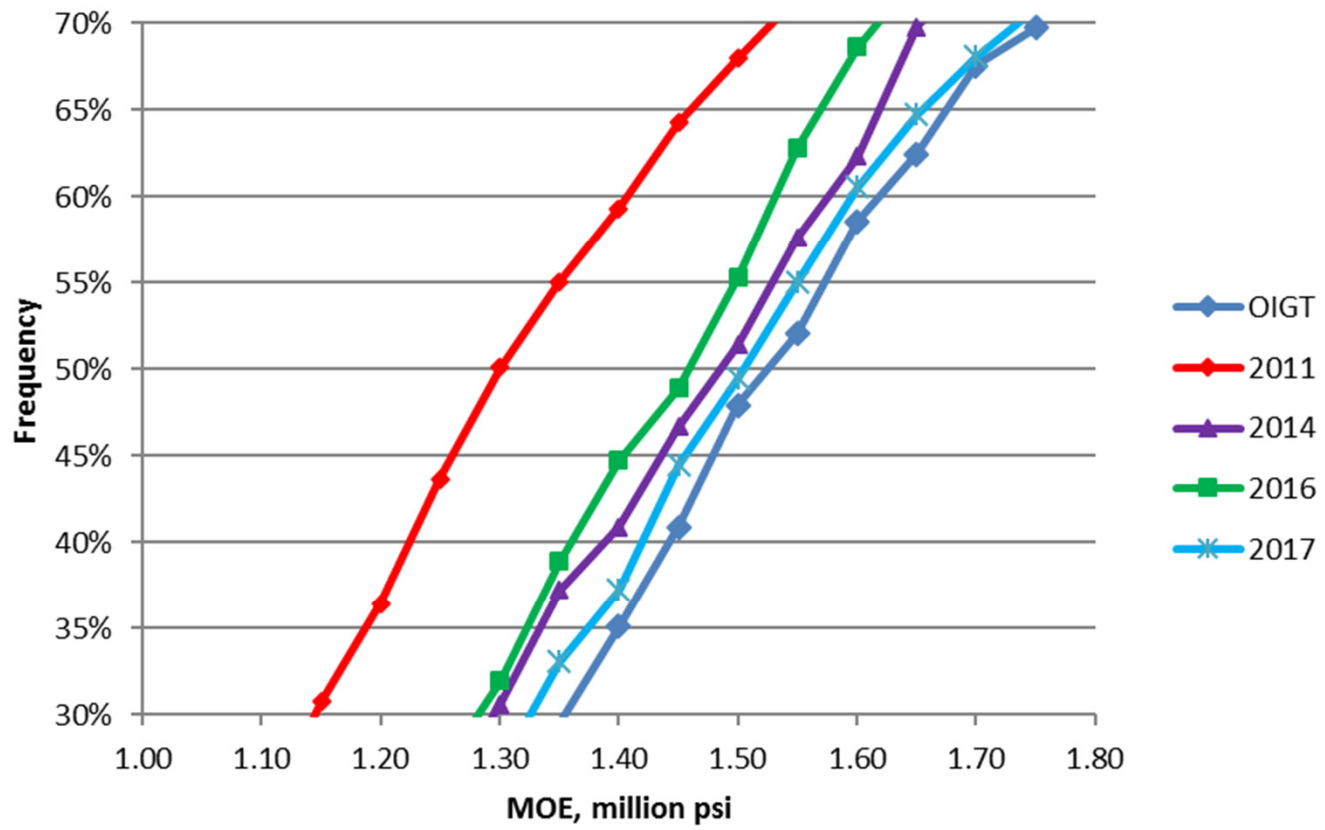
#2 2x4 2017 MOE



CFD #2 2x4 MOE



CFD #2 2x4 MOE



COMPARING 2X4 SAMPLES

	OIGT	2011	2014	2016	2017	'11-17
MOR, TL psi	3621	2547	3265	2900	2714	2831
Avg E	1.56	1.35	1.50	1.47	1.56	1.47
Avg MC	14.2%	11.1%	14.7%	14.0%	14.4%	13.5%
% Dense	55%	39%	59%	50%	65%	50%
% Comb. Kt	0%	22%	5%	12%	10%	13%
RPI	NA	5.7	5.7	5.8	6.2	5.9
%Summerwood	NA	38%	51%	44%	47%	45%
% Prime	NA	29%	19%	22%	14%	21%

OBSERVATIONS

- 2017 MOR TL is less than that observed in 2016 and 2014, but greater than 2011
- 2017 MOE is equivalent to that observed in the original In-Grade Testing
- 2017 values meet or exceed published design values

OBSERVATIONS

- Noteworthy variability between samples.
- Inconsistent relationship between MOR TL and Average MOE between samples.
- Present design values still represent lower end of what could be included in the grade.

HISTORICAL RMP DATA

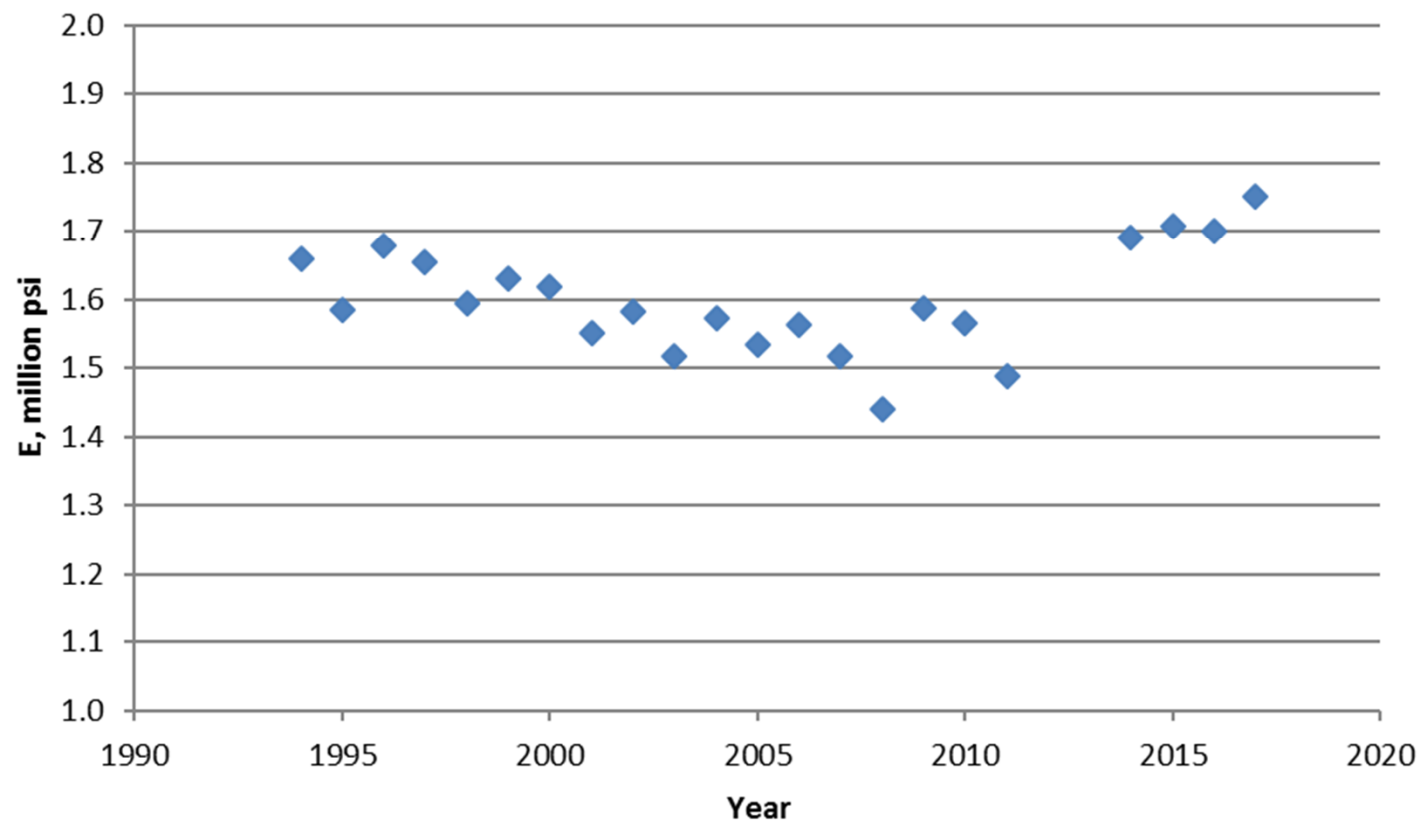
HISTORICAL RMP DATA

- Since 1994, a non-destructive monitoring program had been conducted by SPIB
- From 1994-2010, a portable E-Computer was used at mill sites to collect data
- Flatwise, transverse vibration E is not as correlated to third-point Edge E as we would like

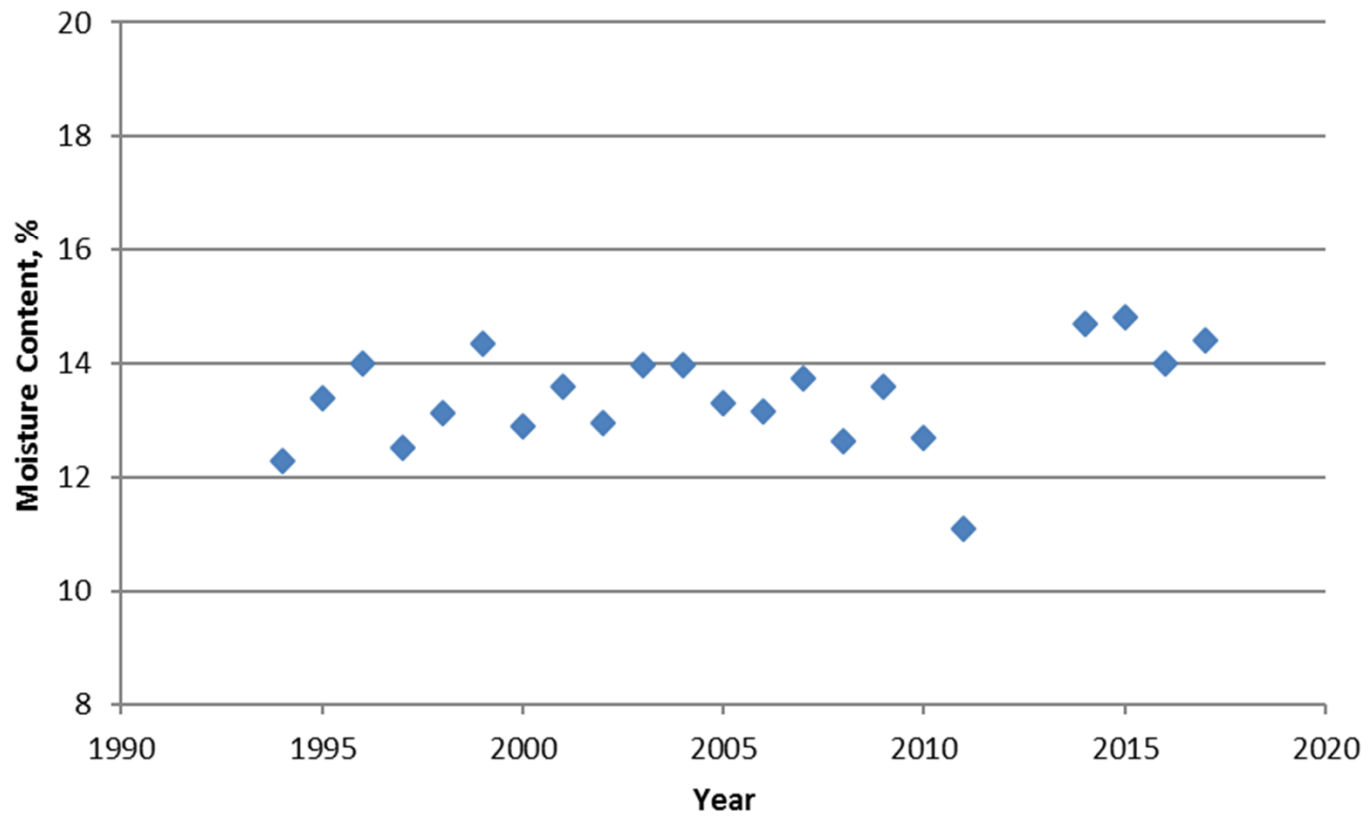
HISTORICAL RMP DATA

- #2 2x4
- Data was useful to detect trends over time
- Continue collecting E-Computer data in recent/future monitoring samples

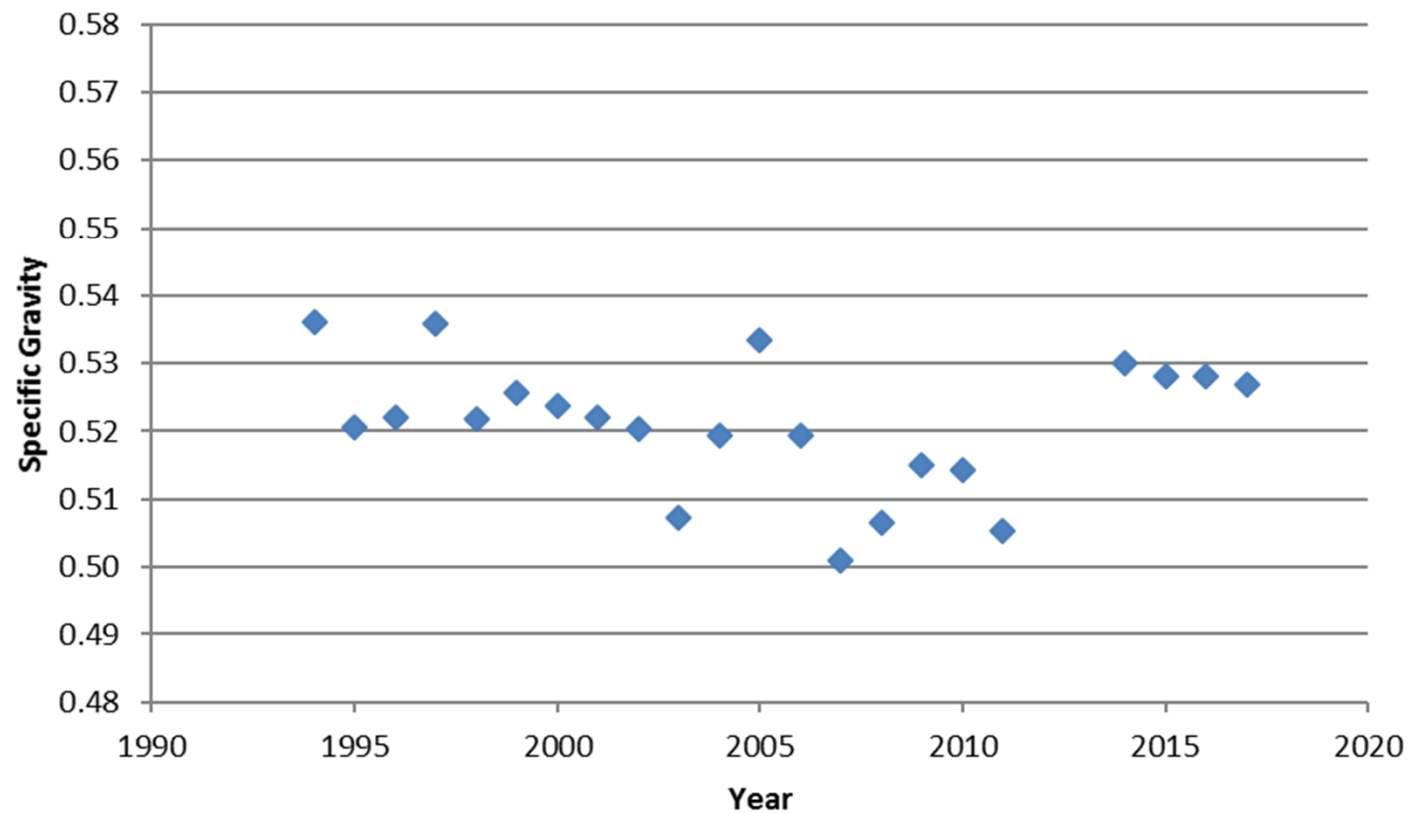
Average E-Computer E



Average MC



Average Specific Gravity



OBSERVATIONS

- Recent monitoring samples are consistent
- Specific Gravity determined on full-size lumber pieces (not approved in ASTM D2395)
- SG not a 1:1 relation with published SG

FUTURE TESTING

- Monitoring procedures added to ASTM D1990
- Requirement: Test most commonly produced size/grade every 5 years
- SPIB: Test #2 2x4 every approximately 18 months, test a wider width every 3rd year.
- Vary between bending and tension tests.
- 18 month cycle – sample different seasons

Year	"Season"	Size	Grade	Property	Meeting
2011		2x4	#2	E, MOR, UTS	
2012	fall	2x4, 2x8, 2x10	SS, #2	E, MOR, UTS, UCS	
2013	summer	2x6	#1	E, MOR	
2014	winter	2x4	#2	E, MOR	
2015	winter	2x4	#2	E, UTS	Jun '16
2016	late fall	2x4, 2x8	#2	E, MOR	Jun '17
2017	spring	2x4	#2	E, MOR	Apr '18
2019	fall	2x4, 2x8	#2	E, UTS, MOR	Jun '20
2021	spring	2x4	#2	E, MOR	Apr '22
2023	fall	2x4, 2x8	#2	E, UTS, MOR	Jun '24



THANK
YOU