Bending Beam Fatigue Test – Update

Geoff Rowe
Bill Criqui
David Jones
Andrew Cooper
Kieran McGrane
Phil Blankenship
John Harvey

Mixture ETG Meeting, Falls River, MA
September -2016

10 Items from last meeting(s)

1. Wave form
2. LVDT reference location
3. Rotational and lateral translation at clamping locations
4. Clamping stress
5. Response sampling intervals and numbers
6. Details calculations of each reporting interval
7. Strain level selection for testing
8. Add discussion about test termination and fatigue life where Nf is desired outcome.

   Run test to S.n with at least reduction of 15 % beyond failure defined as S.n peak. Currently in AASHTO and ASTM.
9. Add note about NMAS min and max and variability
10. Minimum results that must be reported

From our 2016/04 meeting!
Update of work

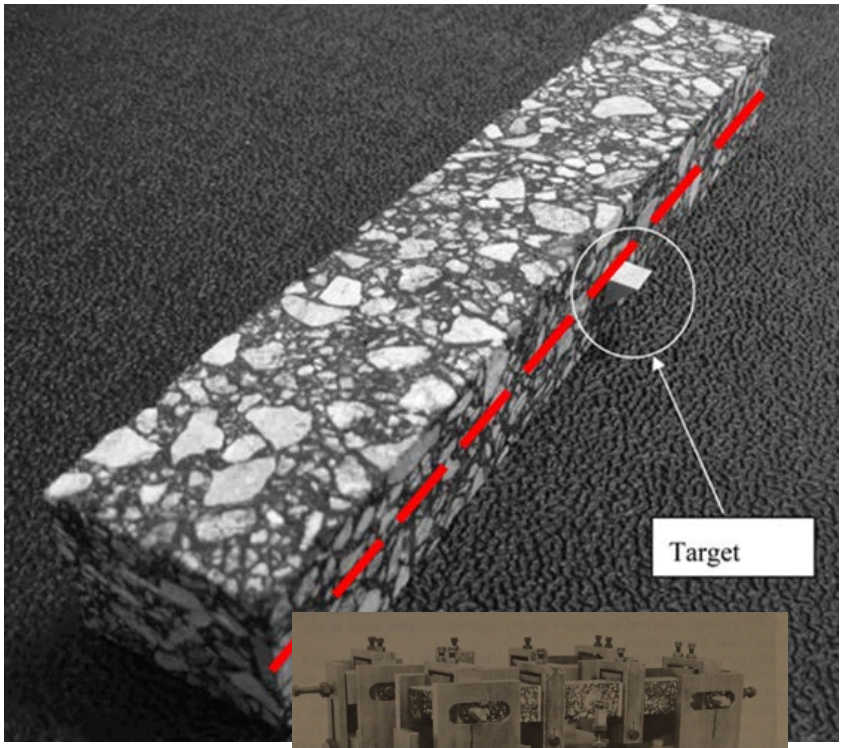
1. Wave form

- Agree that both standards would use sine curve about initial zero position
  - No haversine or versine or offset language in specification
  - Makes specification language simpler
  - Consistent with majority view on what most the majority of tests labs have been doing in the USA
  - Use of other wave forms has shown been shown as not statistically significant in recent review by UC Davis

Agreed

2. LVDT reference location

- Agreed that all standards would use method that was originally proposed by SHRP A003a research
  - Target reference at mid point of beam on specimen
  - Agreement from major equipment manufactures (IPC, Cooper, James Cox & Sons)
  - Makes this issue of possibly needed two standards go away



Agreed

3. Rotational and lateral translation at clamping locations

- Consider this is not an issue – just check wording in ASTM and AASHTO
  - Concern had been raised on ASTM wording
  - Equipment provides for this

Ok

4. Clamping stress

- Provisional agreement on 300 N +/- 30N
  - With area of 25mm – just need to check with manufactures to make sure no issue – but this will be written into both standards

Concern about evidence for importance of this

5. Response sampling intervals and numbers

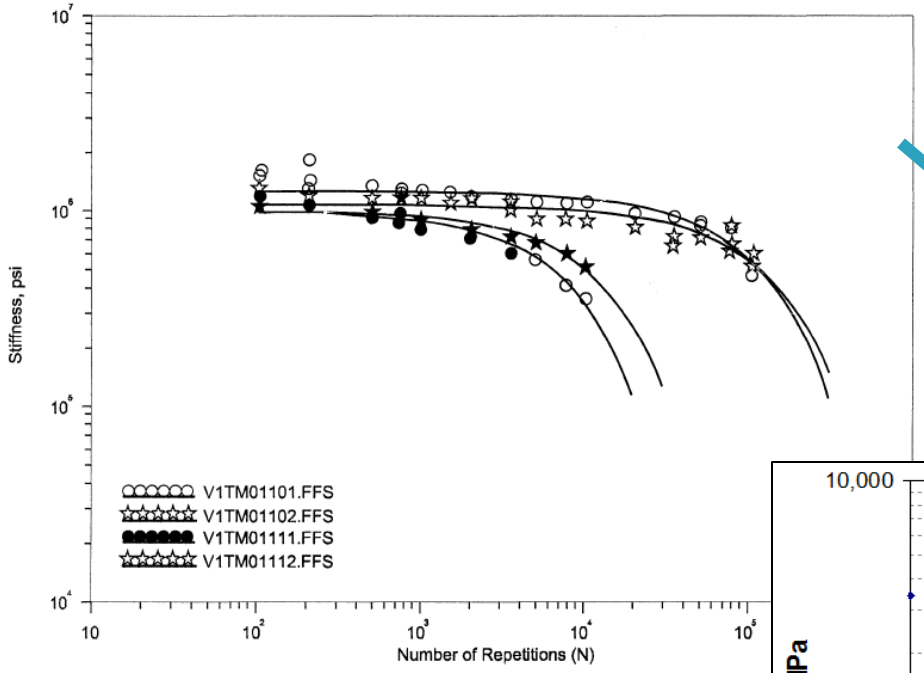
- Agreed that following table will be written into standard

repetitions	Intervals (space equally within each range)	Cycles at each collection points included in average reported
0 to 100	1-10, then every 10 to 100	5 (except for 1-10, report individual cycle)
100 to 1000	10	5
1000 to 10,000	90 40 equally spaced data points	5
10,000 to 100,000	At least one every 1,000 repetitions	5
100,000 to end of test	At least one every 10,000 repetitions	5

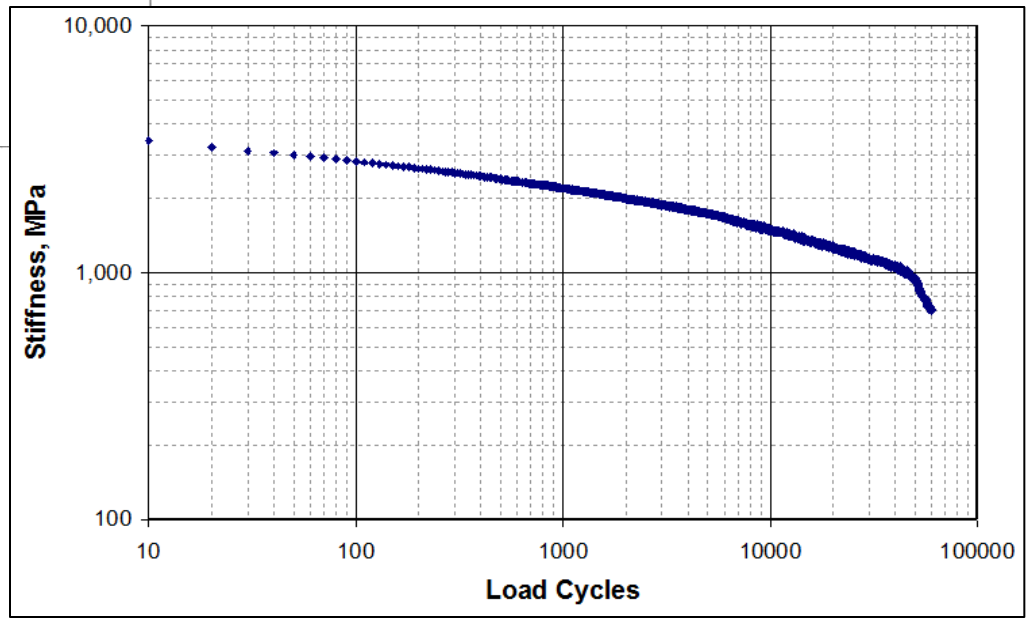
- Current manufactures already do this – but provides minimum standard acceptable for data capture rate
- Needed to ensure adequate data to fully capture peak that is needed to define the failure location in the test

Agreed

5. Data collection cont.



20 years



6. Details calculations of each reporting interval

- Manufactures both noted that they have been implementing the AASHTO TP79/NCHRP 9-29 methods
  - Asked both to check
  - Refine report value to include errors reported in TP79

- *Essential agreement on way forward – check will be done!*

Agreed
Needs to be documented

7. Strain level selection for testing

- Dave Jones will provide a guidance note on this
- Advice to user about how to start test – depends upon initial stiffness estimate for beam
  - No disagreement on need for this

We now have this – being reviewed currently

8. Add discussion about test termination and fatigue life where Nf is desired outcome.

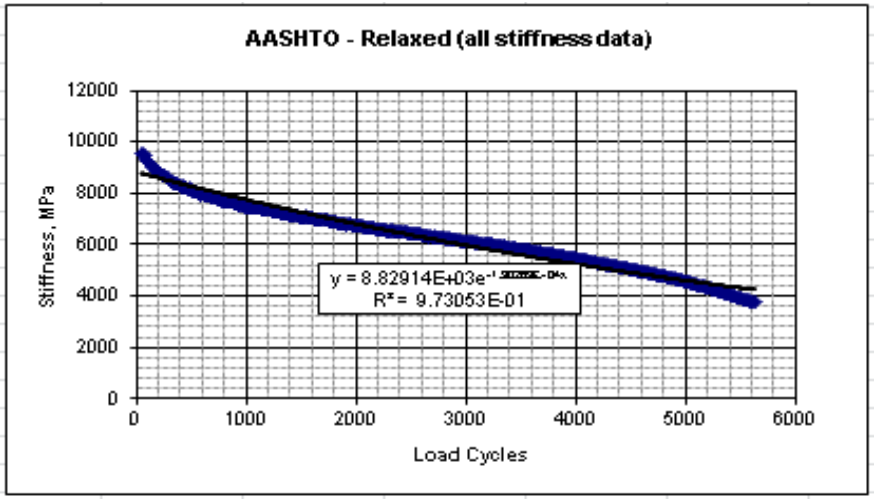
- Run test to S.n with at least reduction of 15 % beyond failure defined as S.n peak. Currently in AASHTO and ASTM.
  - Need to have equipment manufactures terminate test on this criteria
    - Essential agreement – does depend on manufactures workload
    - User has to currently set a lower stiffness – which results in longer test times
- Agreement on use of six order poly fit with differential method – rather than having choice of procedures
  - Make same in both ASTM and AASHTO standards

Being implemented in software

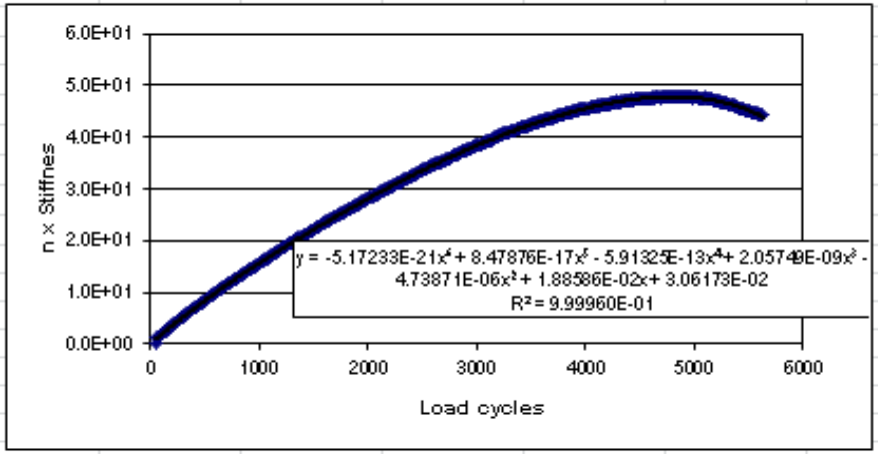
8. cont.

AASHTO - relaxed - all data	
Stiffness,measured, N=50	9,570
A	8.83E+03
b	-1.30E-04
$n_{1,50}$	**5,321**
% of Stiffness (N=50) at Termination	**39.3**

Difference in AASHTO and compared to 50%	
50% of measured stiffness	4,785
First record below	4,790
Point when all records below	4,790
Average	**4,790**
Percent error (AASHTO methods)	16%
Percent error (AASHTO vs. 50%)	29%



ASTM Method	
6-order poly fit method	
-5.17E-21	x^6
8.48E-17	x^5
-5.91E-13	x^4
2.06E-09	x^3
-4.74E-06	x^2
1.89E-02	x^1
dy/dx = 0 at turning point	
dy/dx	0.00
x (by POLY/SOLVER)	**4,796**
Max (strict definition)	22928014
x (at Max)	**4,720**

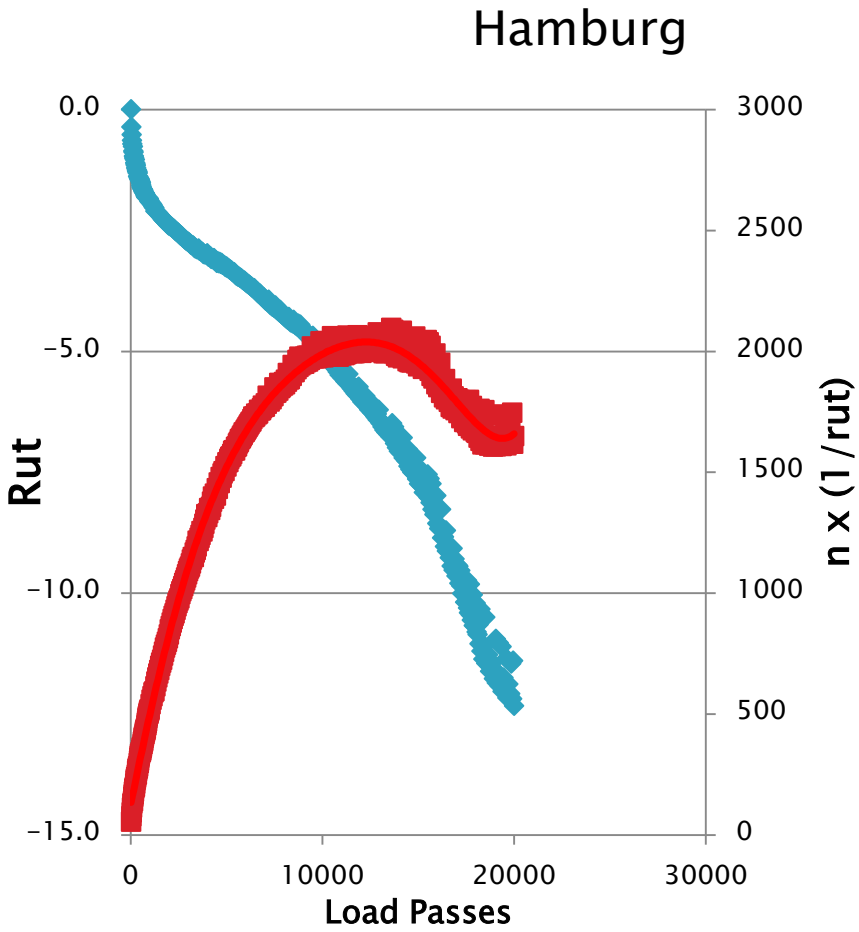


Specimen Ref.	$S_{mix,n=50}$	$S_{mix,AASHTO\ A}$	AASHTO (S)	AASHTO (R)	% Stiff @ Term	50%	ASTM (poly)	ASTM (max)
12.5mm 64-22 600ms	9,570	8,484	**6,173**	**5,321**	**39.3**	**4,790**	**4,796**	**4,720**

Specimen Ref.	$S_{mix,n=50}$	$S_{mix,AASHTO\ A}$	AASHTO (S)	AASHTO (R)	% Stiff @ Term
12.5mm 64-22 600ms	9,570	9,003	**5,181**	**5,181**	**57.0**

Failure concept

- S.n method gives very similar results to other methods
  - Pronk – N_{phi}
  - DER
  - Laser detection of cracks
  - Etc.
- Can use for other tests
  - Rowe has used for Hamburg, Creep Flow Number
  - Others
    - Recently used for Texas Overlay Tester
    - Others



9. Add note about NMAS min and max and variability

- Agreed – use note from ASTM standard!
  - Make same note for both standards

Agreed

10. Minimum results that must be reported

- Agreed to make consistent with item 5 and item 6
  - Will add errors reported – but a small change to both standards

Agreed

New practice

- Needed for “Use of and Interpreting Bending Beam Fatigue Results”
  - Number of results vs. confidence in result
  - Specification advice
  - Averaging results – log basis not linear
  - How to make a fatigue curve
- Will be drafted by next meeting

Draft behind schedule while last meeting issues being considered.

Actions

- AASHTO T321
  - Geoff Rowe – Need to gets edits to standard – what date needed by?
  - Need action by AASHTO asap!
  - A few typos to fix as well!
- ASTM D7460
  - Bill Criqui – Need to update draft for ASTM ballot – needed by next week?
- New practice
  - Geoff Rowe to draft outline of key items and send to group by mid year

    Goal to present at next ETG as draft – go to AASHTO end of 2016/2017

Submitted May 9th??

Updates being redrafted after issues with wording not accepted. Jason Bausano is contacted

Behind schedule – 2017 target

Thanks to our task group!

… our next AAPT

92nd AAPT Annual Meeting and Technical Sessions

The 2017 Annual Meeting will be held March 19-22, 2017
The Island Hotel, Newport Beach, California USA

AAPT Office:
6776 Lake Drive, Suite 215
Lino Lakes, MN 55014
Phone: 651-293-9188
Fax: 651-293-9193 or Email: aapt@aapt.comcastbiz.net

2017 Call for Papers

The Association of Asphalt Paving Technologists is actively soliciting paper offers for its 2017 Annual Meeting and Technical Sessions. Papers reporting on studies concerning any aspect of asphalt paving technology or related fields are considered. These can include research, design, construction and maintenance issues dealing with all types of asphalt binders, asphalt mixtures, and pavement applications – including innovative ideas and improvements to current practice. Papers will be considered for presentation at the Annual Meeting which is attended by specialists from academia, research organizations, material producers, contractors, national and state authorities, and consultants from around the world. Papers offered for the 2017 Annual Meeting must be submitted through the AAPT website.

Important dates

May 1, 2016 web site open for paper submission
August 15, 2016 - deadline for submitting papers
November 4, 2016 - notification of paper acceptance
December 2016 - registration open
March 19 to 22, 2017 - annual meeting and technical sessions

Find us on Facebook
LinkedIn

For current information please check our web site at: http://www.asphalttechnology.org