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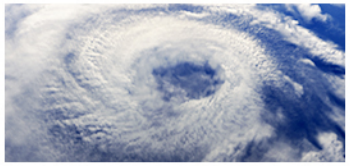


MEMD Calibration Research: Housing Vintage Study

Draft Findings Presented to EWR Collaborative

May 16, 2017

Background

- Currently, the MEMD uses housing type (single family, multi-family) and three vintages (old, average, and new) to assess residential energy savings
  - **Old:** Poorly insulated building constructed in the 1950s or earlier
  - **Average:** Building conforming to 1980s-era building codes
  - **New:** Recent construction conforming to the Michigan State Energy Code
- Anecdotal evidence suggests that a significant portion of the building stock does not meet the "old" levels of efficiency, especially in hard to reach segments.

	Vintage Mapping	Climate Zone	Attic (R-value)	Walls (R-value)	Basement (R-value)	Crawlspace (R-value)	Rim Joist (R-value)
Old	1979 or older	All	11.0	7.0	2.0	2.0	2.0
Average	1980 - 2004	All	19.0	11.0	6.0	6.0	11.0
New	2005 - present	CZ 5	38.0	20.0	10.0	10.0	30.0
		CZ 6	49.0	20.0	15.0	10.0	30.0
		CZ 7	49.0	21.0	15.0	10.0	38.0



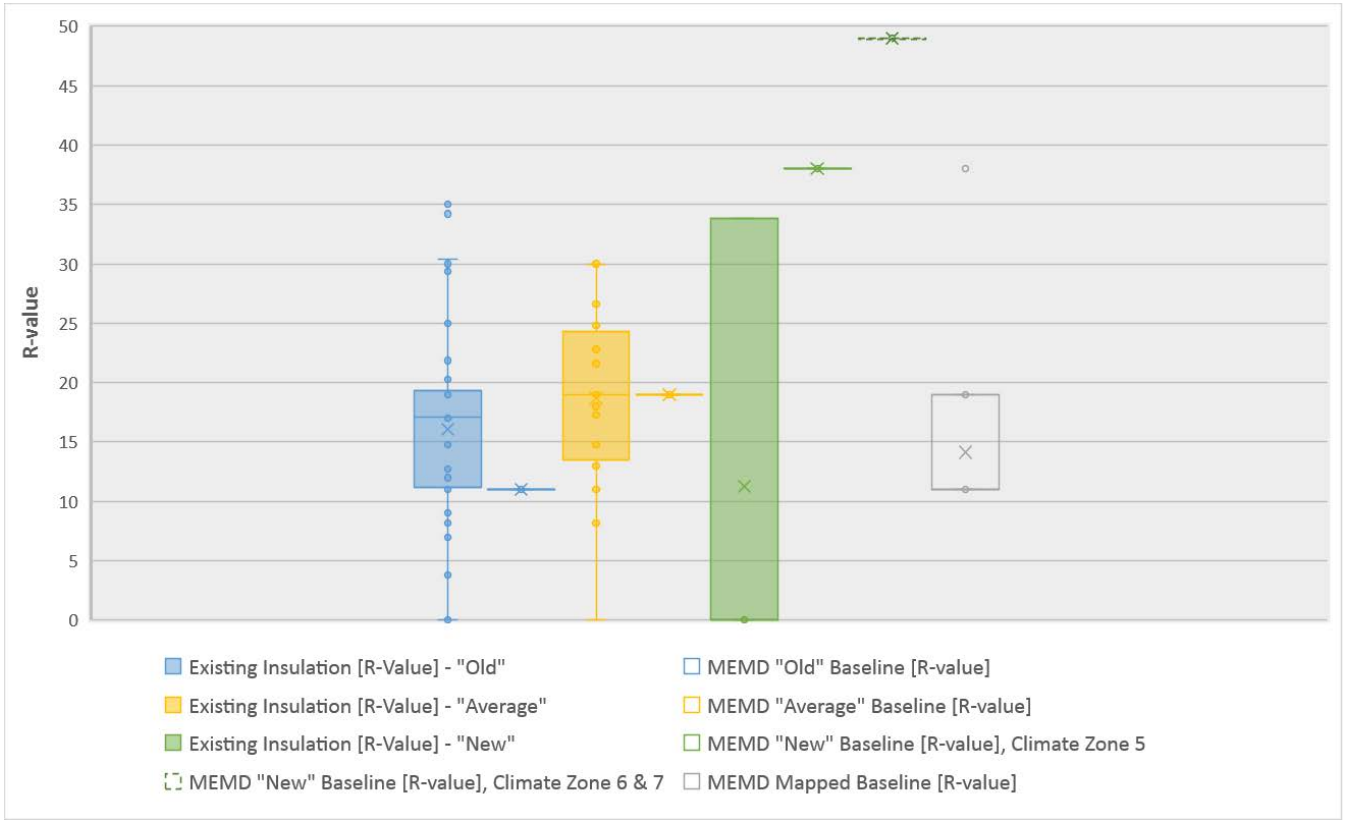

Objectives

- Determine whether a significant portion of existing housing stock does not align with current MEMD classifications (old, average, new) and warrants realignment
  - Assess insulation levels of existing Michigan homes using available program data to determine variation against MEMD savings values for weather sensitive measures
- Assess next steps, including whether a more expansive field study is warranted

Methodology

- Phase I (complete):
  - Collect sample data from Consumers Energy Insulation and Windows program to determine alignment between MEMD and existing MI homes
  - Assess confidence interval of sample population R-values to determine if vintage characteristics are statistically similar or different from MEMD characteristics
  - Determine whether the sample data review results warrant a more substantial study
- Phase II (proposed for 2018):
  - Conduct field study to assess envelope and equipment efficiency levels from stratified sample across Michigan housing types (climate zone, vintage, income level)
  - Propose alternative vintage schema for MEMD adoption (develop white paper for modeling process)
  - Recommend implementer data collection protocols to ensure that all necessary fields are captured

Attic



Vintage	Sample Size (participants)	Average of Existing Attic Insulation (R-value)	Std. Dev. of Existing Attic Insulation (R-value)	Lower Bound, 90% confidence (R-value)	Upper Bound, 90% confidence (R-value)	MEMD Value (R-value)	Within Confidence Interval ?	Similar ?
Old	53	16.4	8.9	14.4	18.4	11.0	No	No
Average	19	18.5	7.9	15.5	21.4	19.0	Yes	Yes
New	2	16.9	23.9	-10.9	44.7	38.0	Yes	Yes
All	**74**	**16.9**	**9.0**	**15.2**	**18.6**	**13.8**	**No**	**No**

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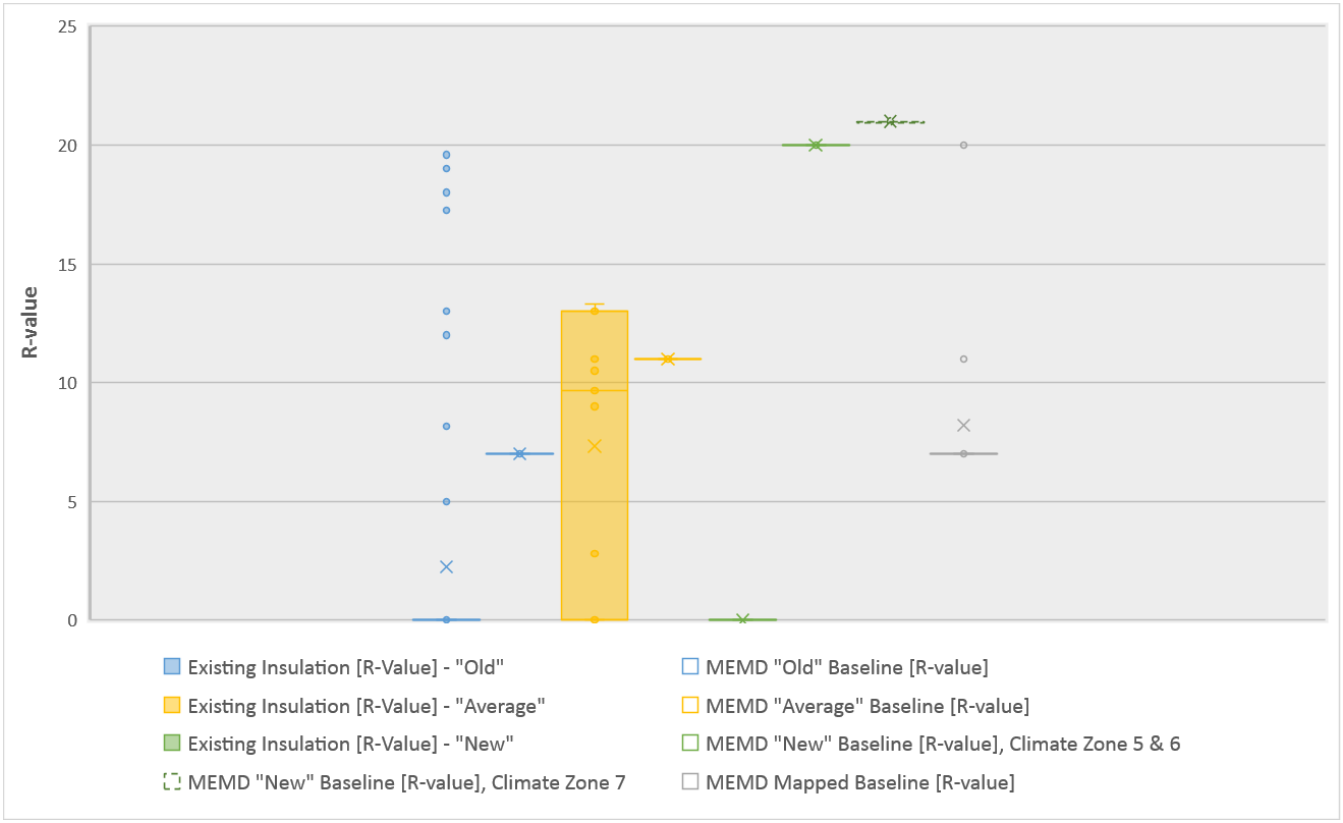
Wall



Vintage	Sample Size (participants)	Average of Existing Wall Insulation (R-value)	Std. Dev. of Existing Wall Insulation (R-value)	Lower Bound, 90% confidence (R-value)	Upper Bound, 90% confidence (R-value)	MEMD Value (R-value)	Within Confidence Interval ?	Similar ?
Old	45	2.5	5.8	1.1	3.9	7.0	No	No
Average	13	7.3	5.8	4.7	10.0	11.0	No	No
New	1	0.0	Error	Error	Error	20.0	Error	Error
All	**59**	**3.5**	**6.1**	**2.2**	**4.8**	**8.1**	**No**	**No**

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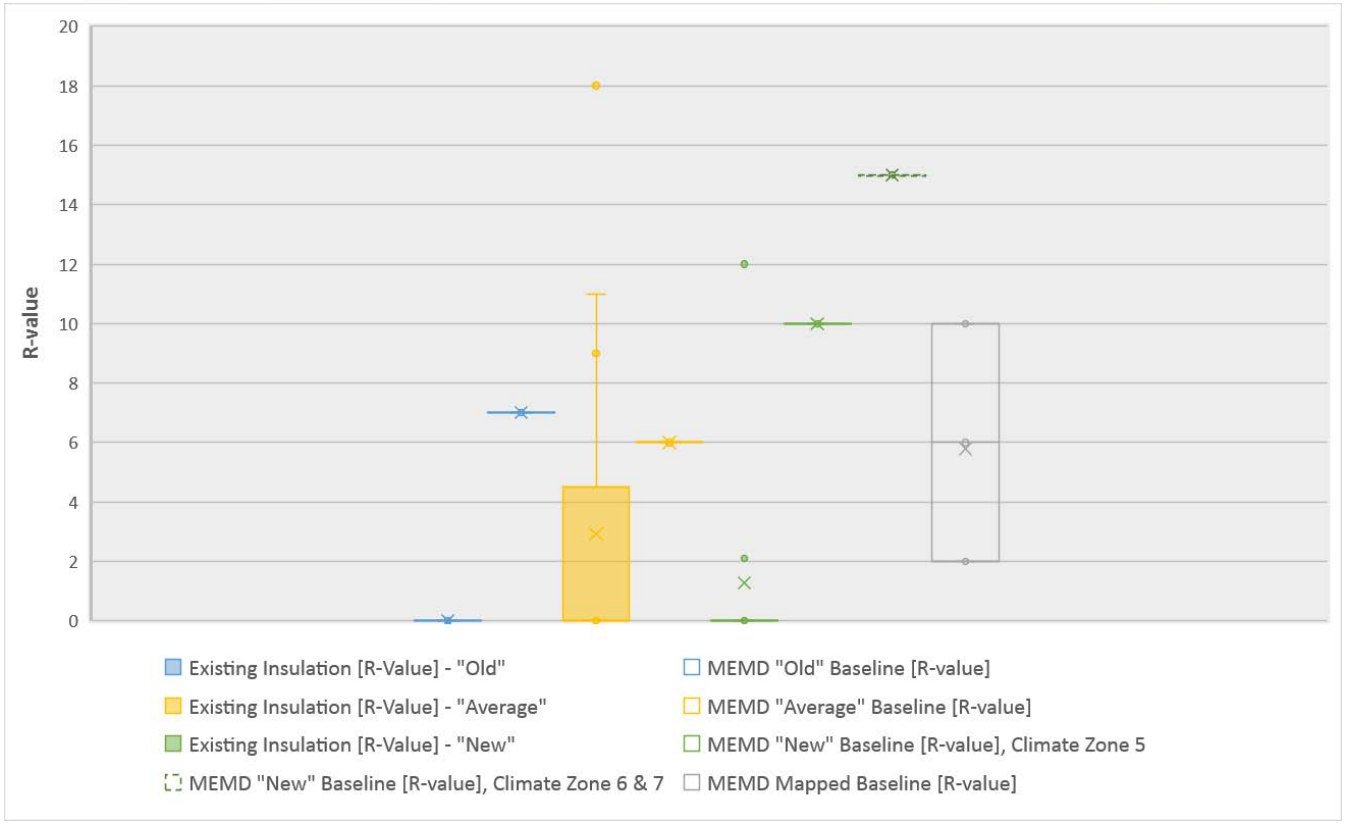
Basement



Vintage	Sample Size (participants)	Average of Existing Basement Insulation (R-value)	Std. Dev. of Existing Basement Insulation (R-value)	Lower Bound, 90% confidence (R-value)	Upper Bound, 90% confidence (R-value)	MEMD Value (R-value)	Within Confidence Interval ?	Similar ?
Old	10	0.0	0.0	Error	Error	2.0	Error	Error
Average	11	3.5	6.3	0.3	6.6	6.0	Yes	Yes
New	10	1.4	3.8	-0.6	3.4	10.0	No	No
All	**31**	**1.7**	**4.4**	**0.4**	**3.0**	**6.0**	**No**	**No**

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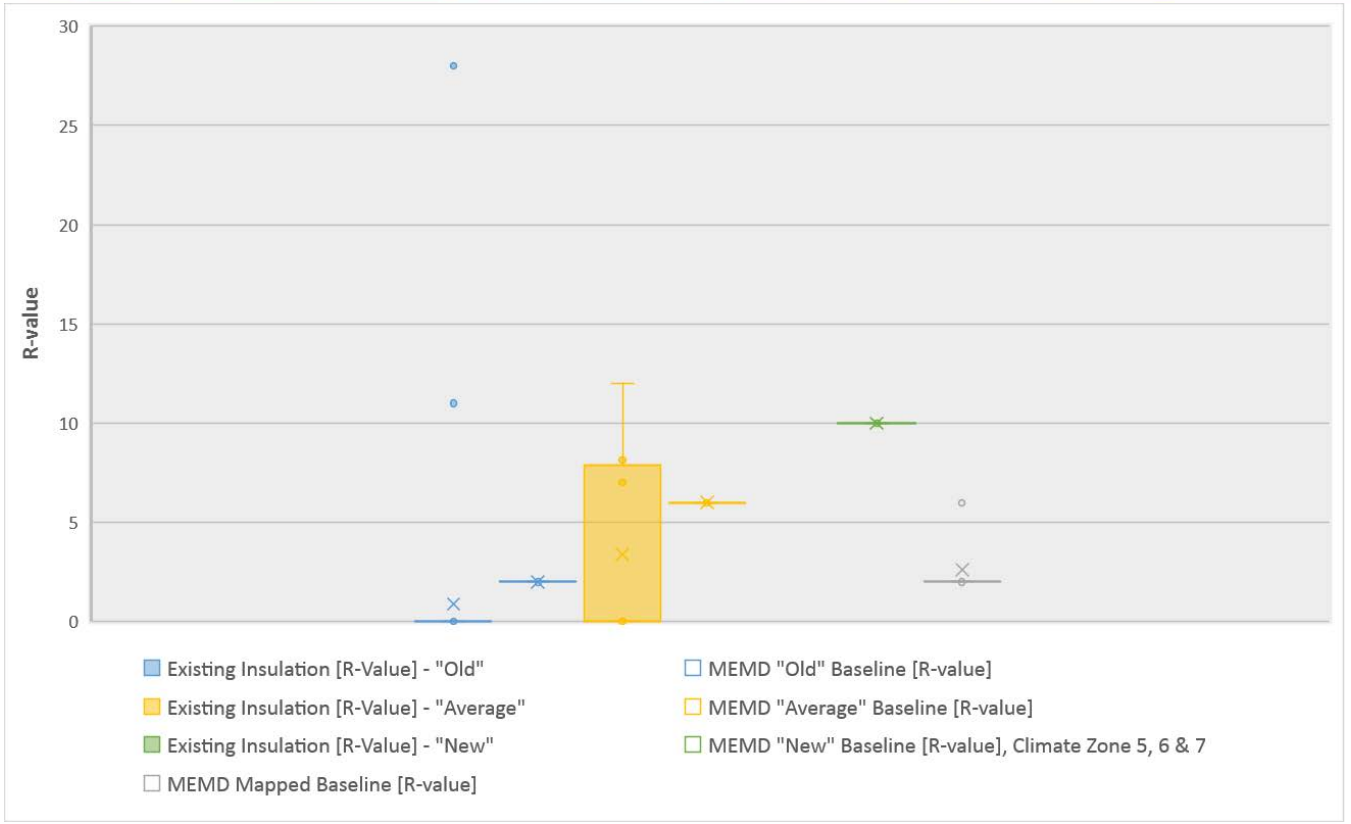
Crawlspace



Vintage	Sample Size (participants)	Average of Existing Crawlspace Insulation (R-value)	Std. Dev. of Existing Crawlspace Insulation (R-value)	Lower Bound, 90% confidence (R-value)	Upper Bound, 90% confidence (R-value)	MEMD Value (R-value)	Within Confidence Interval ?	Similar ?
Old	44	1.0	4.8	-0.2	2.2	2.0	Yes	Yes
Average	8	3.4	4.9	0.6	6.2	6.0	Yes	Yes
New	0	n/a	n/a	n/a	n/a	10.0 / 15.0	n/a	n/a
All	**52**	**1.4**	**4.8**	**0.3**	**2.5**	**2.6**	**No**	**No**

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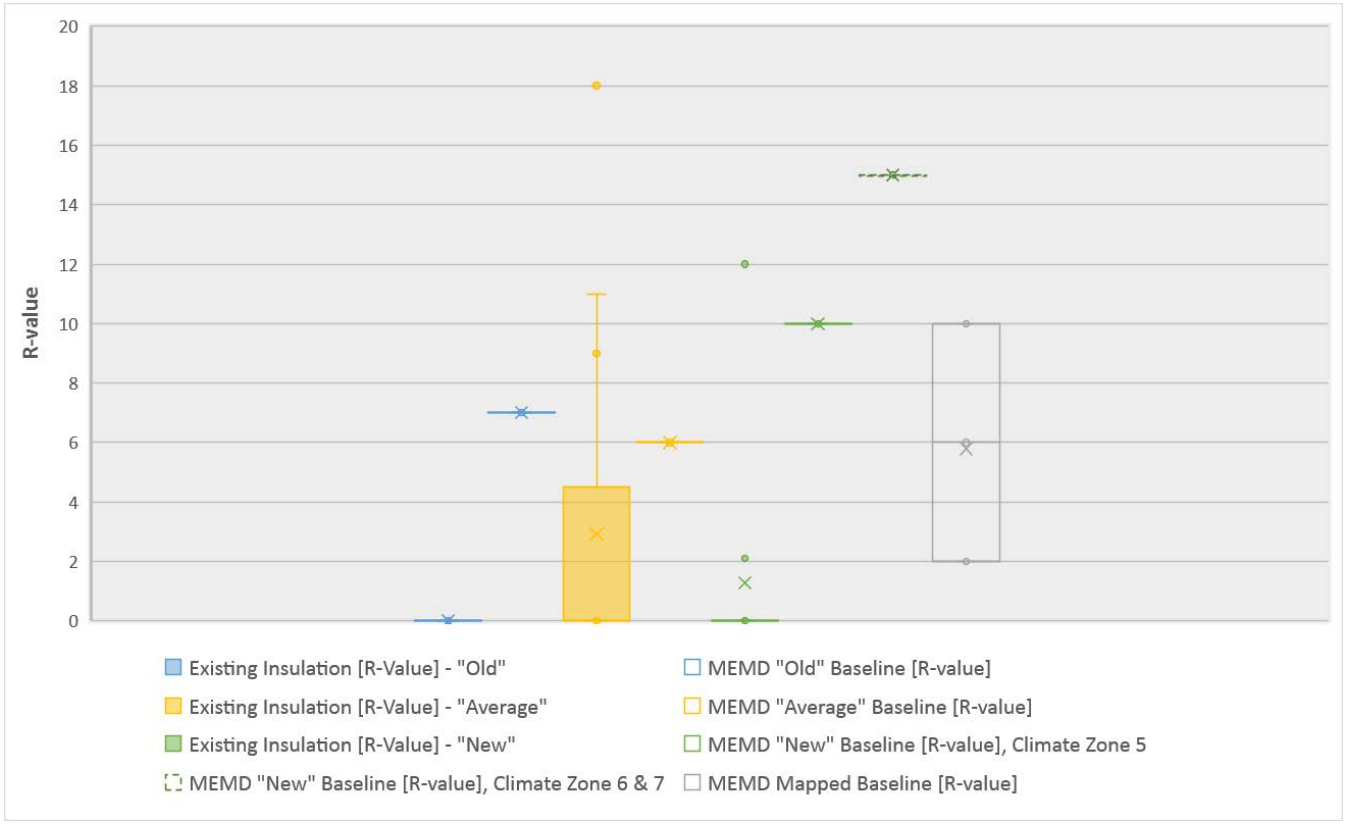
Rim Joist



Vintage	Sample Size (participants)	Average of Existing Rim Joist Insulation (R-value)	Std. Dev. of Existing Rim Joist Insulation (R-value)	Lower Bound, 90% confidence (R-value)	Upper Bound, 90% confidence (R-value)	MEMD Value (R-value)	Within Confidence Interval ?	Similar ?
Old	42	0.3	2.0	-0.2	0.9	2.0	No	No
Average	18	7.2	9.2	3.7	10.8	11.0	No	No
New	4	0.0	0.0	Error	Error	30.0	Error	Error
All	**64**	**2.1**	**5.8**	**0.9**	**3.3**	**6.3**	**No**	**No**

Schedule

- Housing Vintage Assessment: May 2017
- Prototype Development and Modeling: Proposed for 2018
- Reporting: February 2019

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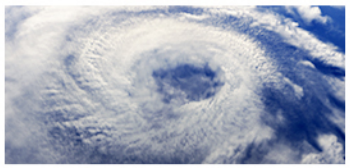

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