MEMORANDUM

To: EA Team

From: Ari Stern; NMR Group

Cc:

Date: February 3, 2022

Re: R1968 RNC Baseline and Code Compliance Scope Change

This memorandum is written to gain approval on two changes to R1968 Residential New Construction Baseline and Code Compliance Study:

1. Changing the study design to look only at homes built under the current code, thus allowing for both single-family and multifamily research.
2. Increasing the budget scope to do additional research at building departments.

R1968 Timing and Code Scope Decision

The RFP for R1968, the Residential New Construction Baseline and Code Compliance Study, requested that the study examine a sample of homes built under the current code (2015 IECC) and the upcoming code (2021 IECC). The RFQ was written before the impacts of the COVID-19 pandemic and did not account for a delay in the development and adoption of the 2021 IECC in Connecticut. The RFP assumed the upcoming code would go into effect in the summer of 2021, while the current anticipated effective date for the upcoming code is October 2022.

NMR learned of this delay the day before responses to the RFP were due by attending a meeting of the Connecticut Codes and Standards Committee meeting and inquiring about the anticipated 2021 IECC effective date due to the COVID-19 pandemic. In NMR's response to the RFP, we provided a study design based on the RFP's assumption of the upcoming code going into effect in 2021, but noted that "at the March 10, 2021, meeting of the Connecticut Codes Amendment Subcommittee, committee members stated that they anticipate the effective date of the upcoming code to be much later, in October 1, 2022. Should the Energy Efficiency Board (EEB) decide they

no longer want to examine homes built under both codes due to the delay in code adoption, NMR can adjust the sample design to include homes built under a single code version."

In August of 2021, NMR had a call with the EA team to discuss the code delay and how it impacts the plan. The original NMR plan included on-site inspections of 45 single-family homes built under the current code and 45 homes built under the upcoming code. The following reasoning resulted in deciding to forgo examination of homes built under the upcoming code in favor of other priorities. The new study design includes 70 on-sites of single-family homes built under the current code and building department visits to target data for 30 MF homes:

- No study has examined homes built under the current code which went into effect in 2018.
- The current UDRH is based on findings from homes built in 2014 and 2015 which is six to seven years in the past. Those homes were built under the 2009 IECC.[1] The UDRH is therefore outdated.
- A study examining homes built under the current code would have to wait a year after enactment to allow homes to be built before starting. Therefore, such research could not begin until October, 2023 and would not have findings until Q3 or Q4 of 2024. That is too late for both contracting and UDRH updates.
- Forgoing the upcoming code removes the need for a "phased approach" as discussed in the RFP and thus allows for results sooner.
- Forgoing examination of homes built under the upcoming code opens budget to examine other important topics. The team considered examining differences in early and late code cycle practices under the current code or an examination of Multifamily properties.
- In August, 2021, the EA team (Bob) and NMR decided to explore using budget to examine multifamily properties. The differences between the 2016 and 2018 CT building codes are minimal in terms of UDRH measures and thus early and late phase code cycle baselines are not crucial.[2]
- The proposed study plan includes doing 70 single-family on-sites for homes built under the current code (same *n* as the previous baseline) and then doing building department visits to collect data on multifamily. The multifamily data will be leveraged with findings from Massachusetts research to help develop MF specific UDRH values.

[1] See Appendix A.

- **In summary: The new study design forgoes examining 45 homes built under the upcoming code because findings would not be available until too far in the future. Instead, the study uses freed budget to examine multifamily properties. It includes 70 on-site inspections for single-family homes and building department visits for 30 multifamily buildings.**
  - ☑ **Gets results sooner**
  - ☑ **Allows for multifamily data collection**
  - ☑ **Allows for building department data collection**
  - ☑ **Provides opportunities for additional research questions through access to building departments (see next section).**

R1968 Additional Scope and Budget

On the January 27, 2022 call between the EA Team and NMR, members of the EA Team brought up two additional research opportunities given the change in study design that now includes doing building department visits:

- **Examine the difference between as-built data from single-family on-site inspections to documentation at building departments.** This mirrors an effort being conducted by NMR in Rhode Island. It could shed light on the ability and accuracy of using building department data to estimate baseline values in the future substantially reducing the cost of future residential new construction baseline studies.
- **Examine the difference between multifamily program energy models and documentation at building departments.** This research can shed light on the accuracy of building department data for multifamily as well as identify measures that HERS raters influence during their interaction with projects. For example, HERS raters might encourage builders to use more insulation that originally planned in building department documentation to receive incentives from the program.

NMR agrees that these to research questions are valuable. Additionally, it makes sense to collect this data while we are already going to building departments. NMR proposes collecting building department data for 20 single-family homes in the on-site sample and 10 multifamily buildings in the program data. This will result in additional scope which we estimate will range between $10,000 and $20,000. The additional scope is the result of the following:

- Procuring the documentation, increased challenges in procuring documentation
- Analysis for answering new research questions
- Reporting/discussion

The greatest sources of uncertainty in our budget estimates are related to the cooperation of building departments and the amount of interest and discussion resulting from this research.

Regarding building department cooperation, we have found in other studies that when building departments are asked to provide greater amounts of documentation, it becomes more difficult to get any amount of documentation. This could result in significant budget increases as it takes more effort to collect data. Regarding discussion, we agree that these are very interesting topics and they could lead to a lot of conversation and revisions.

NMR will add this scope to the project because it is valuable and makes sense to collect data for while we are at building departments. **If available, we are asking for an additional $10,000 to serve this effort.**

Appendix A CT Codes Over Time

For reference, the table below shows the changes in code provisions for key measures over time. Each code went into effect in October of the year listed. The previous baseline study examined homes built in 2014 and 2015 under the 2011 code (2009 IECC). No study has examined homes built under the current code adopted in 2018 (2015 IECC). The 2018 code was practically identical to the 2016 code in terms of key measures that impacted the UDRH. There were other changes between the 2016 and 2018 such as commercial sector changes, adding an energy rating index compliance path to the residential side, and clarifications of testing procedures. Still the 2016 and 2018 codes were mostly identical for the residential market and were adopted due to a statutory obligation to adopt new energy codes after the publication of new International Energy Conservation Code versions. NMR feels it is important to examine homes built under the current code to update the now out of date UDRH.

Table 1: Connecticut State Building Energy Code Comparison

Measure	Effective Year (October)			
	2011 (2009 IECC)	2016 (2012 IECC)	2018 (2015 IECC)	2022 (2021 IECC)
Exterior Walls	R-20	R-20 or R-13+5	R-20 or R-13+5	R-20+5
Ceilings	R-38	R-49	R-49	R-60
Floors	R-30	R-30	R-30	R-30
Conditioned Basement Walls	R-10/R-13	R-15/R-19	R-15/R-19	R15/R-19
Windows	U-0.35	U-0.32	U-0.32	U-0.30
Air Leakage	7.0 ACH50	3.0 ACH50	3.0 ACH50	3.0 ACH50
Total Duct Leakage	12.0 CFM25/100ft^2	8.0 CFM25/100ft^2	8.0 CFM25/100ft^2	4.0 or 8.0 if entirely within envelope
Efficient Lighting	50%	75%	75%	100%