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HIGH PERFORMANCE WALL DESIGN GUIDE

HERE'S A QUICK CHECKLIST FOR NEW BUILDING DESIGN

BACKGROUND INFORMATION

- ☐ Determine the building's intended use and location - refer to the requirements set down in LL97 (forthcoming)
- ☐ Based on building use and early schematic design parameters discuss the anticipated cooling vs heating picture with your mechanical engineer (ballpark of how many months of cooling and heating they anticipate)
- ☐ Talk to client about high energy impact choices and their costs
  - Balconies and Terraces
  - Precast and exposed concrete
  - PTAC
  - Window wall and Curtainwall
  - Vestibules and secondary service doors
  - Non-upgradeable Fenestration
- ☐ Make recommendations for façade style based on the parameters and choices above
- ☐ Determine approximate "living loads" (additional heat generated by human bodies), appliances, technology and other heat sources. Think about the peak periods of loading. Example- In residential buildings, peak human loads are low during daylight hours when solar gain is high but in an office building of the same size the opposite is true.
- ☐ Make recommendations for design strategies to balance the conditions

KEEP IN MIND

- ☐ LL97 requires measuring actual energy used and created not theoretical efficiency, the days of prescriptive design and "oversizing" are over
- ☐ Prescriptive design will meet the current code but not the administrative law
- ☐ More vision glass means more transmittance and solar gain
- ☐ Fenestration U-factors should be used as a guideline only
  - Currently only winter U-factor is used in North America
  - The numbers are not scalable or convertible based on size and configuration
  - U-factor is not a finite rate of thermal transmittance like R-value is, consider it a conditional rating – like EPA estimated mileage on cars
- ☐ Windows aren't the only source of envelope leakage – opaque walls leak as well

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- ☐ Opaque walls do not guarantee air tight or high insulating - design and quality control is key
- ☐ Use good design principals not just numbers
  - Light colored window frames will mean lower thermal transmittance regardless of U-factor
  - Isolate window frames from unconditioned surfaces, keep thermal separation lines in one plane, limit unconditioned air at warm side of frames
- ☐ When using fenestration thermal models
  - Use a weighted average of project sizes for each type and configuration
  - Be conservative – remember the models only consider winter mode so summer mode may not be considered
- ☐ Think about energy movement, not numbers
- ☐ Do not rely on "certified" or "rated" products to be the answer – there is no way to specify your way to compliance
- ☐ How do you deal with "Intentional" vs "Unintentional" holes in your wall?
  - Unintentional holes are leaks from workmanship – we test for those
  - Intentional holes, AKA windows, are usually meant to be opened, you can't control occupant use but the opening can affect the buildings energy performance

FALL IN LOVE WITH A MODEL

- ☐ Work with your energy modeling professional from day 2 of the design
- ☐ Run different "mock-up" models to determine a compliance strategy
- ☐ Remember the model is a living document and needs to be updated every time you change the architectural model
- ☐ You will have to deal with the limitations of the model, the logic is still based on a heating dominant paradigm. If you are designing a mid-rise or high-rise you may be cooling dominant – so consider going beyond traditional U-factor evaluations

FENESTRATION "RULE OF THUMB"

- ☐ Model or test at minimum, the largest and smallest size of each window type/configuration used on the project to get best and worst case U-factors
- ☐ Develop a weighted average based on the best-worst case U-factors, then cut it by 25%
- ☐ Use the conservative U-factor number for the building model
- ☐ When produced and installed correctly, most fixed fenestration is extremely air tight and operable windows are very air tight – far exceeding the requirements for ultra-low energy loss but monitoring and testing to ensure they ARE produced and installed correctly is the key. You can't see an air leak.
- ☐ Dark Color frames perform badly in summer mode
- ☐ Tints and Low-e coatings can control solar gain but will re-radiate heat into the building. The fenestration design must incorporate multiple glazing layers and a large thermal separation. To maximize both summer and winter performance look at triple glazing or secondary panels with large thermal break and a secondary space.

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AIR IT OUT

- ☐ Intentional holes in walls (AKA windows) can be opened by building occupants any time creating a sizeable air leak in the façade. Having multiple air leaks can wreak havoc on tightly designed buildings – stack effect, mechanical system balance even elevator operation is all affected. Keeping air leaks compartmentalized is key. Most partition walls offer enough air barrier but apartment and office entrance doors are notoriously leaky especially when undercut. Utilize an interior door rated for smoke at all units.
- ☐ Rainscreen wall systems will be the go-to solution for many due to price, availability and design options. Proper detailing and installation of the air barrier is **key**. Once the cladding goes on you can't go back to fix the membrane. We recommend:
  - Self-adhered when and where required but the field of walls should utilize a fluid applied system
  - Check for proper adhesion (fluid and self-adhered) every 1,000-2,000 sq. ft utilizing ASTM D4541
  - Check for proper wet film thickness of fluid applied membranes constantly
  - Check for air leaks at penetrations, transitions and repairs using a "bubble Gun Tester" per ASTM E1186 – do this 1-2 times every week
  - Spot check for air leaks using a tracer smoke/pressurized chamber test per E1186 every 2,000-3,000 sq. ft
  - Utilize a modified E779 blower door test to spot check new building sections when feasible and to baseline existing buildings for deep energy retrofits
- ☐ Fenestration Air Leakage – whether labeled or not, air leakage is not an inherent design flaw in most modern windows, it is a workmanship or quality control problem and usually cannot be found by simple visual inspection. An air leakage test per ASTM E783 to low pressure (75 pa) is a an easy and cost-effective way to spot check window performance. 1 in 150 windows on larger projects (over 1,000 windows) or 4-5 minimum should be tested.

TURN DOWN THE HEAT

- ☐ If your projected energy use for cooling exceeds 30% of the conditioning energy use, consider physical testing
  - Heatflux measurements of thermal transmission are very cost effective and can be combined with mockup testing
  - Heatflux measurements can be performed for summer and winter performance on the same samples to have usable numbers for cooling and heating effect

Here are some links that will be helpful:

BEX Climate Mobilization Act Page, including a link to the PACE program
https://be-exchange.org/insight/the-climate-mobilization-act-int-1253/

NYC Local Law 97
https://www1.nyc.gov/assets/buildings/local_laws/ll97of2017.pdf

Urban Green's LL97AQ's
https://www.urbangreencouncil.org/content/nyc-building-emissions-law-frequently-asked-questions

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