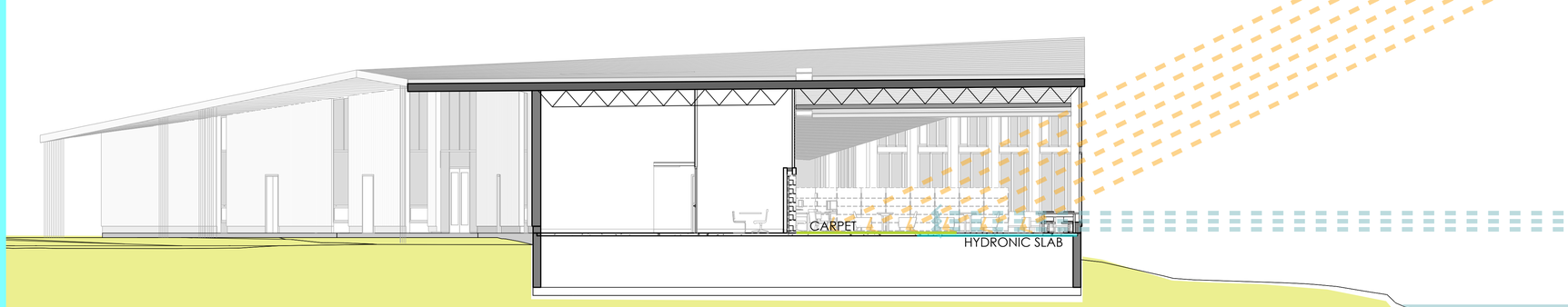
MILWAUKIE LEDDING LIBRARY COOLING SYSTEM OPTIMIZATION

HACKER | PAE | PSU



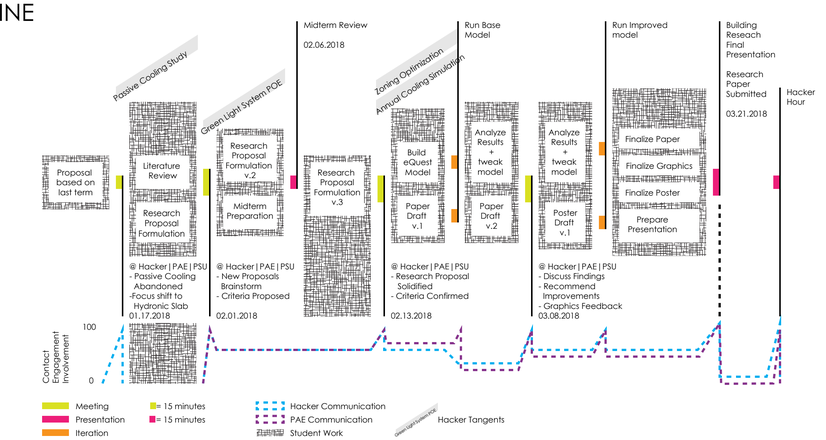
PROJECT OVERVIEW

THE MILWAUKIE LEDDING LIBRARY (MLL) BY HACKER ARCHITECTS IS A NEW CONSTRUCTION 20,000SF PROJECT IN MILWAUKIE, OREGON. THE CITY OF MILWAUKIE, THE CLIENT, WANTED TO TARGET HIGH SUSTAINABILITY GOALS, PURSUING THE ENERGY TRUST OF OREGON'S PATH TO NET-ZERO PROGRAM AND LEED CERTIFICATION. THE INITIAL RESEARCH PROPOSAL INCORPORATED PASSIVE COOLING TO OPTIMIZE HYDRONIC RADIANT SLAB COOLING USING AIR-TO-WATER HEAT PUMPS DESIGNED FOR RADIANT HEATING. DEDICATED TO A COOLING STRATEGY TAKING ADVANTAGE OF AS MANY PASSIVE ELEMENTS AS POSSIBLE GIVEN TIME, DESIGN, AND BUDGET CONSTRAINTS, HACKER AND PAE CONSIDERED ADDING OPERATIONAL OR ACTUATED WINDOWS TO AID WITH NIGHT FLUSH AS WELL AS THE COOLING OF THE BUILDING WITHIN OPERATIONAL HOURS.

METHODOLOGY

THE METHODOLOGY EMPLOYED IN THIS RESEARCH IS FIRST AN EXTENSIVE LITERATURE REVIEW FOLLOWED BY A SERIES OF MEETINGS WITH PAE AND HACKER TO DETERMINE THE CRITERIA, CHOOSE AN APPRORIATE MODELING SOFTWARE, AND NARROW THE TERMS OF THE RESEARCH.
ONCE THE MILWAKIE LEDDING LIBRARY WAS BUILT IN EQUEST, WE COMPARED THE PROJECTED COMSUMPTION OF ELECTRICITY DUE TO COOLING WHILE CONTROLLING FIRST THE PRESENCE OF CARPET, THEN THE ACTUATION OF WINDOWS, AND FINALLY FOR PROBABILITY OF A USER EFFECTIVELY OPERATING THE WINDOWS IN THE PLACE OF AN ACTUATED WINDOW.

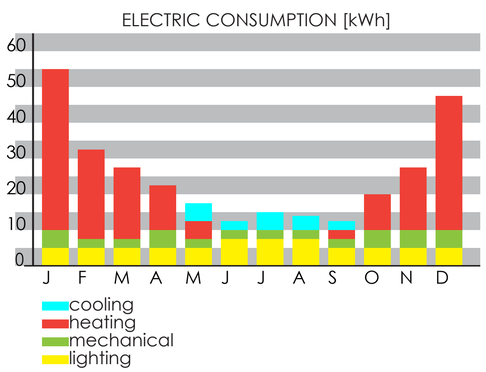
TIMELINE

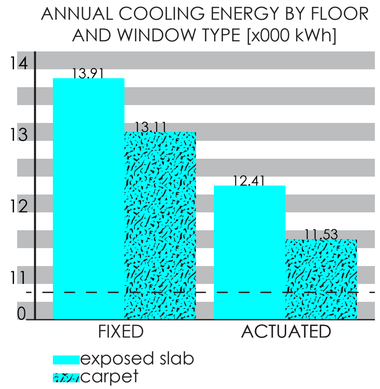


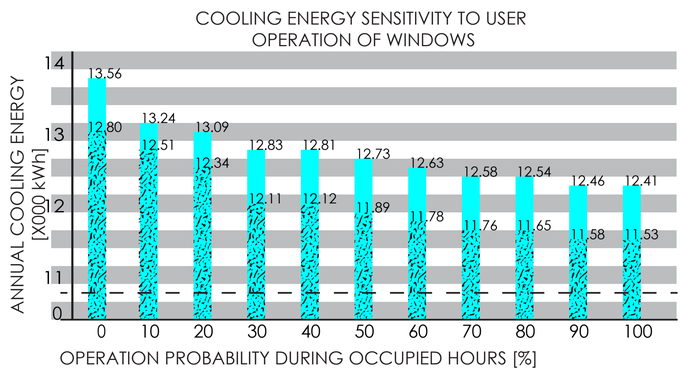
ABSTRACT

THE OBJECTIVE OF THIS RESEARCH IS TO DETERMINE THE EFFECTS OF FLOOR COVERING AND NATURAL VENTILATION ON THE RADIANT SLAB COOLING OF THE NEW MILWAUKIE LEDDING LIBRARY (MLL) AS WELL AS THE SENSITIVITY TO USER ENGAGEMENT WITH OPERABLE WINDOWS. EQUEST ENERGY MODELING SOFTWARE WAS USED TO CALCULATE ANNUAL COOLING ENERGY USE FOR BOTH CARPETED AND EXPOSED SLAB FLOORS WITH VARIED LEVELS OF USER OPERATION OF WINDOWS DURING OCCUPIED HOURS. THE MODEL SHOWED A MAXIMUM COOLING ENERGY SAVINGS OF 10.8% (1,500 KWH) FOR EXPOSED SLAB AND 12% (1,580 KWH) FOR CARPETED FLOORS, THE LATTER CONSISTENTLY USING LESS COOLING ENERGY- BY UP TO 7% IN A COMPARISON OF THEIR BEST CASES. WHILE CARPETING AND OPERABLE WINDOWS CAN LEAD TO A REDUCTION IN COOLING ENERGY, MAXIMUM SAVINGS ON THE SCALE OF TOTAL MODELED ANNUAL ENERGY USE AMOUNT TO LESS THAN 1%. AMONG THE SIGNIFICANT FACTORS RELATED TO FLOOR COVERING AND WINDOW OPERABILITY DESIGN CHOICES, ENERGY AND COST SAVINGS RANK LOW. HOWEVER SMALL, THE ENERGY BENEFITS OF OPERABLE WINDOWS ARE A NET POSITIVE AND PROVIDE OPPORTUNITY FOR USER ENGAGEMENT WITH THE BUILDING.

DATA







SAVINGS BY ACTUATING

	COOLING ENERGY [X000 kWh]	COST SAVINGS	PERCENTAGE ENERGY REDUCTION
EXPOSED SLAB	1.5 (10.8%)	$120.00	0.56 %
CARPET	1.58 (12%)	$126.40	0.72 %

CONCLUSION

THE DATA SHOWS THAT CARPETED FLOORS USE LESS COOLING ENERGY THAN EXPOSED SLAB, AND THE FORMER REDUCES COOLING ENERGY MORE FOR THE SAME INCREASE IN OPERATION PROBABILITY. ACTUATED WINDOWS DO PROVIDE COOLING BENEFITS FOR ALL LEVELS OF USER OPERATION, THOUGH WITH THE MODELED WINDOW AREA SAVINGS ARE NOT SIGNIFICANT IN TERMS OF TOTAL ANNUAL BUILDING ENERGY USE.

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