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Fall 2016

Knight Cancer Research Center

Alesha Evans
Portland State University

Zach Pate
Portland State University

SRG Architects

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Recommended Citation

Evans, Alesha; Pate, Zach; SRG Architects; Catena; and Brightworks, "Knight Cancer Research Center" (2016). *Research-Based Design Initiative*. 76.
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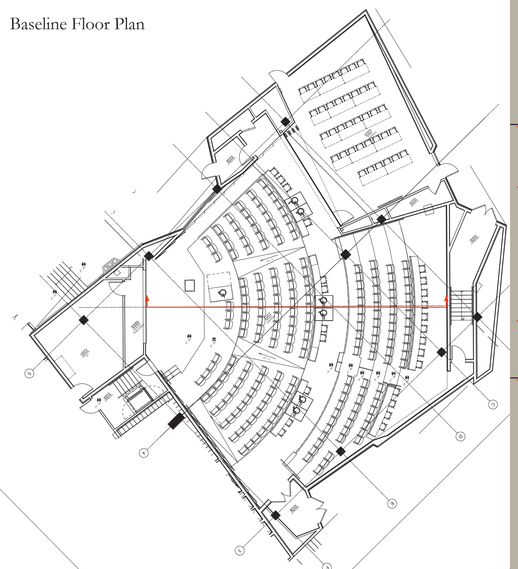
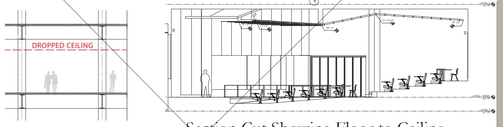
AUDITORIUM DESIGN PROBLEM

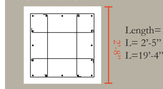
Baseline Floor Plan

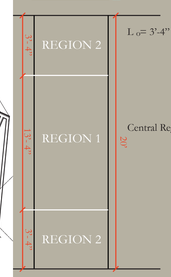




Section Cut Showing Floor to Ceiling Height Changes

Column C-5





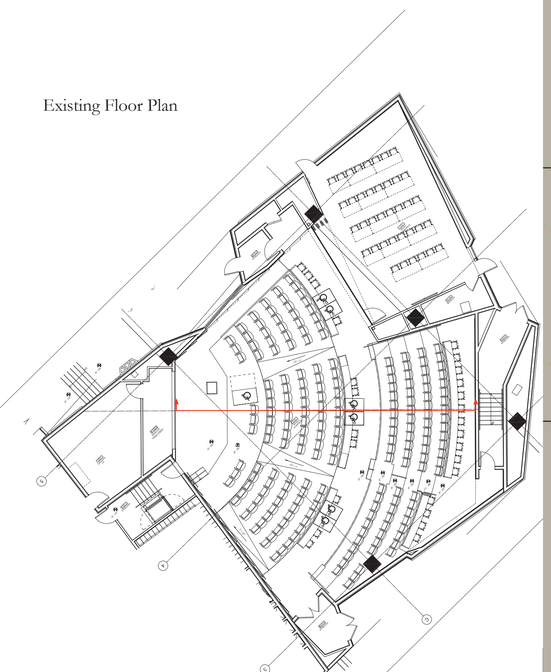
Longitudinal Bar
16 X 5.313#/ft = 85.008
85.008 X 20' = 1,700.16#

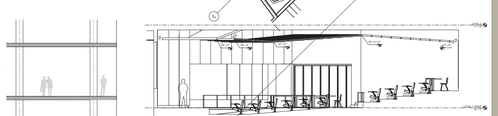
Region 1 Bars
19'-4" X 0.668#/ft = 12.91#/bundle
12.91 X (12"/6") = 25.82#/ft column
25.82 X 13'-4" = 344.27 #

Region 2 Bars
19'-4" X 1.043# = 20.16#/bundle
20.16# X (12"/4.75") = 50.93#/ft column
50.93 X (2(3'-4")) = 339.53#

Sum of Regions
1700.16#
344.27#
339.53#
2383.96#
X 1.25
2979.95# per column
X 5 Columns
14,899.75# for auditorium

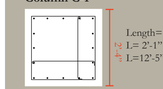
Existing Floor Plan

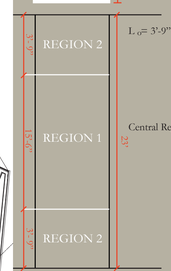




Section Cut Showing Floor to Ceiling Height Changes

Column C-1





Longitudinal Bar
12 X 5.313#/ft = 63.72#
63.72 X 23' = 1,465.56#

Region 1 Bars
12'-6" X 1.04#/ft = 13#/bundle
13 X (12"/6") = 26#/ft column
26 X 15'-6" = 403 #

Region 2 Bars
12'-6" X 1.04# = 13#/bundle
13# X (12"/4") = 39#/ft column
29 X (2(3'-9")) = 299#

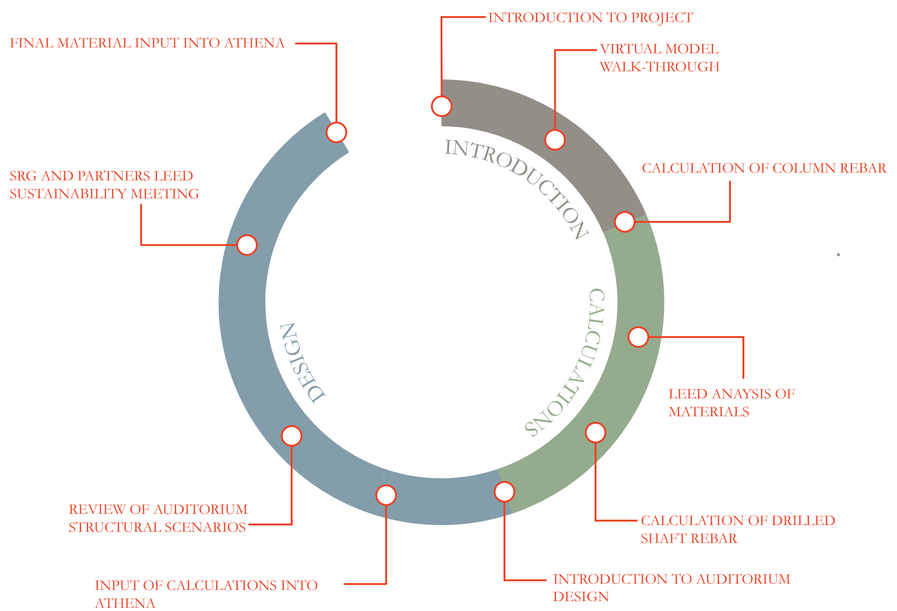
Sum of Regions
1465.56#
299.00#
403.00#
2167.56#
X 1.25
2709.45# per column
X 2 Columns
5418.9 # for auditorium

Knight Cancer Research Center

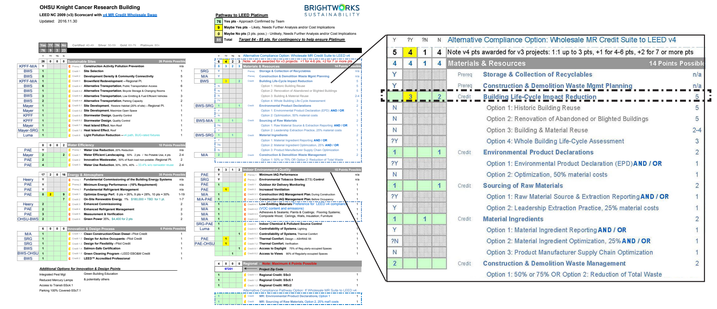
Alesha Evans & Zach Pate | Portland State University, School of Architecture
Dan Davis & Laurie Canup | SRG Partnership
Jason Thompson | Catena
Shilpa Surana | Brightworks

RESEARCH OVERVIEW

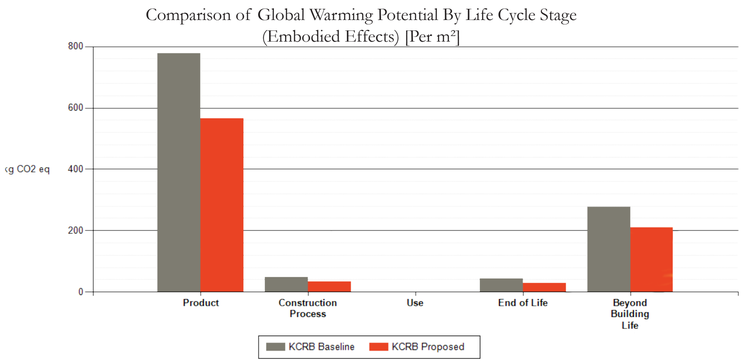
The Knight Cancer Research Building is a continuation of the OHSU campus located on the South Waterfront off Moody Avenue. On the course to LEED Platinum certification, KCRB is pursuing a LEED 4 pilot point that focuses on the influence early design decisions have on the long-term environmental impact of a new building project. Collaborating with team members from SRG, Brightworks Sustainability Consulting, and Catena Structural Engineers, we used Athena software to evaluate the building Life Cycle reduction impact with regard to the use of steel and concrete within the building's structural system. As a starting point, we considered at the building's reinforced concrete structure and compared that to a baseline building. To go more in depth on the differences between a baseline building and the proposed, we took a closer look at the auditorium space located on the main level. When investigating this space, we reverted to the baseline structural assumptions to see how designing this space with those implications could potentially changed this particular space, and how that would affect the space around the auditorium, and potentially the entire building.

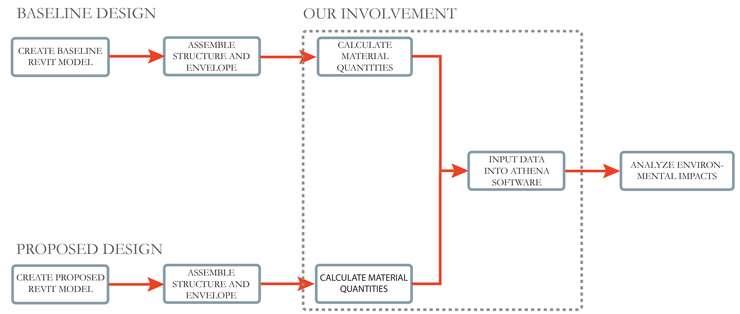


LEED SCORECARD



ATHENA TOOL





RESULTS

The focus of our efforts was designing a baseline structural system for the auditorium and seeing how that would influence environmental impacts of its construction. While the existing design uses a post-tensioned concrete structural system we wanted to analyze how a typical concrete structural system would compare. The structural system without post-tensioning required the use of a 3' steel girder to keep columns on above floors from landing in the middle of the auditorium. This steel girder eliminated occupant sightlines to the front of the auditorium and created the need to raise the ceiling and above floors 3'. Taller columns at more frequent intervals were required around the periphery of the auditorium to support the building above.

Athena took the quantities of materials we used for the baseline structural system and displayed the environmental impacts of materials used throughout their lifecycle. We found that the baseline design would contribute 300 more kilograms of CO_2 emissions per square meter of floor area than the existing design. This proved that the use of a post-tensioned structural system is an important step to achieving a LEED platinum status for the project.

Moving forward, the process we went through would have to account for the increase of all structural and envelope materials on the first floor with the extra three feet of floor height added for the auditorium. It is believed that the difference in CO_2 emissions per square meter of floor space of the auditorium can be applied to the whole building to estimate the difference of environmental impact between a baseline building and existing building.