Optimizing Building Layout to Minimize Walking Distances

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Abstract

Building Information Modeling can be enhanced with API applications to help architects and their clients design better buildings. “Out-of-the-box” software often lacks key features, does not understand how the building will be used, and is unaware of the goals of the client. Particularly when it comes to analyzing the building model, authoring applications that focus on allowing the user to generate a BIM model are unlikely to include the needed analysis functionality. In these cases, the options will be to create custom API-based solutions, purchase 3rd party solution, or rely on less effective legacy solutions. Engineers, builders, owners, and others can reap significant benefits by customizing BIM software with API-based applications to add intelligence specific to the building type or use.

Hospital design is a particular focus where extending the BIM model can save time, reduce errors, and lead to a better building design. This is particularly true as hospitals embrace “lean” techniques for process improvement to reduce waste, reduce healthcare costs and improve quality.

The design phase of a new hospital is the prime opportunity to reduce unnecessary transportation of people, medications, specimens, and supplies. Kaizen Institute USA notes that “Unlike warehouses, production facilities or offices, it is very difficult to make dramatic changes to the layout of a hospital once it is built. This results in poor patient flow, poor use of space or excessive walking distances becoming set in concrete for many decades.” As part of the construction of a new building, the Children’s Hospital of Saskatchewan set a goal to reduce walking time by 50% and Virginia Mason Hospital achieved a 44% reduction in people travel distance.

A Stantec client required extensive documentation of the shortest walking distance between different types of rooms in the design of a new hospital. Manually identifying these paths and measuring walking distances between hundreds of rooms would be a tedious, time-consuming, and error-prone task, so Stantec partnered with Boost Your BIM to develop a custom and proprietary API application called PathFinder.

PathFinder automates the computation of walking distances and straight-line distances between rooms in the building design. The ability to analyze a proposed design within a few hours, as compared to days gives the architects at Stantec a method to quantify the efficiency of the hospital layout and compare it. WIth the data analysis complete the designers can work to optimize the design as required by their client and best meet their needs.

Examples of PathFinder Output:

Excel output of shortest walking distance, straight line distance, and path efficiency

4	Surgey OR's to Surgical Day Surgery	CRH-DT04-36c.01	LEVEL 2 (74.25)	CRH-AC03-05.07	LEVEL 2 (74.25)	47.43	0	47.43	37.02	0.780518659
4	Surgey OR's to Surgical Day Surgery	CRH-DT04-36c.01	LEVEL 2 (74.25)	CRH-AC03-05.08	LEVEL 2 (74.25)	50.9	0	50.9	40.39	0.793516699
4	Surgey OR's to Surgical Day Surgery	CRH-DT04-36c.01	LEVEL 2 (74.25)	CRH-AC03-06.01	LEVEL 2 (74.25)	40.83	0	40.83	24.73	0.605682096
4	Surgey OR's to Surgical Day Surgery	CRH-DT04-36c.01	LEVEL 2 (74.25)	CRH-AC03-06.02	LEVEL 2 (74.25)	37.63	0	37.63	24.71	0.656656923
4	Surgey OR's to Surgical Day Surgery	CRH-DT04-36c.01	LEVEL 2 (74.25)	CRH-AC03-06.03	LEVEL 2 (74.25)	54.37	0	54.37	43.76	0.804855619
4	Surgey OR's to Surgical Day Surgery	CRH-DT04-36c.01	LEVEL 2 (74.25)	CRH-AC03-06.04	LEVEL 2 (74.25)	56.8	0	56.8	44.01	0.774823944

48.25	Average Actual	33.14	Average Euclidean
	Corridor Efficiency	**68.68%**	
	Travel Efficiency	63.36	Lower = 3.75 points
	RFP Min:	101.00	
	RFP Max:	88	
	Tech Submission was	41.55	
	December 05 was	65.03	
	7-Jan	63.69	

Graphic representation of the shortest path between two rooms