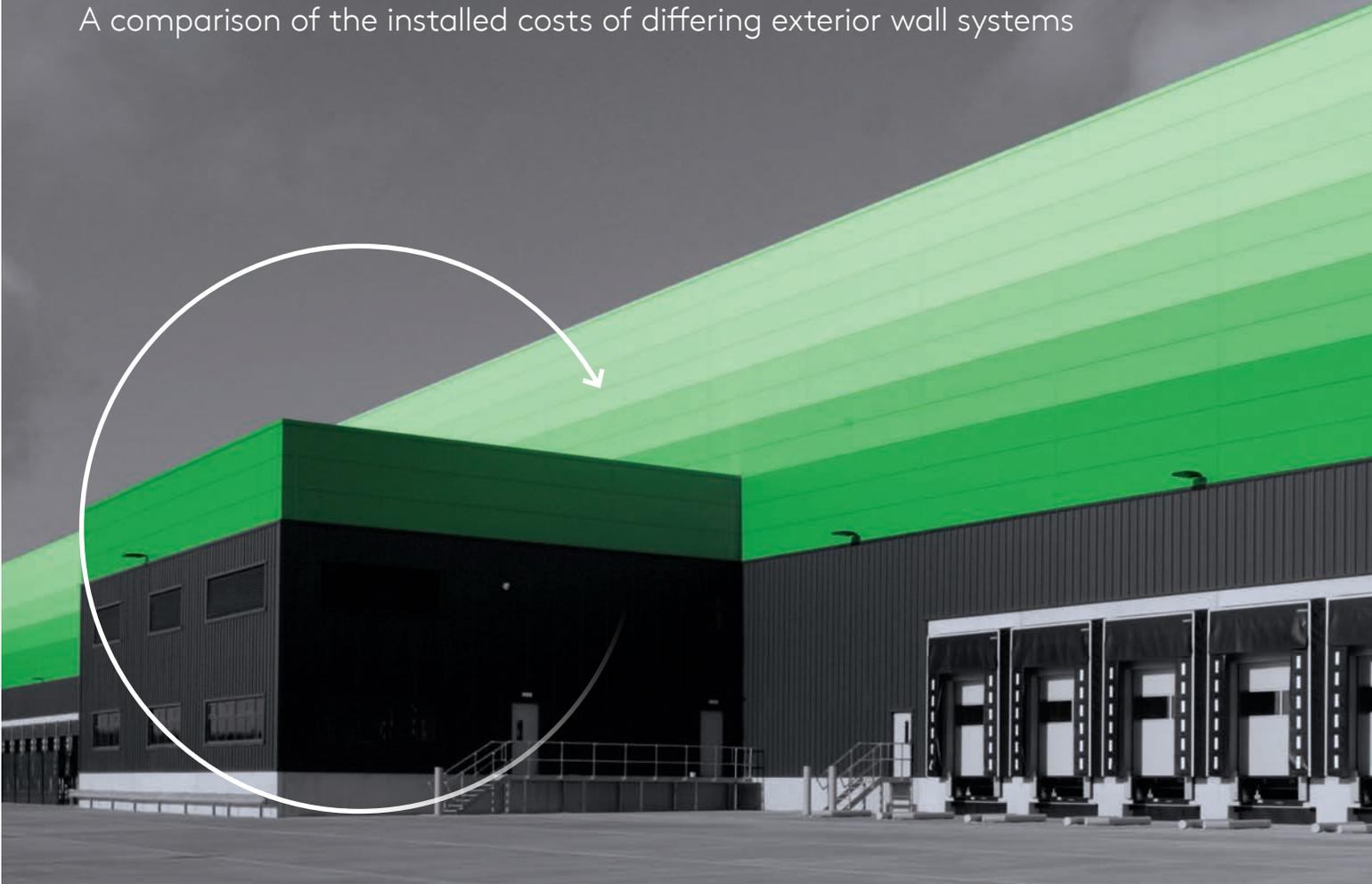


Insulated Panel Systems
North America

Reducing the Construction Costs of Industrial Buildings

A comparison of the installed costs of differing exterior wall systems



This study seeks to unpack the perceived trade-off that low-carbon materials cost more, by systematically comparing the installed costs of various exterior wall assemblies commonly used in industrial buildings.

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Introduction

Does reducing embodied carbon in construction cost more?

According to Architecture 2030, the building sector accounts for 39% of global greenhouse gas (GHG) emissions – 28% is attributed to the operational carbon impacts from building operations, while the remaining 11% is embodied carbon specifically from building materials and construction¹.

In a previous Kingspan white paper based on life cycle assessments (LCA) conducted by architectural research firm KieranTimberlake, the embodied carbon of various wall assemblies was compared. The study demonstrated that, in an example industrial building design of a gross floor area (GFA) of 150,000 square feet (sf) based in Philadelphia, using Kingspan QuadCore[®] insulated metal panels (IMP) instead of insulated precast concrete or tilt-up concrete systems reduced embodied carbon by 28%, saving 596,399 lbs (270,522 kg) of CO₂ equivalents².

These savings in embodied carbon illustrate that thoughtful material selection can make a significant difference in the effort to reduce the overall carbon footprint of buildings. However, there remains a perception that low carbon buildings cost more.

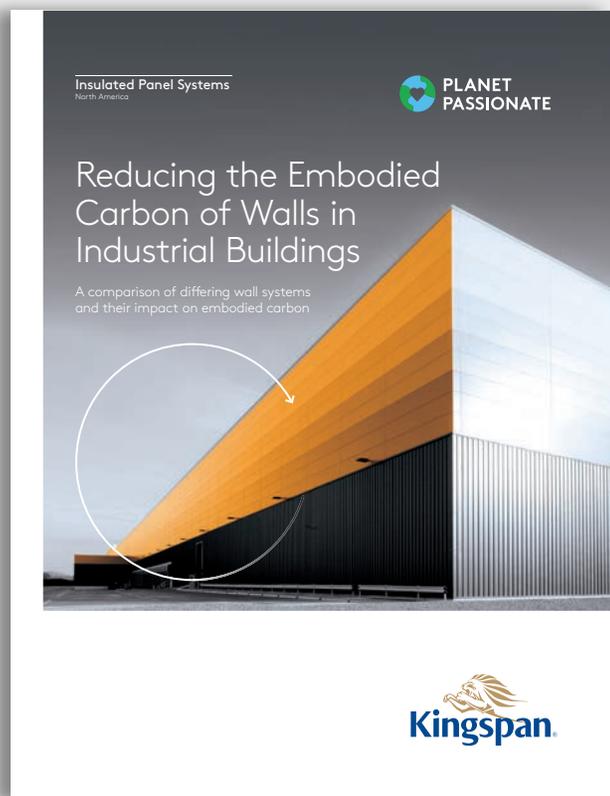
This study seeks to unpack that perceived trade-off by systematically comparing the installed costs of various exterior wall assemblies commonly used in industrial buildings.

The Kingspan QuadCore[®] IMP wall system reduced embodied carbon by 28% compared to both insulated precast concrete and tilt-up concrete.

To learn more about our embodied carbon comparison research and download the white paper, click here



Watch the video here



Executive Summary

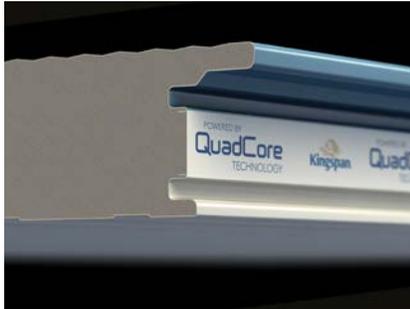
This paper compares the installed costs of three different exterior wall assemblies commonly used in industrial buildings – Kingspan QuadCore® IMP wall systems, insulated precast concrete, and tilt-up concrete wall systems – across 18 cities in North America to quantify the cost differences.

To conduct this study, Kingspan engaged global construction and asset management consultancy Currie & Brown. The firm applied standard construction cost estimating methodologies, leveraging historical data of actual projects to identify warehouse and light manufacturing buildings around 150,000 sf GFA, which had used IMP walls, insulated precast concrete or tilt-up concrete walls. Costs were normalized based on material costs for Quarter 2, 2021 and local labor rates were applied across the 18 different locations.

The comparison study revealed that the installed costs of Kingspan QuadCore® IMP wall systems were on average 25% lower in the United States and 27% lower in Canada compared to insulated precast and tilt-up concrete walls.

The potential cost savings ranged from averages of 18% to 32% depending on location, with the variation being largely driven by differences in local labor costs.

The results demonstrate that reducing embodied carbon in buildings does not have to cost more. In fact, using Kingspan QuadCore® IMPs instead of concrete wall assemblies could save on both construction costs and embodied carbon.



The potential average savings in installed costs using Kingspan QuadCore® IMPs instead of concrete ranged from 18% to 32%, depending on location.



Background

Purpose of Study

The purpose of this comparison study is to understand how the installed cost of Kingspan QuadCore® IMP wall systems compare to other common exterior wall assemblies used in industrial buildings – namely, insulated precast concrete and tilt-up concrete wall systems.

Scope

The study examines the installed costs of Kingspan QuadCore® IMP wall systems, insulated precast concrete and tilt-up concrete wall systems, in typical warehouse or light manufacturing buildings of around 150,000 sf GFA. A total of 18 cities across the United States and Canada were included in the study to provide a broad representation of regions.

Region	City
West Coast	Seattle, WA San Francisco, CA Los Angeles, CA Denver, CO
Midwest	Chicago, IL St. Louis, MO Columbus, OH
Northeast	Boston, MA Philadelphia, PA Richmond, VA
South	Dallas, TX Nashville, TN Atlanta, GA Orlando, FL
Canada	Vancouver, BC Calgary, AB Toronto, ON Montreal, QB

Table 1. US and Canadian cities included in the study.

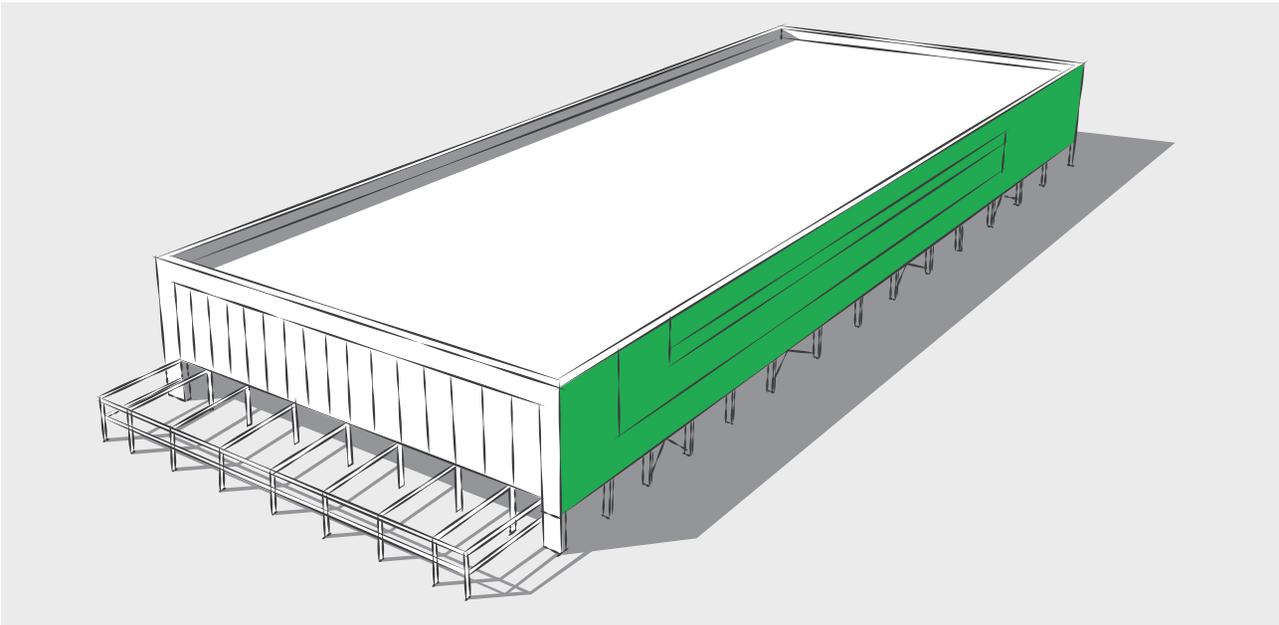


Figure 1. The study compares three exterior wall envelope options for a typical industrial building of around 150,000 sf GFA.

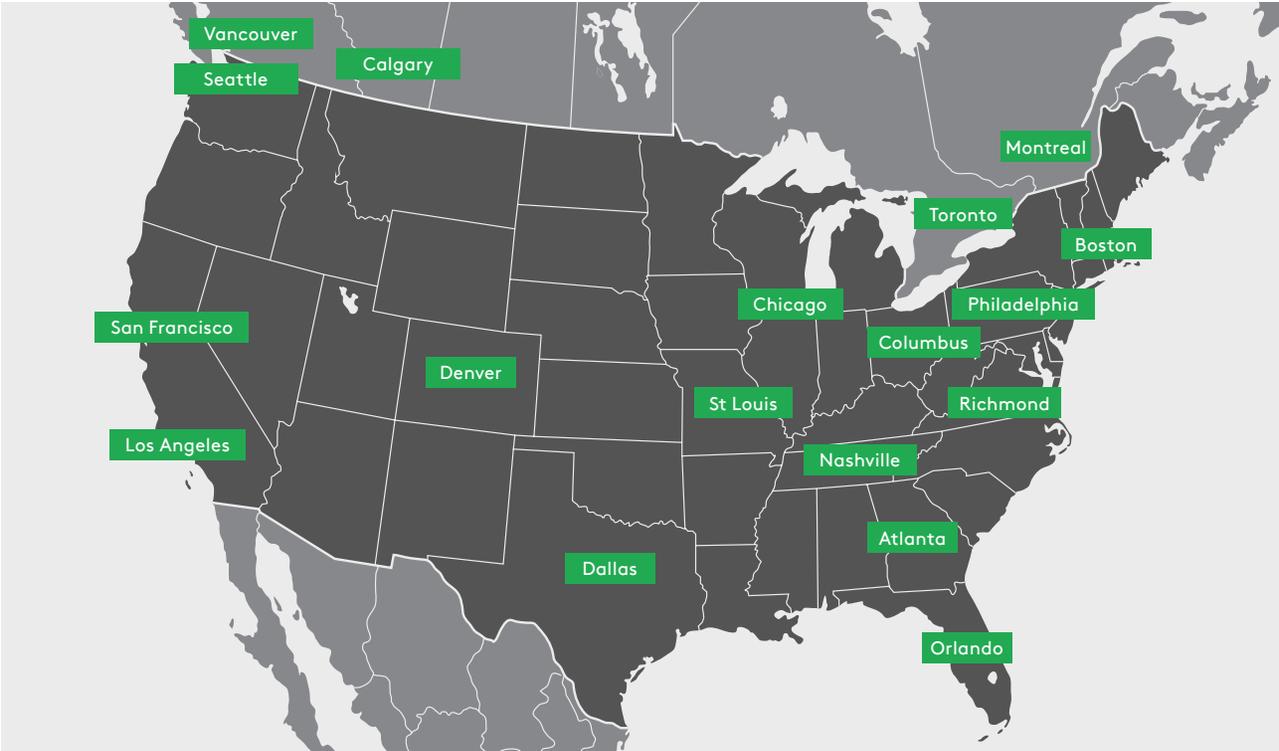


Figure 2. Eighteen cities were included in the comparison study – fourteen across the United States and four across Canada.

Wall Assemblies

Kingspan IMP insulated with QuadCore®

The Kingspan QuadCore® IMP assembly was priced based on a KS Series panel with a thickness of 2" (R-16), 2.5" (R-20) or 3" (R-24) depending on local energy code requirements and a width of 42". Both external and internal steel gauges were 26 ga and the panel coating was a Category 1 PVDF color. All associated trim and accessories were also included in the pricing inputs.

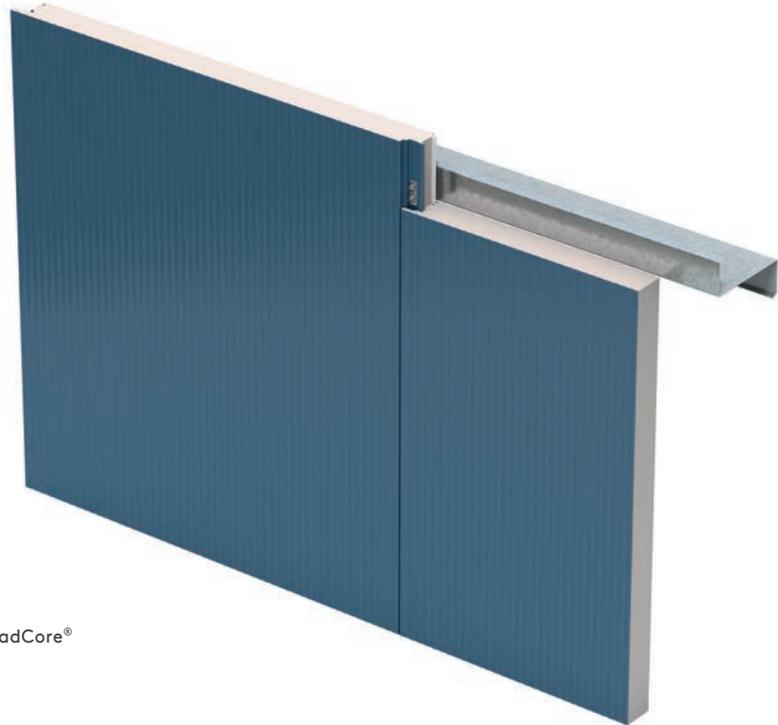


Figure 3. Kingspan KS Series panel insulated with QuadCore®

Kingspan IMP Configurations

Insulated metal panels can be installed both vertically and horizontally, with variations in the associated back-up steel, each carrying slightly different material and labor implications. To account for these variations in the cost analysis, three different configurations were included in the study as seen in Figure 4, Figure 5, and Figure 6.

Importantly, the cost analysis also included the vertical structural steel columns required for the superstructure of a metal building.



Figure 4. Configuration A: Kingspan IMP installed vertically on horizontal sub-girts.

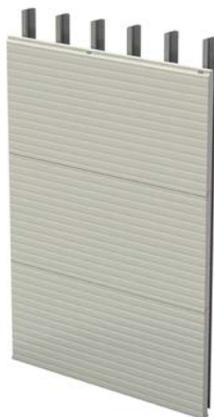


Figure 5. Configuration B: Kingspan IMP installed horizontally on vertical steel studs.



Figure 6. Configuration C: Kingspan IMP installed vertically on horizontal Z girts.

Insulated Precast Concrete

Insulated precast concrete panels consist of rigid expanded polystyrene (EPS) foam insulation sandwiched between layers of reinforced precast concrete.



Figure 7. Insulated precast concrete wall with an EPS core.

Tilt-up Concrete

Tilt-up concrete wall assemblies consist of the tilt-up reinforced concrete panel itself in addition to steel studs, fiberglass insulation batts, and an internal lining of gypsum board.



Figure 8. Tilt-up concrete wall assembly with fiberglass batt insulation, steel studs, and internal gypsum lining.

Methodology

To conduct this study, Kingspan engaged global construction and asset management consultancy Currie & Brown.

The firm applied standard construction cost estimating methodologies, leveraging historical data of actual projects to identify warehouse and light manufacturing buildings around 150,000 sf GFA, which had used IMP walls, insulated precast concrete or tilt-up concrete walls.

For each project identified, product costs were normalized based on material costs for Quarter 2, 2021 and local labor rates were applied for each of the 18 different locations.

Exterior Wall Assembly	No. of Identified Projects (≈150,000 sf GFA)	Total Product Quantity (sf)
Insulated Metal Panel Kingspan QuadCore® IMP	7	1,273,159 150,000*
Insulated Precast Concrete	9	598,743
Tilt-up Concrete	8	389,205

*For the purposes of estimating installed costs for each of the three Kingspan IMP configurations, it was assumed that 50,000 sf of product for each configuration would be used in an industrial building of this size.

Table 2. Historical projects and product quantities identified for the cost analysis.

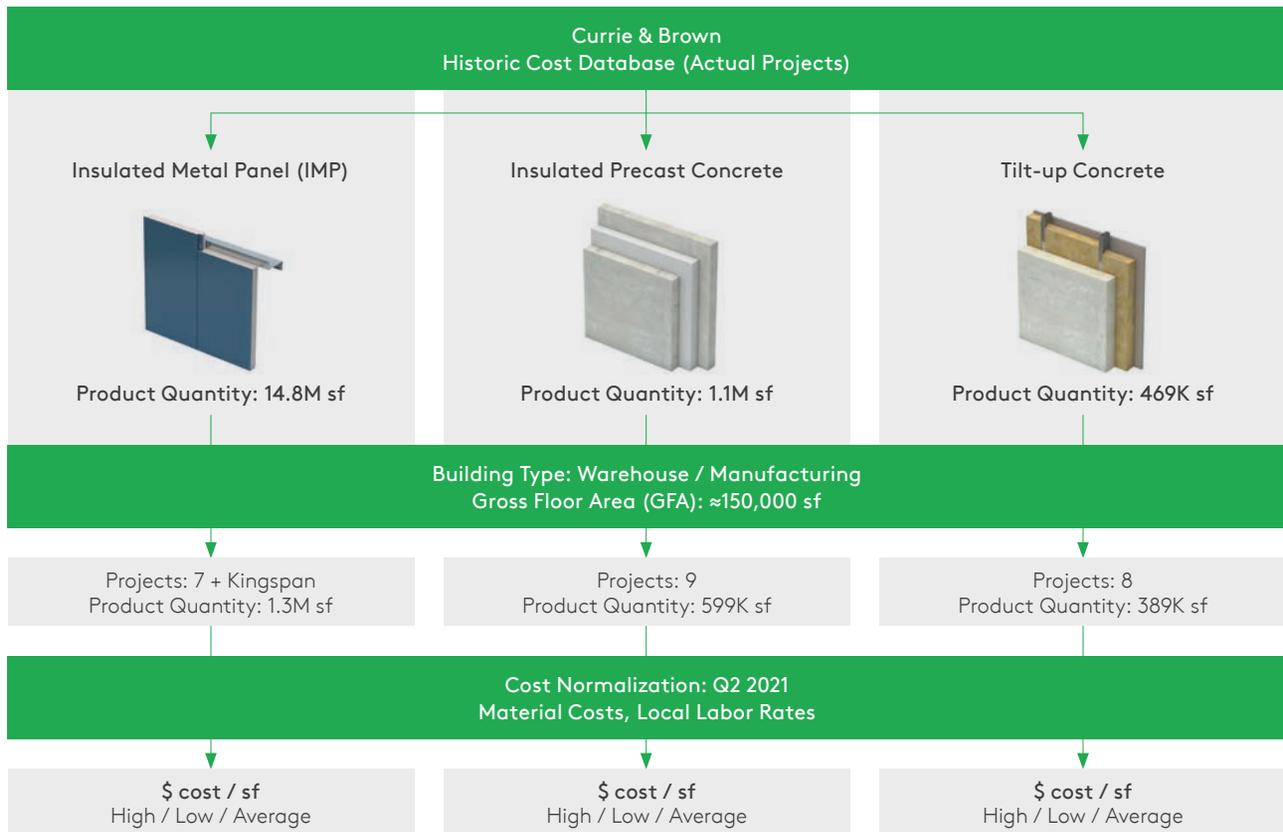


Figure 9. Conceptual representation of the cost analysis methodology.

General Assumptions

All costs shown are at the subcontractor level inclusive of subcontractor overhead and profit.

Costs include material, labor, and equipment costs, as well as shipping costs and associated costs for caulking, sealing, cleaning and expansion joints.

Costs exclude general contractor overhead, fees, design contingency, construction contingency, permits, design fees, and other soft costs and owner costs.



Results

Example City Analysis: Philadelphia

To illustrate the wall type cost evaluation for the identified projects, this section presents the analysis for Philadelphia.

The cost estimating methodology was applied for each of the wall assembly types and the installed costs per square foot were ascertained for each project. The average installed cost was then calculated to form a benchmark cost per square foot for each wall type.

This same process was replicated for each of the other 17 locations.

IMP

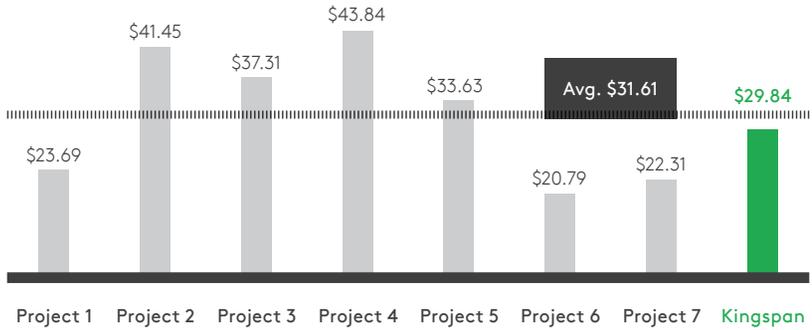


Figure 10. Installed costs for IMPs in Philadelphia.

Insulated Precast Concrete

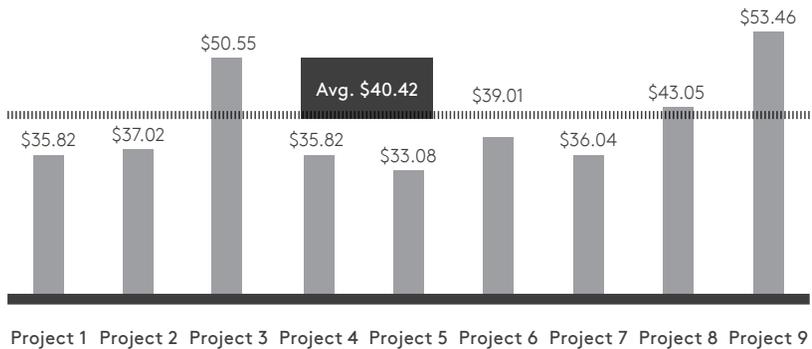


Figure 11. Installed costs for insulated precast concrete in Philadelphia.

Tilt-up

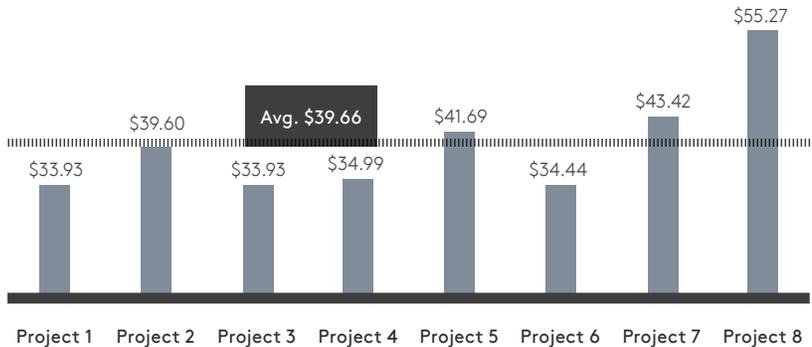


Figure 12. Installed costs for insulated precast concrete in Philadelphia.

Cost variations for the same wall types can be due to nuances such as project complexity, associated labor requirements, architectural finishes, coating options, product specifications and more.

In subsequent sections of this analysis, when comparisons are made between the concrete wall systems and the Kingspan QuadCore® IMP assembly, only the Kingspan installed costs are used as a basis for comparison.

United States

Comparison by Region

The analysis reveals that costs are generally higher overall in the Northeast and West Coast, slightly lower in the Midwest, and lowest in the South where labor tends to be cheaper.

The installed costs for Kingspan QuadCore® IMPs were found to be cheaper across the board, with potential savings ranging from 20% to 29%. Larger savings in the South could indicate better labor availability for associated IMP trades there compared to other regions.



Benchmark Installed Costs per SF

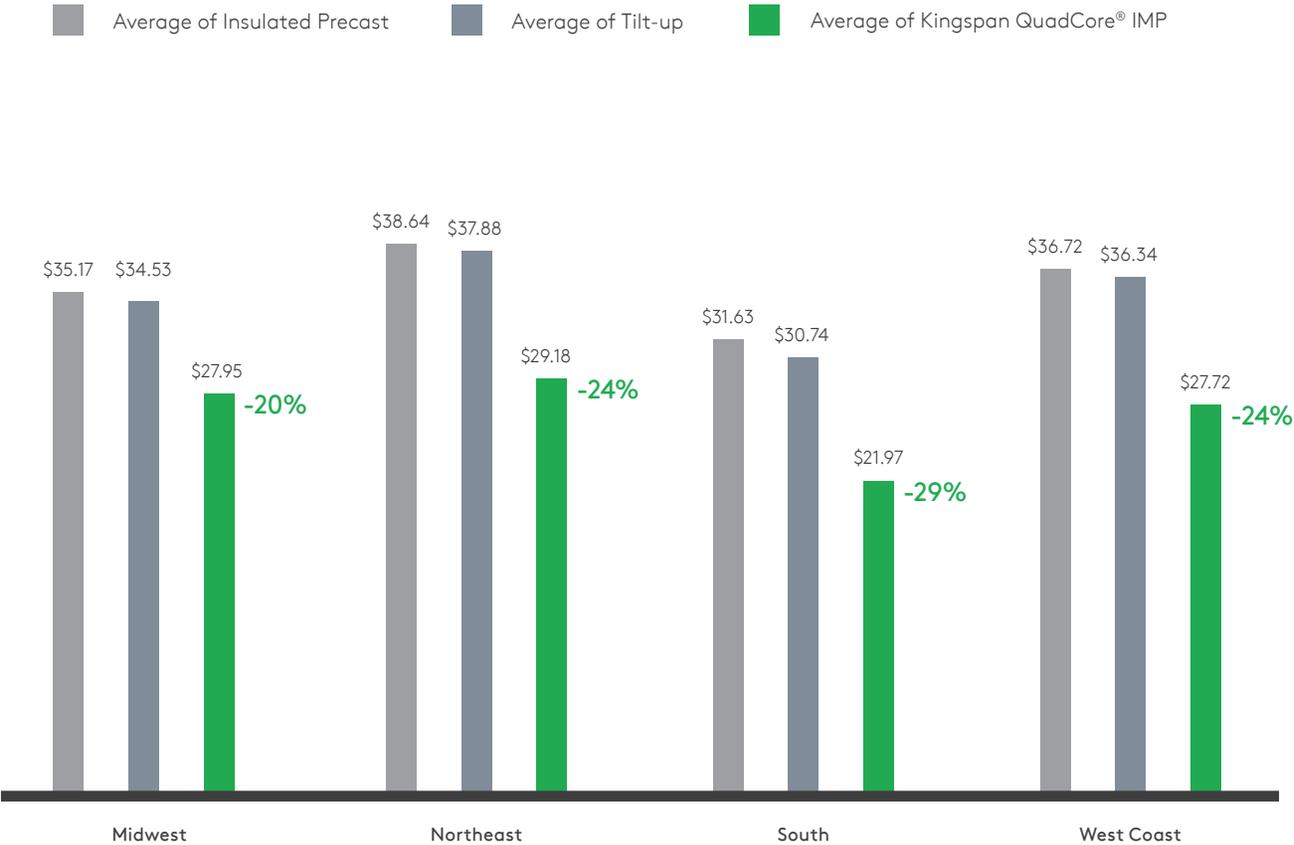


Figure 13. Comparison of benchmark installed costs by US region.

Results

Comparison by City

West Coast

Costs are highest in San Francisco, not surprising as it is one of the most expensive cities in the United States. Costs in Seattle, also considered among the most expensive cities in the United States, are not far behind. Installed costs in Denver are considerably lower than the coastal cities.

The potential cost savings using Kingspan QuadCore® IMPs in San Francisco of 20% are not quite as large as some other cities and could be due a tighter labor market there for associated IMP trades. The biggest potential savings of 27% are in Denver and Seattle.



San Francisco, CA

Benchmark Installed Costs per SF

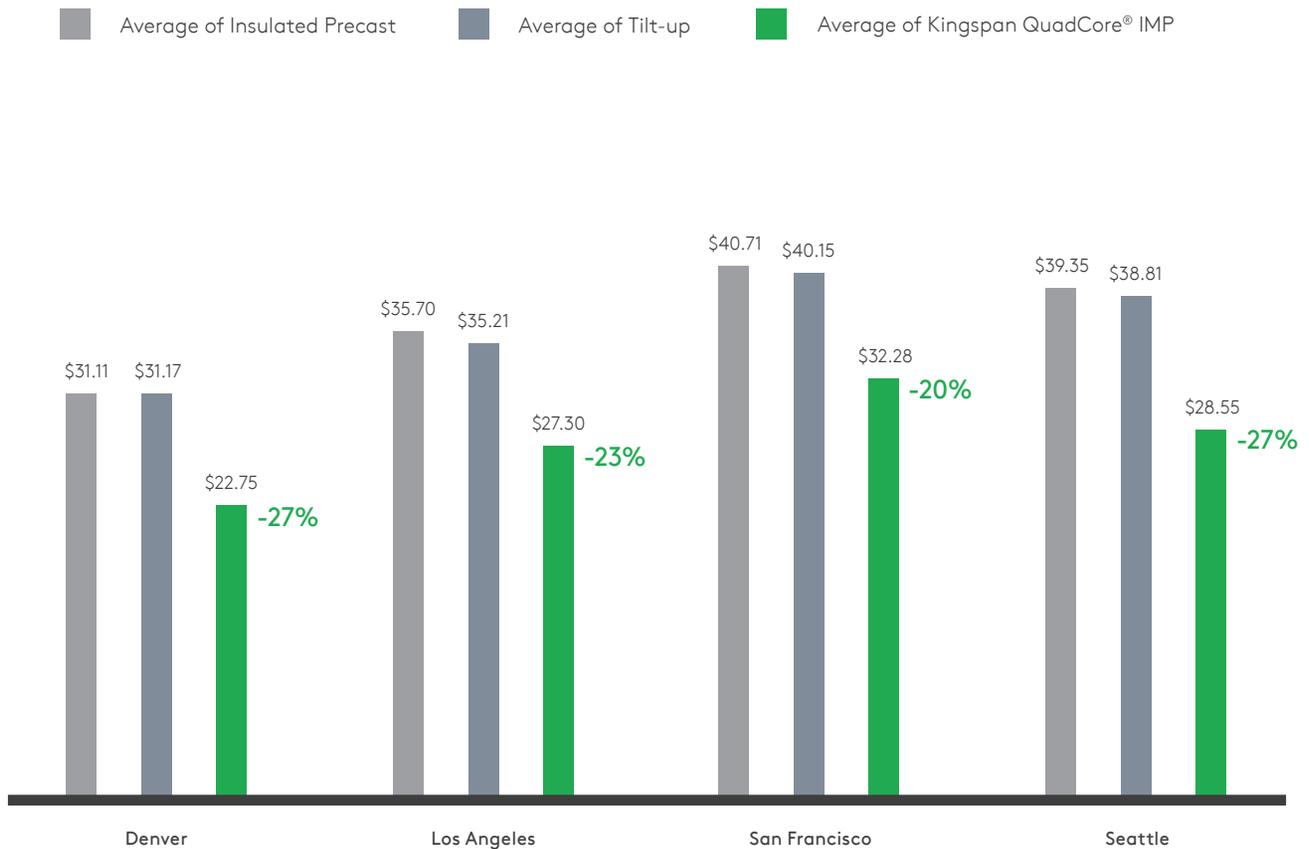


Figure 14. Comparison of benchmark installed costs for West Coast cities.

Comparison by City

Midwest

In the Midwest, costs are highest in Chicago, with Columbus and St. Louis at very similar levels, Columbus being only slightly cheaper.

Potential cost savings with Kingspan QuadCore® IMPs in the Midwest range from 18% in St. Louis to 22% in Columbus, which is overall lower than other regions. The cost savings in St. Louis, at 18%, is the lowest in this study, potentially indicating a much tighter labor market in that city for associated IMP trades.



St. Louis, MO

Benchmark Installed Costs per SF

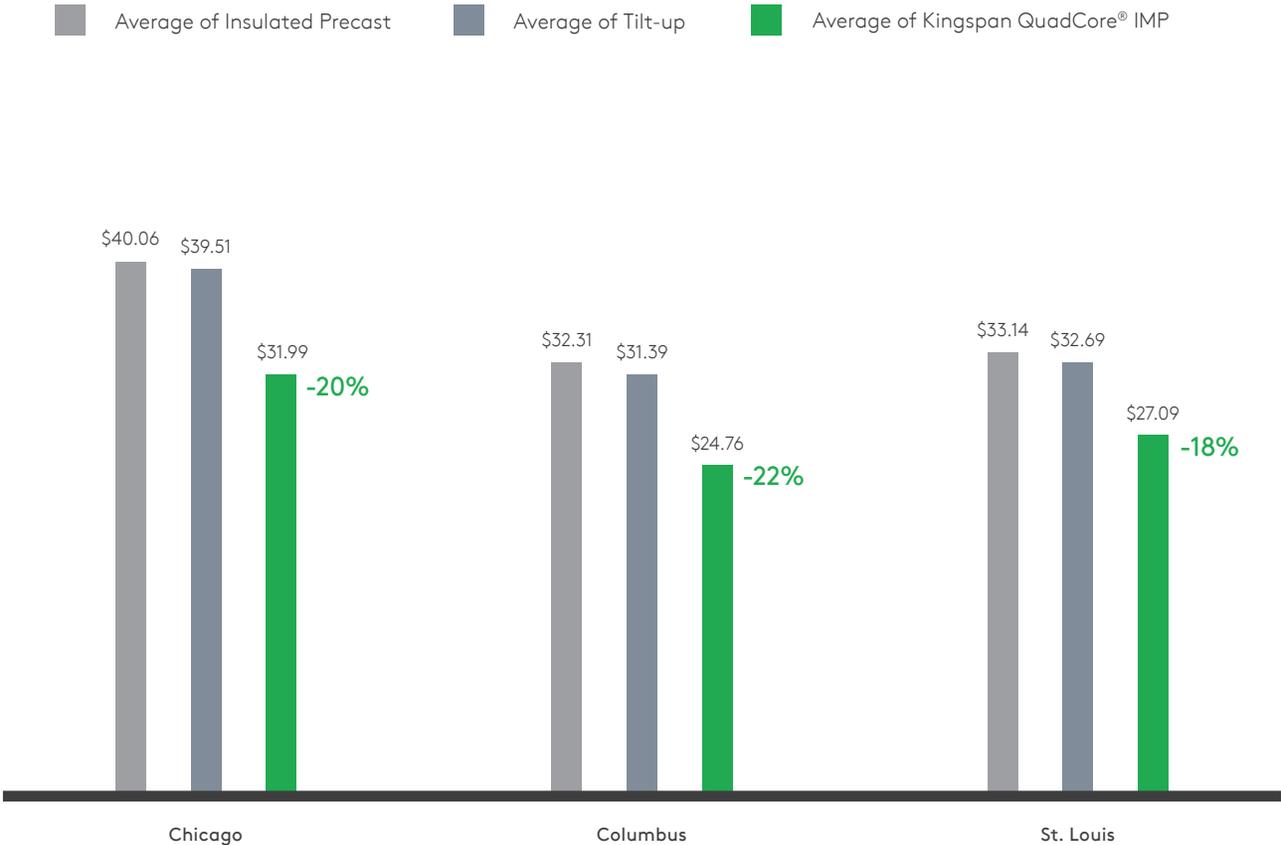


Figure 15. Comparison of benchmark installed costs for Midwest cities.

Results

Comparison by City

Northeast

Analysis in the Northeast reveals Boston as the highest-cost city not just in the Northeast, but among all 14 US cities analyzed in this study. Philadelphia is also among the higher-cost cities analyzed. Costs in Richmond are considerably lower.

Using Kingspan QuadCore® IMPs in the Northeast could save between 22% and 25%, with the biggest savings in Philadelphia.



Philadelphia, PA

Benchmark Installed Costs per SF

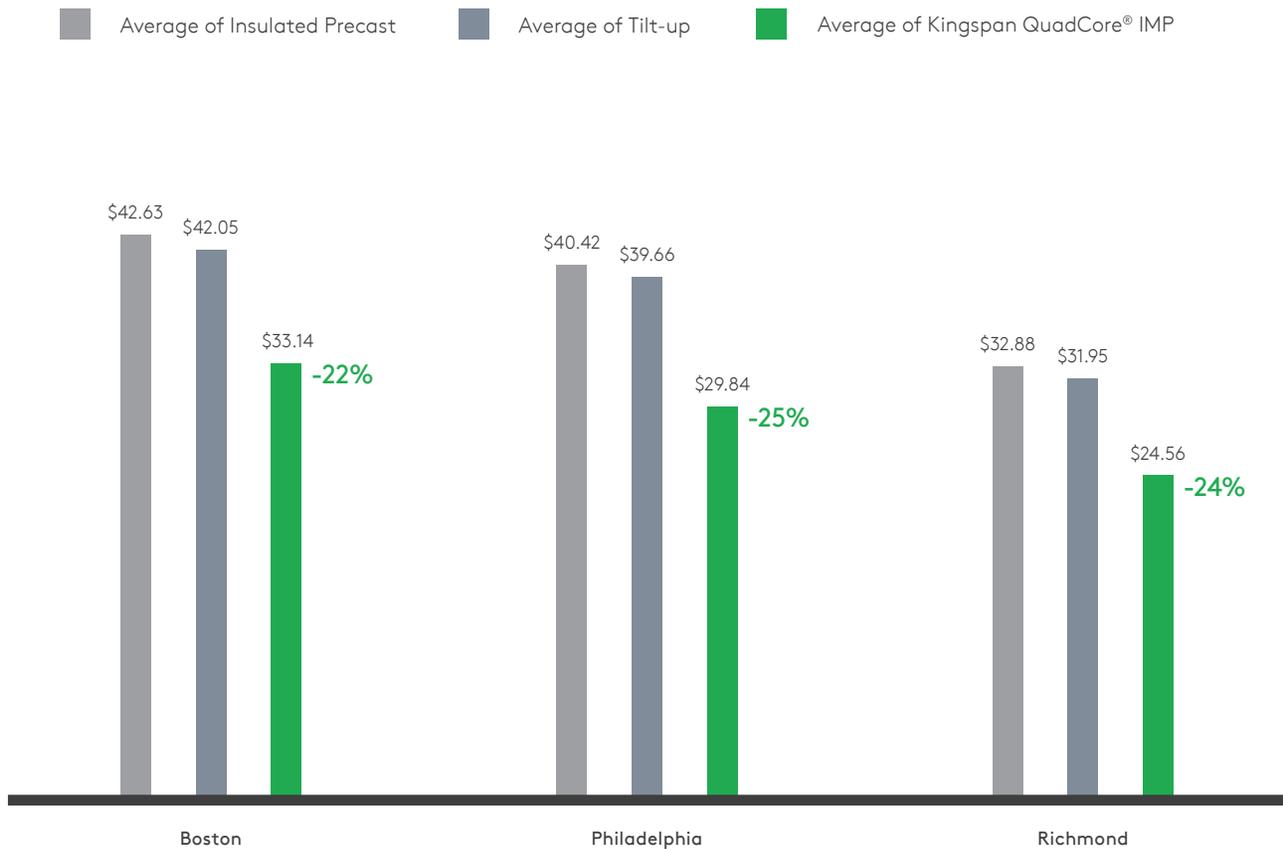


Figure 16. Comparison of benchmark installed costs for Northeast cities.

Comparison by City

South

The study revealed that installed costs were broadly lower in the South than other regions in the United States, as expected due to cheaper labor rates in this region in general. Examining the installed costs for concrete systems, no city in the South exceeded the \$40/sf benchmark, which a number of cities in other regions surpassed.

In terms of potential savings using Kingspan QuadCore® IMPs, the South saw the largest savings ranging from 27% in Atlanta, right up to 32% in Orlando, as labor makes up a smaller proportion of the overall installed costs. The significant savings of 31% and 32% in Nashville and Orlando, respectively, could indicate greater availability of associated IMP trades in those cities.



Nashville, TN

Benchmark Installed Costs per SF

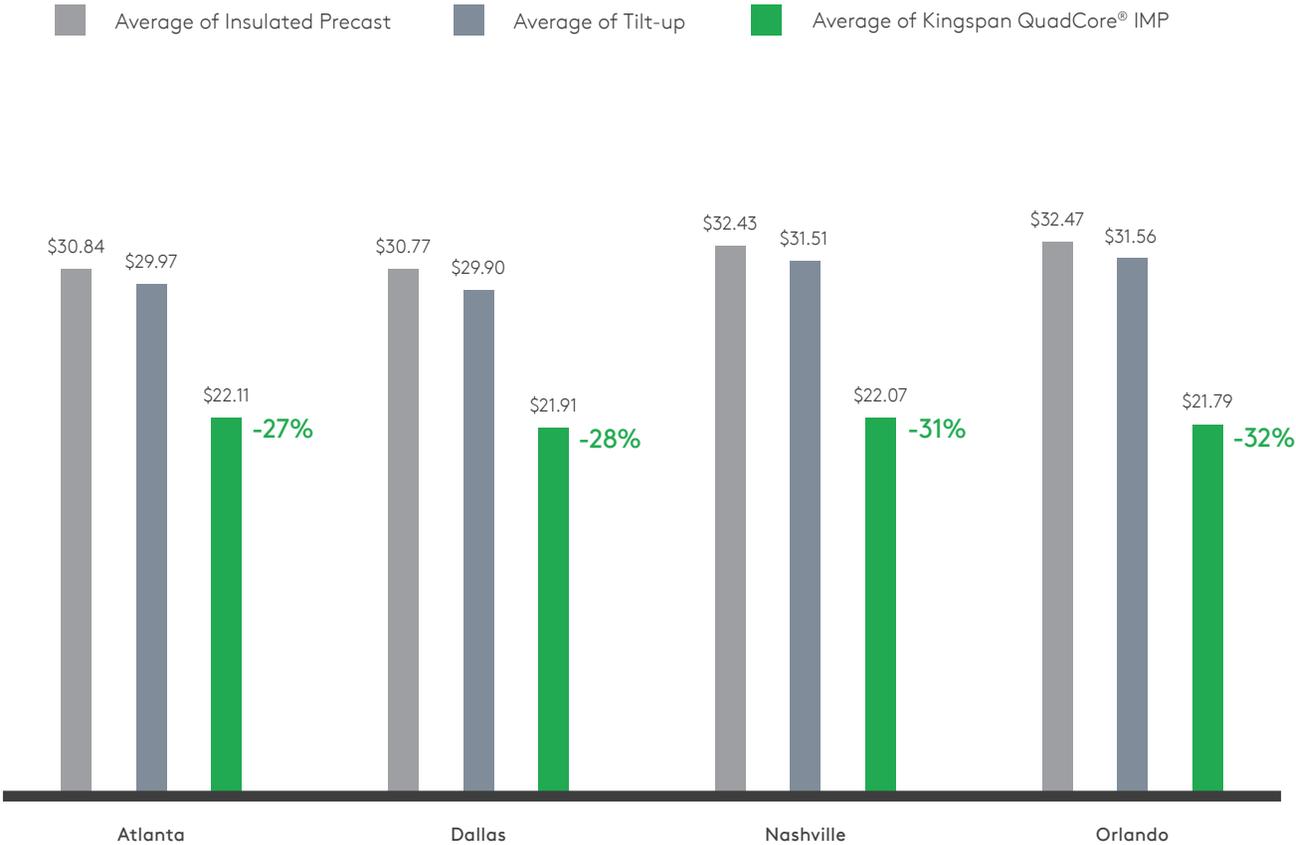


Figure 17. Comparison of benchmark installed costs for cities in the South.

Results

Canada

Comparison by City

In Canada, analysis revealed that there is much less variation in installed costs across the different parts of the country compared to the regional differences observed in the United States.

The scale of potential cost savings by using Kingspan QuadCore® IMPs are also rather consistent, and significant, at 27% for all cities except for Vancouver, where the savings were 26%.



Toronto, ON

Benchmark Installed Costs per SF

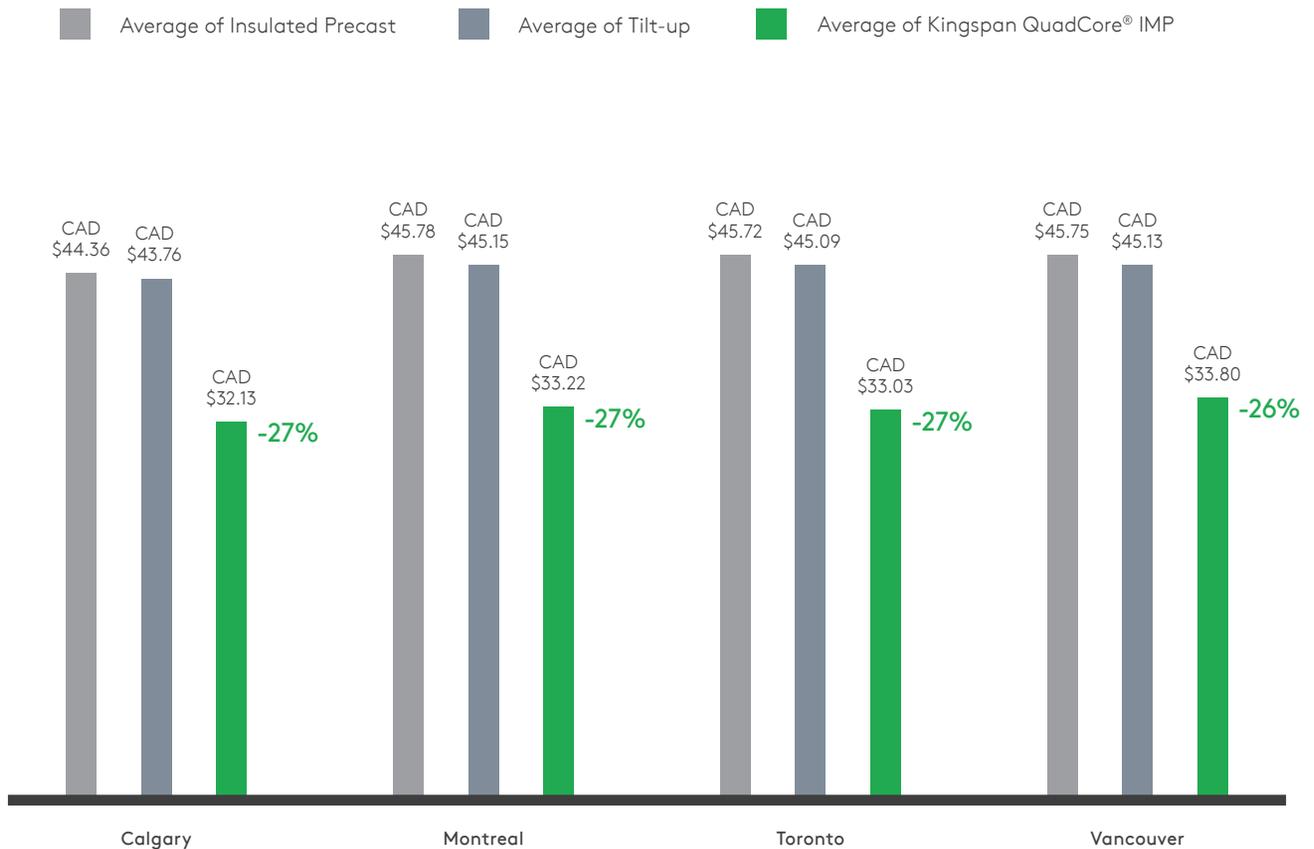


Figure 18. Comparison of benchmark installed costs for Canadian cities.

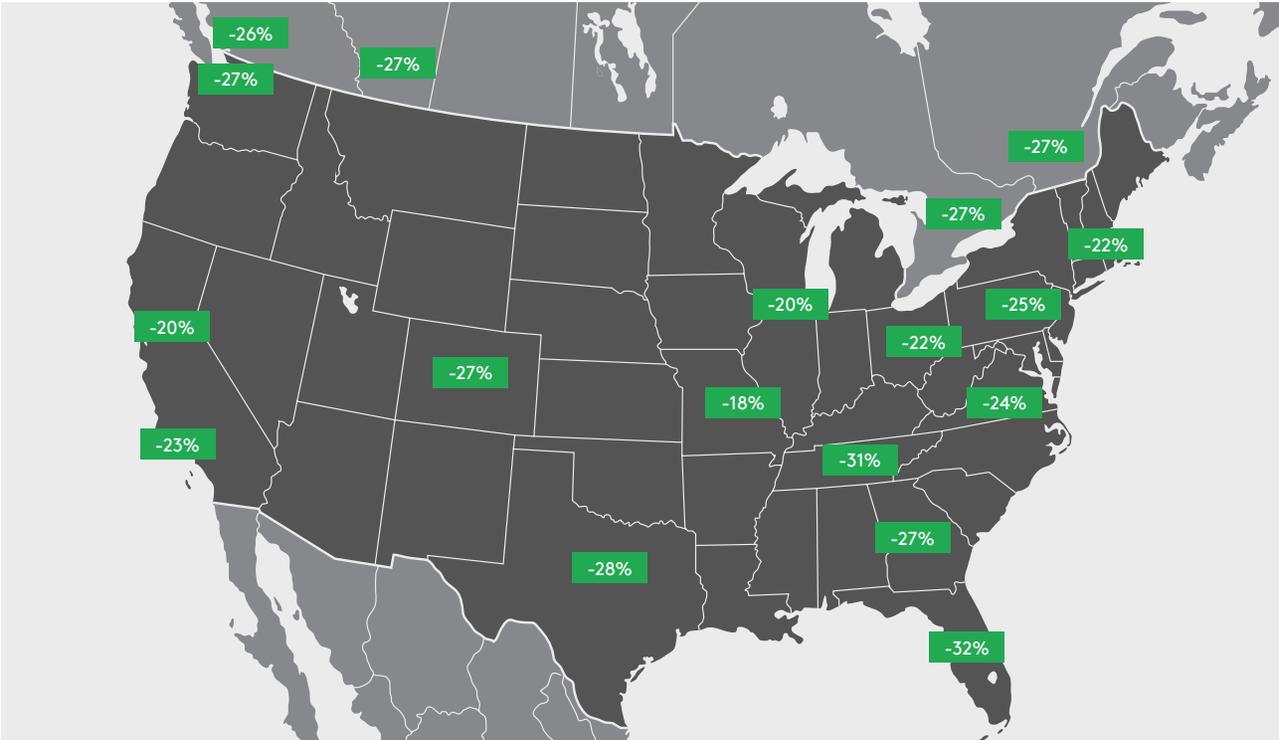
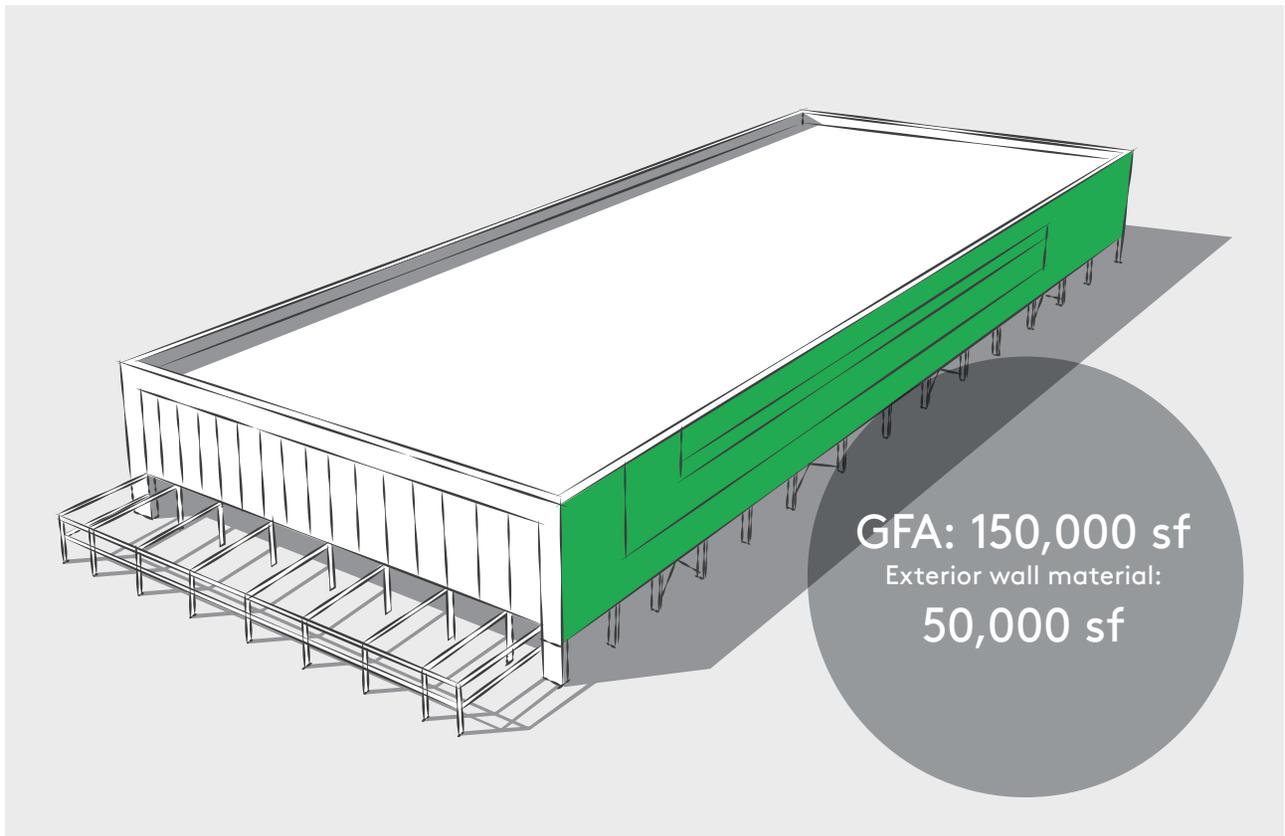


Figure 19. Summary potential cost savings by using Kingspan QuadCore® IMPs instead of concrete wall systems across the 18 cities analyzed in the United States and Canada.



Applied Savings Analysis

To demonstrate the scale of potential savings by using Kingspan QuadCore® IMPs instead of concrete wall systems, it is useful to apply the installed costs to an example project, in this case the 150,000 sf GFA industrial building used as the basis of this study. For a building of this size, it was assumed that 50,000 sf of exterior wall product would be installed.



United States

The applied total cost savings by using Kingspan QuadCore® IMPs in the example 150,000 sf industrial building instead of concrete wall systems can be significant, ranging from \$279,941 in St. Louis compared to tilt-up concrete walls, right up to \$540,324 in Seattle compared to insulated precast concrete.

Applied Total Cost Savings Comparison

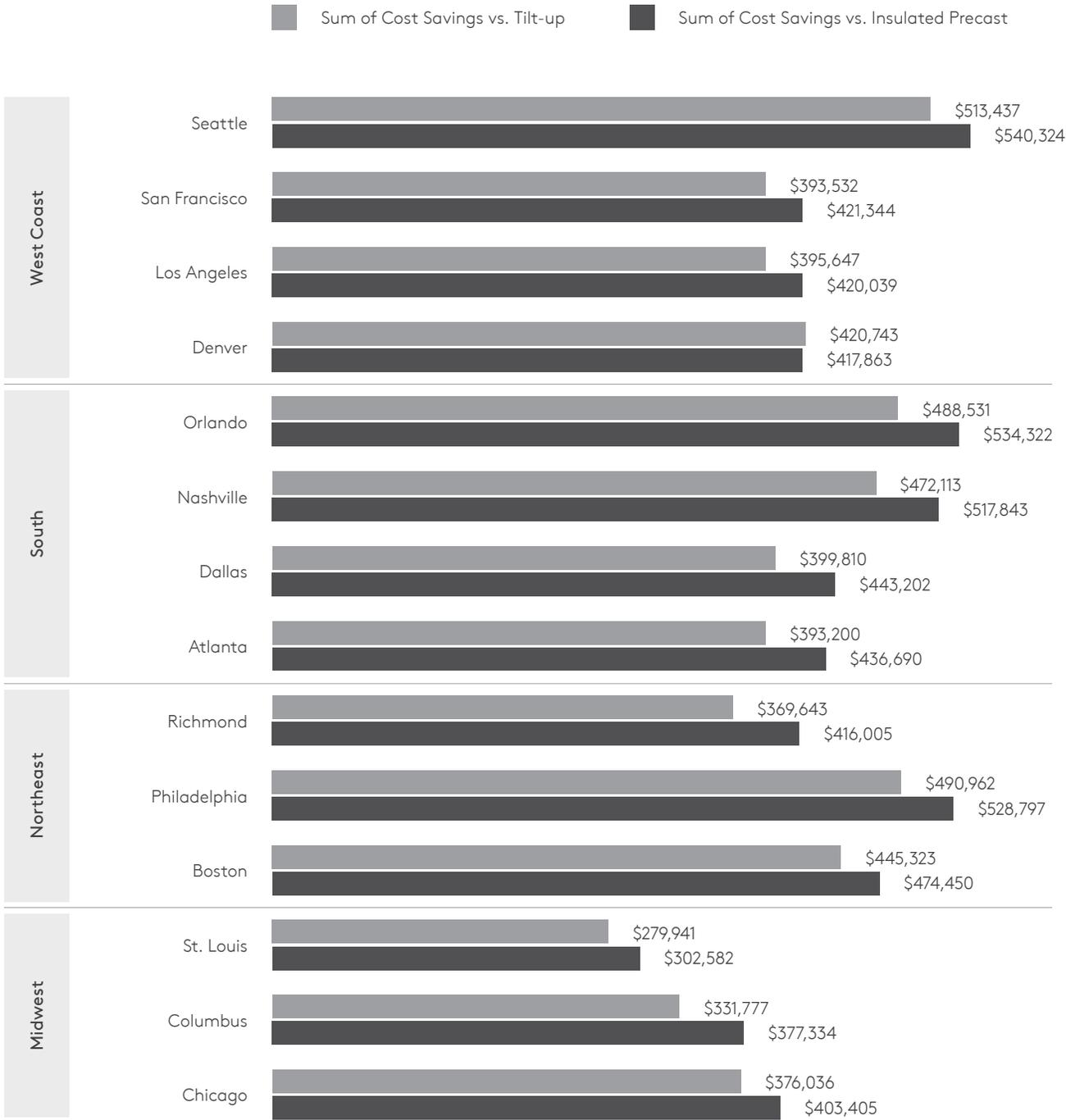


Figure 20. Summary of applied total cost savings based on 50,000 sf of installed product.

Applied Savings Analysis

Canada

In Canada, there is less variation in the applied total cost savings by using Kingspan QuadCore® IMPs in the example 150,000 sf industrial building instead of concrete wall systems, but they are nonetheless significant. The savings range from CAD\$566,341 in Vancouver compared to tilt-up concrete, up to CAD\$634,544 in Toronto compared to insulated precast concrete.

Applied Total Cost Savings Comparison

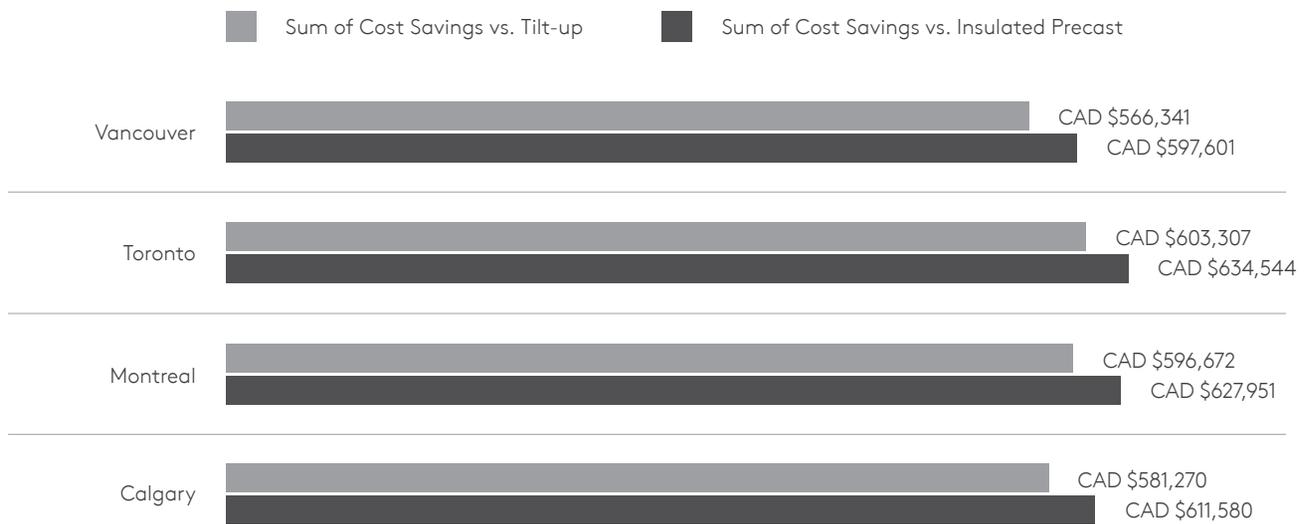


Figure 21. Summary of applied total cost savings based on 50,000 sf of installed product.



Conclusion

The results from this research clearly show that Kingspan QuadCore® IMP wall systems cost less to install in industrial buildings than both insulated precast concrete and tilt-up concrete wall systems. Cost reductions were demonstrated across all 18 cities evaluated, with average potential savings between 18% to 32%, depending on location.

In the example industrial building of 150,000 sf GFA, with 50,000 sf of exterior wall product installed, these savings translate to up to \$540,324 in Seattle and up to CAD\$634,544 in Toronto when compared to the total cost of installing insulated precast concrete walls.

Furthermore, this research refutes the perception that low-carbon material choices cost more. In Philadelphia, for example, previous research demonstrated a 28% reduction in embodied carbon by using Kingspan QuadCore® IMPs instead of concrete wall systems². In addition to the embodied carbon savings, this analysis revealed that Kingspan QuadCore® IMPs could also deliver an installed cost saving of 25% in Philadelphia compared to concrete wall systems.

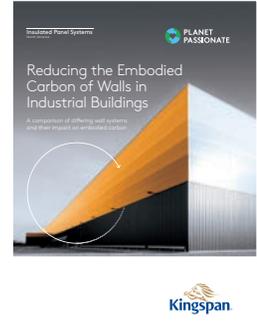
For the 150,000 sf GFA warehouse building in Philadelphia that equates to an average cost saving of \$509,879 and an embodied carbon saving of 596,399 lbs (270,522 kg) of CO₂ equivalents² compared to concrete wall systems.



Installed cost reductions of between 18% and 32% were demonstrated by using Kingspan QuadCore® IMPs instead of concrete wall systems.

To reduce the construction costs of exterior walls in industrial buildings, while also reducing embodied carbon, Kingspan QuadCore® IMPs should be considered the product of choice compared to conventional concrete wall systems.

To learn more about our embodied carbon comparison research and download the white paper, click here 





Watch the video here 

Our 2030 Global Commitments

At Kingspan, we want to play our part. We believe advanced materials, building systems and digital technologies hold the key to addressing these issues. With our Planet Passionate global sustainability program, we are confident that together we can move to a clean energy future, manage the earth's resources more sustainably and protect our natural environment.

To do this we have set ourselves a series of goals to be achieved by 2030. ↘



Energy

- Maintain our **Net-Zero** energy target
- **Increase** our direct use of renewable energy to **60%** by 2030
- **Increase** our onsite generation of renewable energy to **20%** by 2030
- Install solar PV systems on **all owned facilities** by 2030



Carbon

- **Net-Zero** carbon manufacturing by 2030
- **50% reduction** in product CO₂ intensity from our primary supply partners by 2030
- **Zero emission** ready company cars by 2025

Planet Passionate Program to Further Drive Down Embodied Carbon

Planet Passionate is Kingspan's ambitious 10-year global sustainability program that aims to impact three big global issues – climate change, circularity, and protection of our natural world.

In addressing these issues, Kingspan has set targets in the areas of energy, carbon, circularity, and water, which are also aimed at making significant advances in the sustainability of both our business operations and our products.

Some of the targets that will specifically the impact embodied carbon of our products include:

- Increasing the use of direct renewable energy to 60% by 2030
- Increasing our on-site renewable energy generation to 20% by 2030
- Reducing the product CO₂ intensity from our primary supply partners by 50% by 2030
- All QuadCore® to use upcycled PET by 2025



Through Planet Passionate, we are playing our part by driving energy and carbon out of our business operations and supply chain, as well as increasing our recycling of rainwater and waste, while also accelerating our participation in the circular economy.

For more details on the program and the full list of targets, please visit www.kingspan.com/planetpassionate.



Circularity

- **1 billion** PET bottles upcycled into our manufacturing processes by 2025
- All QuadCore® insulation to utilise upcycled PET by 2025
- **Zero company waste** to landfill by 2030



Water

- **5 active** ocean clean-up projects by 2025
- **100 million** liters of rainwater harvested by 2030

Appendix

Labor Rates

Region	City	Carpenter	Ironworker	Roofer	Cement Mason
Midwest	Columbus	\$61.70	\$66.89	\$58.69	\$55.35
	Chicago	\$111.89	\$120.98	\$91.14	\$109.01
	St. Louis	\$76.69	\$84.21	\$68.67	\$69.62
Northeast	Boston	\$108.43	\$125.17	\$102.97	\$107.56
	Richmond	\$62.29	\$61.67	\$58.80	\$53.72
	Philadelphia	\$102.39	\$90.17	\$90.43	\$95.85
South	Nashville	\$51.81	\$52.98	\$39.03	\$45.33
	Atlanta	\$47.63	\$54.52	\$40.67	\$45.27
	Orlando	\$47.54	\$55.42	\$41.69	\$44.56
	Dallas	\$49.56	\$42.58	\$45.99	\$49.70
West Coast	Denver	\$55.26	\$56.52	\$43.54	\$55.76
	Los Angeles	\$90.70	\$97.32	\$60.28	\$84.76
	San Francisco	\$116.51	\$123.63	\$96.14	\$100.31
	Seattle	\$85.80	\$95.23	\$76.70	\$86.66
Canada	Vancouver	CAD \$85.80	CAD \$99.82	CAD \$93.22	CAD \$92.40
	Calgary	CAD \$88.77	CAD \$91.82	CAD \$78.89	CAD \$82.58
	Toronto	CAD \$97.64	CAD \$92.38	CAD \$88.50	CAD \$93.25
	Montreal	CAD \$102.68	CAD \$81.00	CAD \$96.48	CAD \$93.46

Table 3. Hourly labor rates by trade and city.

Cost Data Summary

Region	City	Insulated Precast Average \$/sf	Tilt-up Average \$/sf	IMP Average \$/sf	Kingspan QuadCore® Average (A, B & C) \$/SF
Midwest	Columbus	\$32.31	\$31.39	\$25.16	\$24.76
	Chicago	\$40.06	\$39.51	\$32.48	\$31.99
	St. Louis	\$33.14	\$32.69	\$27.54	\$27.09
Northeast	Philadelphia	\$40.42	\$39.66	\$31.61	\$29.84
	Boston	\$42.63	\$42.05	\$34.46	\$33.14
	Richmond	\$32.88	\$31.95	\$24.98	\$24.56
South	Nashville	\$32.43	\$31.51	\$24.37	\$22.07
	Atlanta	\$30.84	\$29.97	\$23.32	\$22.11
	Orlando	\$32.47	\$31.56	\$23.28	\$21.79
	Dallas	\$30.77	\$29.90	\$23.25	\$21.91
West Coast	Denver	\$31.11	\$31.17	\$24.22	\$22.75
	Los Angeles	\$35.70	\$35.21	\$28.80	\$27.30
	San Francisco	\$40.71	\$40.15	\$32.98	\$32.28
	Seattle	\$39.35	\$38.81	\$31.55	\$28.55
Canada	Vancouver	\$36.90	\$36.39	\$29.65	\$27.26
	Calgary	\$35.78	\$35.29	\$28.68	\$25.91
	Toronto	\$36.87	\$36.37	\$29.55	\$26.64
	Montreal	\$36.92	\$36.41	\$29.60	\$26.79

Table 4. Average installed cost summary by wall type for each city.

Appendix

Kingspan QuadCore® Cost Estimate: Philadelphia

This table details the breakdown of the installed cost estimation for Kingspan QuadCore® IMPs in Philadelphia. The average of the three configurations was taken to form the average installed cost for this city.

This estimate was applied to each city with modifications in labor rates adjusted to reflect current trade rates in each city as well as adjustments in Kingspan material costs to reflect variations in product thickness per location.

IMP Configuration	Component	Quantity	Unit
A	Vertical IMP on horizontal sub-girts and vertical metal studs	50,000	sf
	Metal stud wall framing (assume 14 ga. 6" studs, 12" O.C.)	2,000	lf
	Subgirts (assume 2' O.C.)	27,000	lf
	IMP, including trim, accessories and shipping	50,000	sf
	Steel columns (assume W12 x 79, 30' O.C.)	67	ton
B	Horizontal IMP on vertical metal stud framing	50,000	sf
	Metal stud wall framing (assume 14 ga. 6" studs, 12" O.C.)	2,000	lf
	Sheathing, DensGlass or similar (optional)	50,000	sf
	IMP, including trim, accessories and shipping	50,000	sf
	Steel columns (assume W12 x 79, 30' O.C.)	67	ton
C	Vertical IMP on horizontal Z girts	50,000	sf
	Z girts (assume 3" x 4" x 3", 4' O.C.)	14,500	lf
	IMP, including trim, accessories and shipping	50,000	sf
	Steel columns (assume W12 x 79, 30' O.C.)	67	ton
	Total Direct Cost		

Table 5. Detailed installed cost estimate for Kingspan QuadCore® IMPs for Philadelphia.

Materials outside of IMPs were not adjusted as, per Currie & Brown location data, they do not vary across the United States and Canada.

All quantities assume a 25' wall height.

Material Cost per Unit	Equipment Cost per Unit	Labor Hours per Unit	Labor Rate	Labor Cost per Unit	Unit Cost	Total Cost
\$55.68		0.662	\$102.39	\$67.78	\$123.46	\$246,922
\$1.75	\$0.85	0.155	\$90.17	\$13.98	\$15.73	\$424,603
\$7.40		0.089	\$90.43	\$8.05	\$15.45	\$772,405
\$3,500.00	\$300.00	10.5	\$90.17	\$946.76	\$4,446.76	\$297,933
						\$1,741.863
					\$/sf	\$34.84
\$55.68		0.662	\$102.39	\$67.78	\$123.46	\$246,922
\$0.87		0.008	\$90.43	\$0.72	\$1.59	\$79,671
\$7.40		0.089	\$90.43	\$8.03	\$15.43	\$771,509
\$3,500.00	\$300.00	10.5	\$90.17	\$946.76	\$4,446.76	\$297,933
						\$1,396.035
					\$/sf	\$27.92
\$2.25	\$1.40	0.18	\$90.17	\$16.23	\$18.48	\$267,963
\$7.40		0.089	\$90.43	\$8.05	\$15.45	\$772,405
\$3,500.00	\$300.00	10.5	\$90.17	\$946.76	\$4,446.76	\$297,933
						\$1,338.301
					\$/sf	\$26.77

Appendix

Applied Total Cost Savings Summary

Region	City	Total Costs			Savings with Kingspan QuadCore® IMPs	
		Insulated Precast	Tilt-up	Kingspan QuadCore® IMP	vs. Insulated Precast	vs. Tilt-up
Midwest	Columbus	\$1,615,287	\$1,569,730	\$1,237,953	\$377,334	\$331,777
	Chicago	\$2,002,873	\$1,975,504	\$1,599,467	\$403,405	\$376,036
	St. Louis	\$1,656,918	\$1,634,276	\$1,354,336	\$302,582	\$279,941
Northeast	Philadelphia	\$2,020,776	\$1,982,941	\$1,491,979	\$528,797	\$490,962
	Boston	\$2,131,499	\$2,102,373	\$1,657,049	\$474,450	\$445,323
	Richmond	\$1,643,797	\$1,597,436	\$1,227,793	\$416,005	\$369,643
South	Nashville	\$1,621,420	\$1,575,690	\$1,103,577	\$517,843	\$472,113
	Atlanta	\$1,542,023	\$1,498,533	\$1,105,333	\$436,690	\$393,200
	Orlando	\$1,623,575	\$1,577,784	\$1,089,253	\$534,322	\$488,531
	Dallas	\$1,538,543	\$1,495,150	\$1,095,340	\$443,202	\$399,810
West Coast	Denver	\$1,555,574	\$1,558,455	\$1,137,711	\$417,863	\$420,743
	Los Angeles	\$1,785,078	\$1,760,685	\$1,365,038	\$420,039	\$395,647
	San Francisco	\$2,035,340	\$2,007,527	\$1,613,995	\$421,344	\$393,532
	Seattle	\$1,967,609	\$1,940,722	\$1,427,285	\$540,324	\$513,437
Canada	Vancouver	CAD \$2,287,659	CAD \$2,256,398	CAD \$1,690,057	CAD \$597,601	CAD \$566,341
	Calgary	CAD \$2,218,120	CAD \$2,187,810	CAD \$1,606,540	CAD \$611,580	CAD \$581,270
	Toronto	CAD \$2,285,925	CAD \$2,254,688	CAD \$1,651,381	CAD \$634,544	CAD \$603,307
	Montreal	CAD \$2,289,007	CAD \$2,257,728	CAD \$1,661,056	CAD \$627,951	CAD \$596,672

Table 6. Applied total cost savings for Kingspan QuadCore® IMPs compared to concrete wall systems for each city based on 50,000 sf of installed product.

References

- 1 Architecture 2030, <https://architecture2030.org/new-buildings-embodied/>, accessed on May 21, 2020.
- 2 Kingspan Insulated Panels, "Reducing the Embodied Carbon of Walls in Industrial Buildings: A comparison of differing wall systems and their impact on embodied carbon." October, 2020.

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