ICEAA Cost Challenge Submission 2025

Estimate the cost of relocating the Olympics on an accelerated timeline

The Boeing Company

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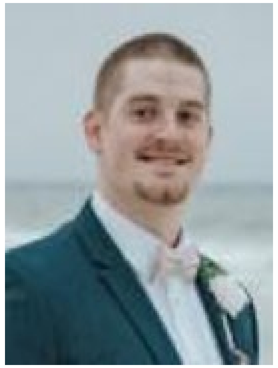
Team Composition



Henry Herzberg

Estimating & Pricing Specialist

Henry has an MBA from the University of Missouri - St. Louis & a B.S. in Psychology from Southern Illinois University – Edwardsville. He joined Boeing in Summer of 2023 and has worked in both Labor & Material estimating since, focusing on Truth in Negotiations Act compliant proposals.

Henry Glenn

Estimating & Pricing Specialist

Henry has a B.A. in Economics from the University of California, Irvine. He joined Boeing in 2023 and supports proposal development for Phantom Works Space, Intelligence and Weapon Systems

Max Manalo

Estimating & Pricing Specialist

Max has a B.A. in Supply Chain Management from the University of Washington and an MBA from Eastern Washington University with a concentration in Finance. He joined Boeing in 2022, supporting BCA Supply Chain Contracts. He currently supports BCA Strategy and Decision projects.

Jacqueline Phillips

Estimating & Pricing Specialist

Jacqueline has a B.S in Business Administration with a major in Finance from the University of Alabama. She joined Boeing in June 2020 after graduation and was selected for a business rotation program. She currently supports Government proposal activities as well as parametric data-driven projects.

- **Donald Law – Mentor**
  - Cost Estimator & Applied Mathematician

Purpose and Scope

Purpose

- The purpose of this challenge (*as interpreted by our Boeing team*) is to provide ICEAA with the costing requirements needed to relocate the Summer Olympics to Atlanta from host city Los Angeles and shift the Games from Summer 2028 to Summer 2027.

Scope

- The ICEAA 2025 Workshop Chair provided guidelines for relocating and accelerating the Olympics on April 15, 2024.
- With no other requirements defined or provided, our team made assumptions and ground rules regarding the estimate pertaining to the Olympics which are captured in our Ground Rules and Assumptions.

What is the cost of relocating the Summer Olympics and moving it one year earlier?

Ground Rules and Assumptions

GR&A Topic	GR&A Information
Ceteris Paribus	Assumed that there will be no unforeseen external influences such as pandemics, global crises, or other significant disruptions that could impact the timeline of the project
Olympics Definition	Defined the Olympics to include all the events planned for the 2028 Los Angeles Olympic and Paralympic games. It's assumed costs for moving the games start incurring immediately and would conclude when the closing ceremony is over.
Cost Scope	The cost of relocating and hosting the Olympics in Atlanta and the surrounding area
ATP: June 2025	Authorization To Proceed (ATP) for Project will be June 2025 after receiving ICEAA approval on May 16, 2024 Assumed the associated activities of moving the Olympics will all begin concurrently
Sunk Cost	This estimate will not include any costs associated with the LA current or ongoing planning for the 2028 Summer Olympics
Cost to Relocate & Expediate	Per the ICEAA challenge prompt pricing is exclusively focused on the cost/expenditures thus Revenue was excluded
Current Year and Currency (CY$2024)	All estimates are in USD CY2024
Georgia Pricing	Assumed salary wages, renting spaces locations based off Georgia for estimating purposes
Accurate Bid	Olympics bids cover the minimum cost to host the Olympics. Our estimate will focus on predicting accurate final costs.

Estimating Process Overview
(Planning)

WBS Development

- Developed a WBS Structure by researching recent bids to Summer Olympics
- Utilized Ai, ChatGPT, to identify major cost drivers
- Cost categorized by element of cost

Baseline Development

- Developed GR&As to define the estimate
- Researched the current spending trends of past Olympics and existing infrastructure in Atlanta
- Validated strategy approach and WBS elements with previous LA Bid for 2024 Olympics

Data Collection and Analysis

- Leveraged relevant data
- Validated credible data sources and cites
- Implemented relevant data visualization
- Referenced CEBoK Unit II – Cost Analysis Techniques

Methodology

- Developed hybrid approach between similar-to and bottoms-up
- Bottoms-up approach included data-driven detailed task buildup and level of effort framework
- Derived compression adjustment factor for sped up timeline

Model Development and Validation

- Identified variable inputs that drove the estimate costs for each line item
- Compiled unique WBS elements into a unified model, accounting for uncertainty in the model by making reasonable assumptions to create low, point, and high estimates

Results and Report Generation

- Used Monte Carlo simulation to determine probability of different scenarios based on inputs outlined in the model
- Used Sensitivity Analysis to identify high risk factors and validate assumptions
- Document results

Work Breakdown Structure (WBS)

WBS	WBS Description
1	***Venue Infrastructure***
1.1	Capital Investment
1.2	Temporary-Demountable Infrastrcture
1.3	Temporary Infrastructure
1.4	Energy (Excluding consumption)
2	***Sport, Games Services & Operations***
2.1	Accomodation
2.2	Food and Beverage
2.3	Medical Services (including Anti-Doping)
2.4	Logistics
2.5	Sports
2.6	Transport
2.7	Events Services
2.8	Venue Operations Management
2.9	Villages Operations
2.10	Test Events
2.11	Other Games Services & Operations Expenses
3	***Technology***
3.1	Information Technology
3.2	Telecoms
3.3	Internet Infrastructure
4	***People Management***
5	***Ceremonies & Culture***
5.1	Opening & Closing Ceremonies
5.2	Torch Relay
6	***Communications, Marketing and Look***
6.1	Communication, Community Relations & PR
6.2	Look of the Games
6.3	Marketing and Commerical Programme
7	***Corporate Administration and Legacy***
7.1	Administration and Governance
7.2	Environment, Sustainability and Legacy
8	***Other Expenses***
8.1	Marketing Rights & Royalties
8.2	Athlete & Innovation
9	***Contingency***

Our team used the Los Angeles 2024 Bid to help develop our WBS

Venue Infrastructure
- Captures upgrades and temporary infrastructure required to host games

Sport, Games Services and Operations
- Services and management necessary to support game operations

Technology
- Information technology, internet infrastructure, and telecoms for communications and broadcasting

People Management
- Includes staffing of direct employees and other various HR costs

Ceremonies and Culture
- Provision for opening and closing ceremonies, the torch relay, education and culture

Communications, Marketing and Look
- Look of the games, marketing and commercial expenses

Corporate Administration and Legacy
- Expenses for administration, governing bodies and sustainability initiatives

Other Expenses
- Marketing rights and royalties, athlete and innovation

Contingency
- Contingency for cost growth (over-run)

WBS Specific Ground Rules and Assumptions

WBS Element	Assumption	Justification
Security Costs	Excluded estimate as it is classified as NSSE. Security and safety-related costs required by Olympic Committee distributed in relevant functions.	Security will be classified as a National Special Security Event (NSSE) where the US Secret Service (USSS) becomes lead agency by statute, for the planning, implementation and coordination of operational security for the games. The Federal Bureau of Investigation is responsible (FBI) is responsible for counter terrorism activities. The LA Games received confirmation of the games as a NSSE in LA2024 Bid via guarantee.
Technology	Similar-to LA Bid	80% of the Technology budget comes from the International Olympic Committee (IOC) and TOP sponsorship contributions as determined by IOC thus data-driven factors were only applied to 20% of the cost
Transport Operations	9.5 million Summer Olympic Attendees	Cost driver based on tickets sold in Paris 2024 Olympics. Atlanta in 1996 broke the record for tickets sold. 1996 tickets sold, and tickets offered used as upper and lower bounds.
Torch Relay	~11,500 miles distance	Los Angeles 1984 course was ~9300 miles while Atlanta 1996 was ~16,000. Point estimate based off last three Olympic Torch Relays.
Technology/Marketing Rights & Royalties	Unaffected by time compression factor	With Contingency costs being considered, we deemed these costs to be unaffected by the expedited games schedule combined with these cost elements being largely dependent on IOC contributions
Test Events	36 Test Events needed for the Atlanta 2027 Games	Number of Test Events has varied widely by host country: Tokyo used as little as 18 while Beijing and Rio used 45. Point estimate is the number of Sports planned for 2028 Games.
Staffing Levels	Analogous to 2024 Paris staffing figures	Based on recency and number of sports involved in each games.
Infrastructure	No new venues need to be constructed	Atlanta has hosted Olympic Games previously and continues to maintain and upgrade existing event facilities.
Infrastructure	Any regulatory impediments would be waived/expedited to ensure the Olympics will take place	The Olympic Games are a crucial event that unite the world. Regulatory agencies will unite in the common goal of ensuring the success of the 2027 Olympic Games in Atlanta

Work Breakdown Structure (WBS)

WBS	WBS Description	Methodology	Basis of Estimate/Data-Driven Factors
1	Venue Infrastructure	Similar-To	ATL/GA: BEA Regional Price Parities, utilities adj.
2	Sport, Games Services & Operations	Similar-To, Historical Costs	ATL/GA: cost of living adj., cost per athlete/attendee
3	Technology	Similar-To	ATL/GA: salary adj., business internet cost per mbps
4	People Management	Detail Task Build-up/Bottoms-up	Based on Paris Olympics historical staffing and adjusted for inflation
5	Ceremonies & Culture	Similar-To/Cost Estimating Relationship	ATL/GA: opening/closing ceremonies event capacity adj, cost per mile
6	Communications, Marketing and Look	Similar-To	Validated cost reasonableness
7	Corporate Administration and Legacy	Similar-To	ATL/GA: Insurance adj., Natural Disaster Index
8	Other Expenses	Similar-To/Cost Estimating Relationship	R&D Costs per Athlete, salary adj.
9	Contingency	Time Compression Diseconomies	See Slide 14

Basis of Estimate
How LA’s 2024 bid relates to an Olympics in Atlanta

- Los Angeles and Atlanta are among the 10 largest metropolitan areas in North America
- Both cities have hosted a modern Summer Olympic Games
- Both cities have steadily increased transit agency budgets over time, but are still largely car dependent
- Both cities have robust national sports industries; they are home to teams in each of the three largest American sports (football, baseball, basketball)
- Both cities have major, public universities that could assist with athlete housing and laboratories for anti-doping programs
- Both cities have reliable telecommunication structure supported by large telecommunication companies
- The LA bid is reliable because it was developed from a detailed statement of work by a leading architecture/engineering firm (AECOM) that has estimated and managed projects of similar scale
    - The LA bid was vetted based on prior Olympic actual costs by AECOM and third-party partners
- Independently assessed by KPMG LLP and determined estimates were reasonable
- Like Los Angeles, Atlanta has been investing in existing sporting infrastructure to host a major world sporting event. Atlanta is expected to host eight matches during the 2026 FIFA World Cup.

Venue Adequacy

- Atlanta's major venues have 80% of the Los Angeles' major venue capacity
- Atlanta also has areas for sports with unique infrastructure demands
- Ran power regression on past Olympic and population data to predict attendance from events and host city population. Resulted in ~7% less demand for ATL attendance.
- With shortened timeline and change in location and current travel climate that 80% capacity is sufficient for existing venue

Los Angeles' Major Venues		Atlanta's Major Venues	
Rose Bowl	92,000	Mercedes Benz Stadium	75,000
Memorial Coliseum	70,000	Hyundai Field	51,913
Dignity Health Sports Park	27,000	Center Parc Stadium	24,000
Crypto.com Arena	18,000	State Farm Arena	17,600
Honda Center	18,000	Gas South Arena	13,100

Mapped Los Angeles venues to comparable venues in Atlanta

Data Sources and Approach for Gathering Data

Data Source	Data Source Information
Occupational Employment Wage and Statistics (OEWS)	Average Labor data from U.S. Department of Labor's Bureau of Labor Statistics / Occupational Employment Growth Projections
US Energy Information Administration (EIA)	Historical Energy Data on Consumption by type of Fuel and Electricity Costs
Massachusetts Institute of Technology Living Wage Calculator (LWC)	LWC estimates the local wage rate that a full-time worker requires to cover the costs of basic needs by county, metro area, or state for different individual living situations.
Consumer Price Index Data (CPI)	Average CPI data from the U.S. Department of Labor's Bureau of Labor Statistics (BLS) by county
Producer Price Index (PPI)	Average PPI data for specific equipment from Federal Reserve Economic Data (FRED) by county
The Centennial Olympic Games	The Official Planning Report of the 1996 Olympics in Atlanta
International Olympic Committee (IOC)	Reports and resources related to the Olympic Games, including financial reports and guidelines for organizing committees
U.S. Government Accountability Office (GAO)	Historical Costs to Plan and Stage the Olympic Games in the United States. Independent, government agency that provides auditing, evaluative, and investigative services for the US Congress.

- Validated all sources were credible. Relied heavily on Government agency sites, well-known organizations, and educational institutions for data and information. On available data, cross-checked the accuracy and relevant timeliness.
- Our team utilized Artificial Intelligence ChatGPT as a resource to familiarize ourselves with Olympic Games topics, access information sources, help generate ideas and validate WBS cost elements.

All sources cited in Backup slides

Approach for Data Preparation

Planning and Research:

- Accessed multiple economic databases and Olympic case studies
- Gathered data on last Olympics in Atlanta and previous Summer Games, included information such as attendance, events, cost overrun, historical expedited games and cost
- Focused data collection on driving factors of moving the games geographically

Clean and Consolidate:

- Cleaned the collected data to remove inconsistencies, errors, or missing values
- Cross checked data with alternative sources
- Standardized the format of the data to ensure consistency across different variables

Normalize:

- Inflation was calculated and used to normalize all historical cost data to CY$2024

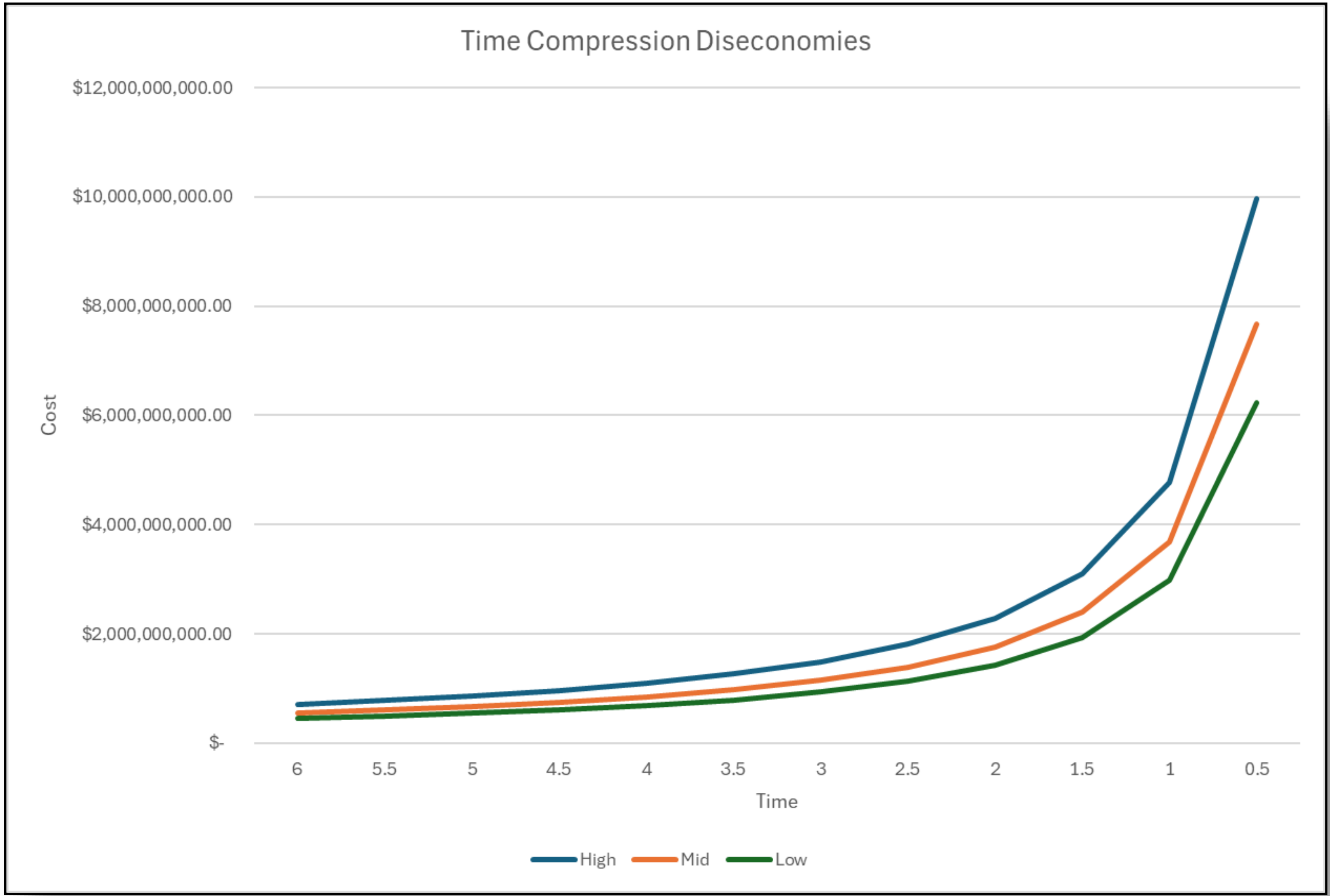
Time Compression

Methodology:

- Principle that costs increase exponentially as time of a project is compressed
- $C_T = C_O * (T/O)^X$
  - C = Cost
  - T = compressed time
  - O = original time
  - X = Unknown exponent

Data:

- Based on Denver to Innsbruk Olympics move, 1976
  - Final estimate at Denver Cancelation = $77,000,000
  - Final cost of Innsbruk = $118,400,000
  - Original time = 6 years
  - Compressed Time = 4 years
  - X = -1.06115986799397



Contingency

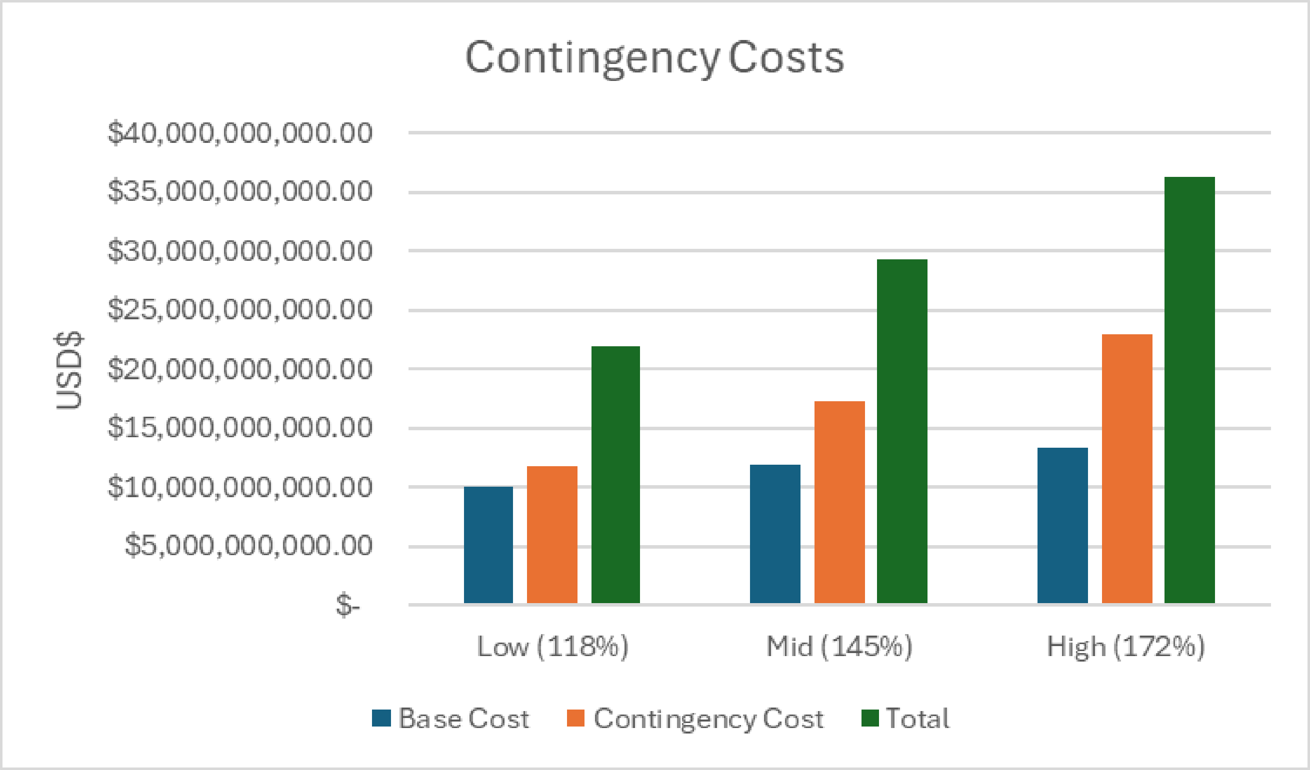
City	Overrun
Grenoble	181%
Montreal	720%
Lake Placid	324%
Sarajevo	118%
Calgary	65%
Barcelona	266%
Albertville	137%
Lillehammer	277%
Atlanta	151%
Nagano	56%
Sydney	90%
Salt Lake City	24%
Athens	49%
Torino	80%
Beijing	2%
Vancouver	13%
London	67%
Sochi	289%
Rio	352%
Median	**118%**
Ave.	**172%**

Data:

- Data sourced from academic analysis of historic cost overruns by Bent Flyvbjerg
- Midpoint factor based on average of the two measures of central tendency (Median, Average).

Explanation:

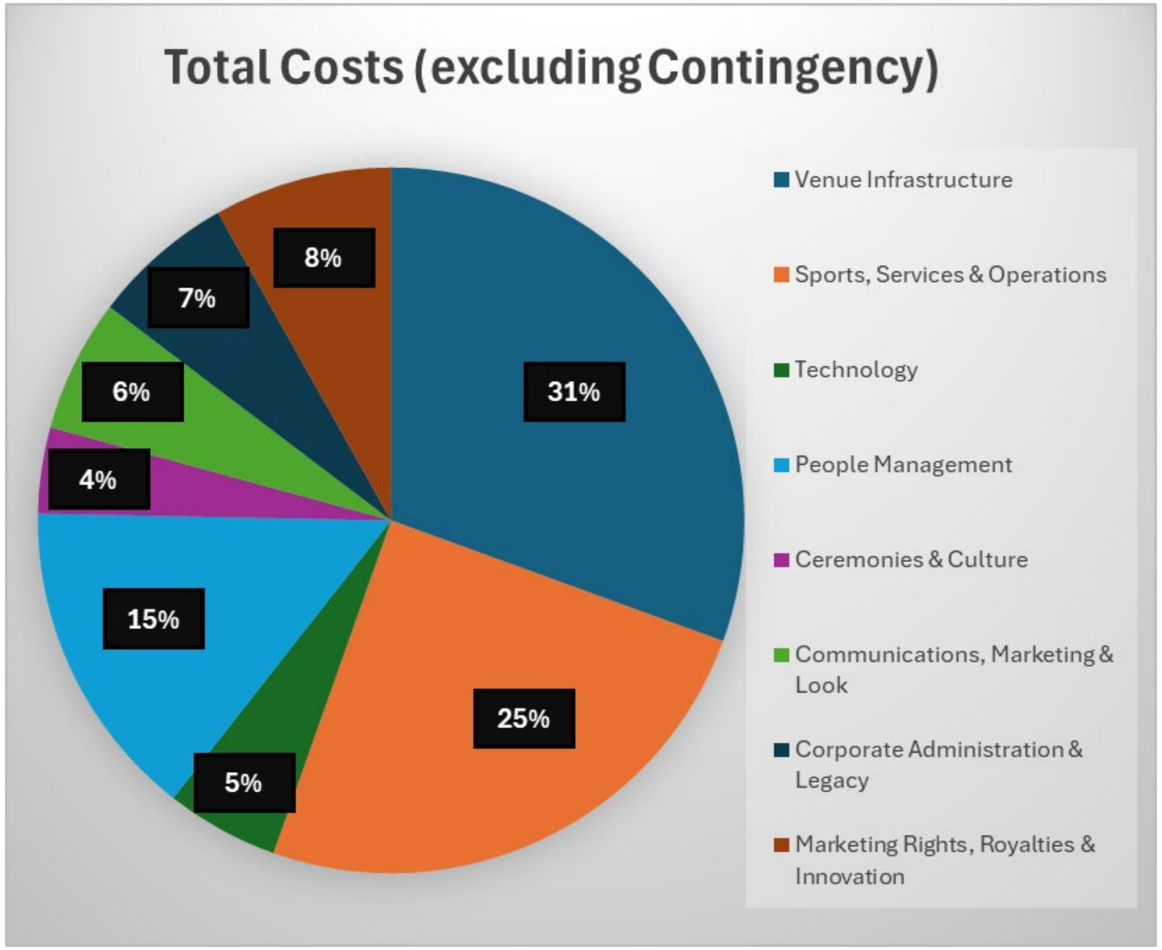
- No Olympic games has ever been on or below budget



WBS Detail of Point Cost

WBS	WBS Description	ATL 2024 ($M USD)
	Total Cost to Relocate	**$29,274.42**
1	*Venue Infrastructure*	*$3,651.4*
1.1	Capital Investment	$247.5
1.2	Temporary-Demountable Infrastrcture	$1,498.5
1.3	Temporary Infrastructure	$1,462.2
1.4	Energy (Excluding consumption)	$443.1
2	*Sport, Games Services & Operations*	*$2,969.4*
2.1	Accomodation	$82.6
2.2	Food and Beverage	$245.2
2.3	Medical Services (including Anti-Doping)	$131.7
2.4	Logistics	$181.9
2.5	Sports	$281.6
2.6	Transport	$727.4
2.7	Events Services	$148.5
2.8	Venue Operations Management	$831.1
2.9	Villages Operations	$137.9
2.9.1	Olympic/Paralympic Village Operations	$107.9
2.9.2	Media Village(s) Operations	$22.6
2.9.3	Other Village(s) Operations	$7.4
2.10	Test Events	$102.7
2.11	Other Games Services & Operations Expenses	$98.7
3	*Technology*	*$617.2*
3.1	Information Technology	$283.6
3.2	Telecoms	$161.0
3.3	Internet Infrastructure	$172.6
4	*People Management*	*$1,760.8*
5	*Ceremonies & Culture*	*$470.6*
5.1	Opening & Closing Ceremonies	$386.6
5.2	Torch Relay	$84.0
6	*Communications, Marketing and Look*	*$727.1*
6.1	Communication, Community Relations & PR	$181.7
6.2	Look of the Games	$211.9
6.3	Marketing and Commerical Programme	$333.5
7	*Corporate Administration and Legacy*	*$778.6*
7.1	Administration and Governance	$711.4
7.2	Environment, Sustainability and Legacy	$67.3
8	*Other Expenses*	*$973.7*
8.1	Marketing Rights & Royalties	$826.6
8.2	Athlete & Innovation	$147.1
9	*Contingency*	*$17,325.7*

Point Cost Estimate

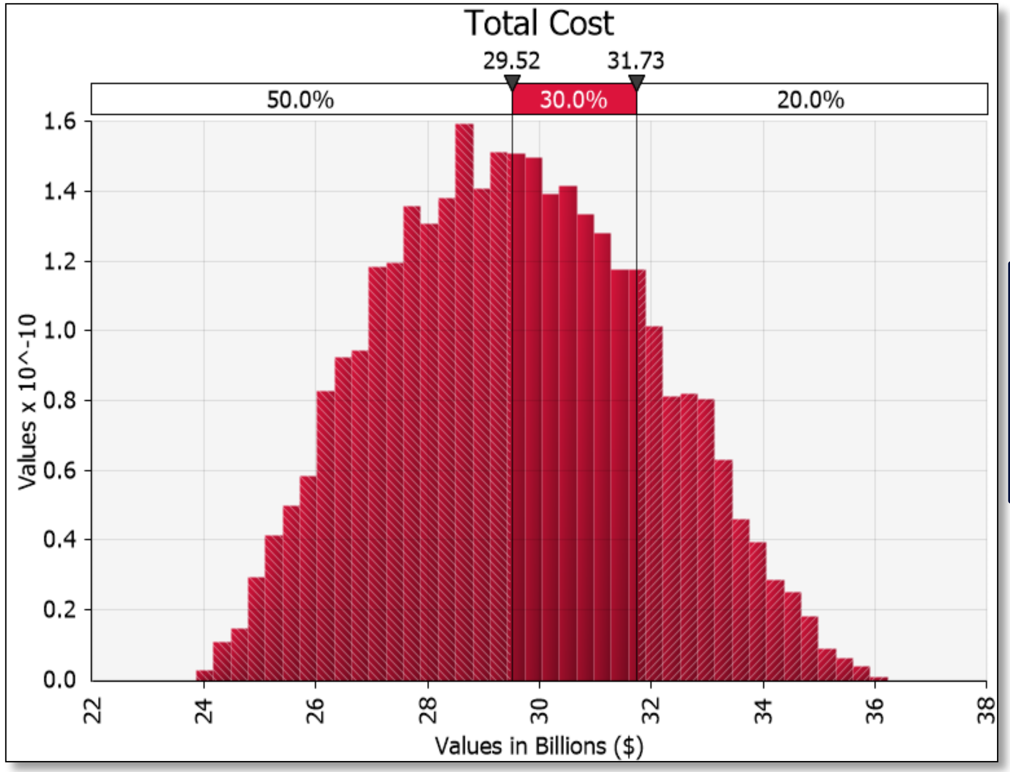


WBS	WBS Description	Total Cost ($M)
1	Venue Infrastructure	$3,651.4
2	Sports, Games Services & Operations	$2,969.4
3	Technology	$617.2
4	People Management	$1,760.8
5	Ceremonies & Culture	$470.6
6	Communications, Marketing & Look	$727.1
7	Corporate Administration & Legacy	$778.6
8	Marketing Rights, Royalties & Innovation	$973.7
9	Contingency	$17,325.7
Total Cost		**$29,274.4**

High risk driven by significance of facility and transportation preparation

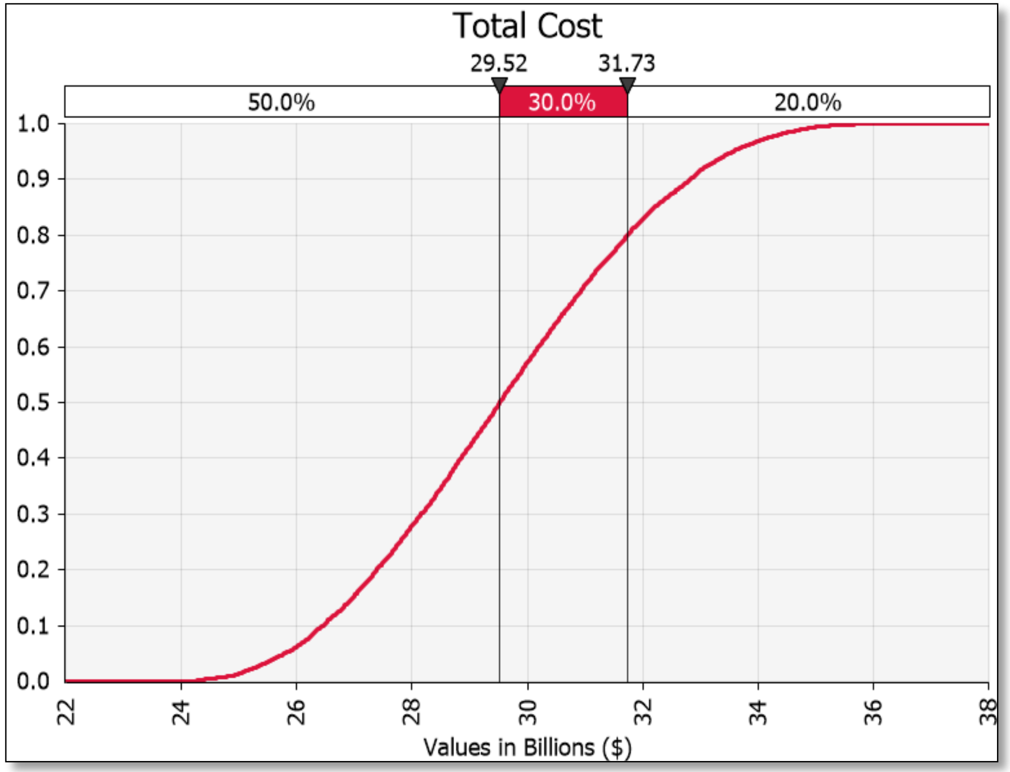
Monte Carlo Simulation

Distribution



There is a ~7% increase between the 50th and 80th percentiles, reflecting a range of cost possibilities

S-Curve

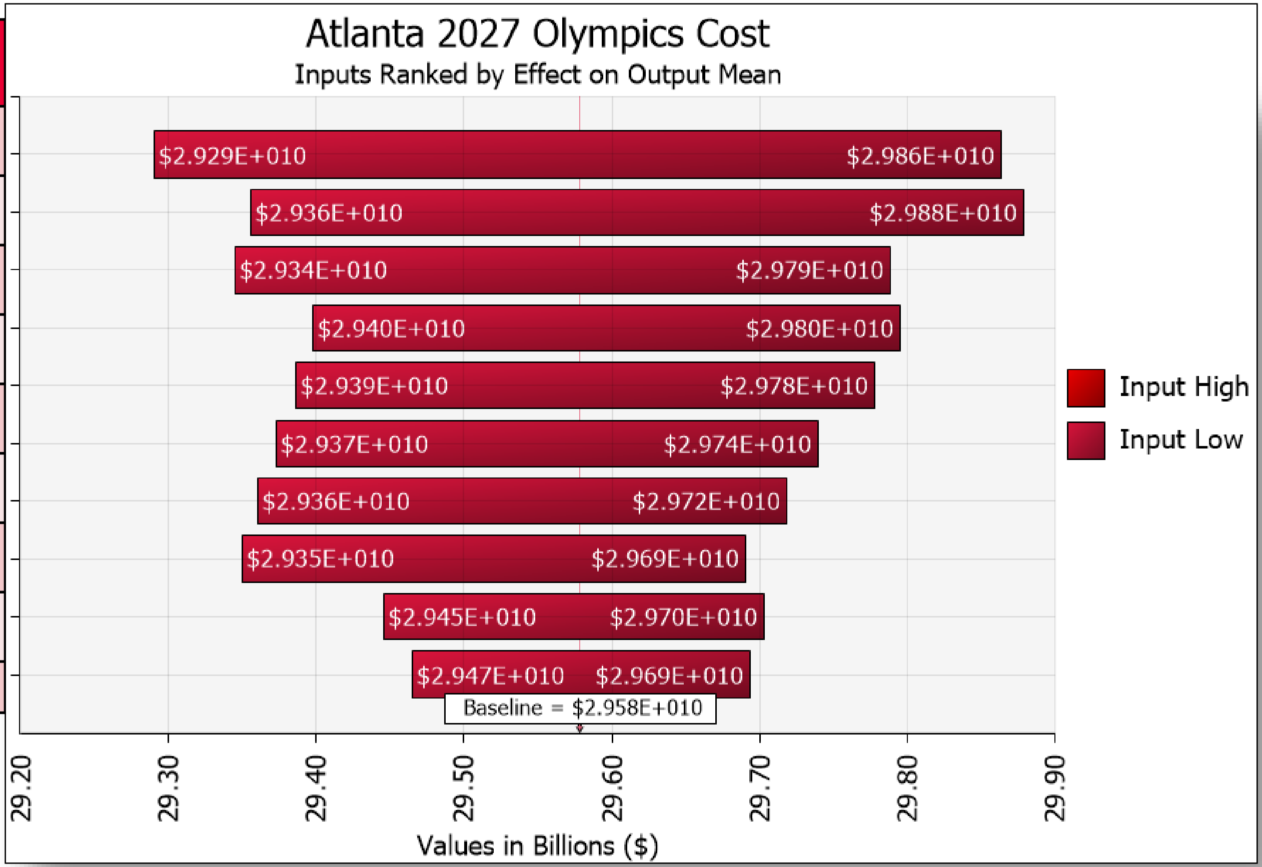


50th Percentile Confidence: $29.52B ***80th Percentile Confidence: $31.73B***

Sensitivity Analysis

Tornado Chart

Drivers of Variance
HR Staffing
Venue Operations Management
Transport Operations
Energy
Internet Infrastructure
Media Village(s) Operations
Temporary Infrastructure
Temporary/Demountable Infrastructure
IT Costs



Notable drivers of variance: Labor rates, Attendance, Accommodation availability, Utilities

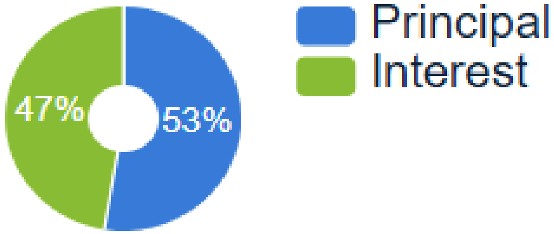
Economic and Social Trend Analysis

Atlanta Metro

- Population: 6,272,000
- Net Income CY24: $0.609 B
- Reserves: $9.812 B

Loan Amount (High): $25.809B

Payment Every 6 Months	**$0.82**
Total of 60 Payments	**$49.07**
Total Interest	**$23.27**

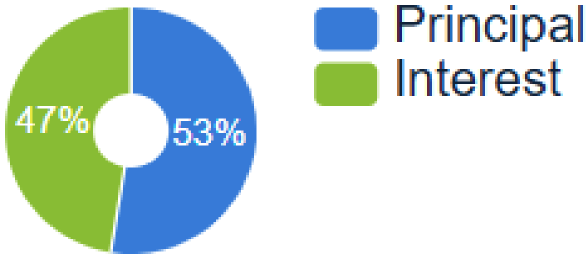


Effects

- Pros
  - Tourism/Publicity
  - Job Boom
- Cons
  - Debt per Citizen: $2,141 - $4,114
  - Less returns than '96 games

Loan Amount (Low): $13.429B

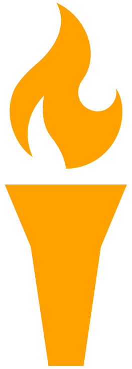
Payment Every 6 Months	**$0.43**
Total of 60 Payments	**$25.54**
Total Interest	**$12.11**



Lessons Learned

Key Takeaways

- Usually, our estimating has rigid parameters. It was a valuable learning opportunity to set our own ground rules and parameters in our estimate.
- The problem space invited creativity in looking at different analysis techniques.
- Our team is grateful for the chance to delve into the complexities and understand the real-world implications of the planning the Olympics.



The Olympics impacts billions globally!

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