Optimization Strategies for the Oakland Athletics Baseball Club

Executive Summary

This report was modeled for the benefit of the Oakland Athletics (A's) Baseball Club. They are a low-budget organization and are struggling to stay afloat in today's professional baseball status. They rank at the bottom of the league in terms of revenue, ticket sales, attendance, and payroll (for players, coaches, and employee payroll). They are in dire need of saving every possible dollar that they can in their overall operations costs, this enables them to maximize the product the put on the field for 162 games a year. They want to cut costs at every possible outlet they can, whether it be in food waste reduction, staffing employees, or not signing the hottest free agent available to help the team's on-field success.

As these struggling economic times continue, there is a bright light shining through the tunnel of the future. With the A's playing in one of the oldest baseball stadiums left in the world (let alone among Major League Baseball franchises) they are due for a much needed, and timely, upgrade. By building a new stadium in Oakland, the A's will be able to provide a better fan experience with a new ballpark, which in turn will maximize their team revenue. With an increase of revenue comes more money that the team will be able to spend on keeping its current players and adding new players through free agency. A better team leads to higher attendance, and higher attendance equals more sales at the ticket windows, concession stands, shops, and memorabilia.

This report will show two models, which will focus on the team's immediate issues of needing to cut costs for employee staffing and building a new stadium in Oakland. Our group has provided the team with two ways of optimizing these high-need issues, in turn giving the team a wonderful foundation for both now and in the future.

Firstly, we focused on optimization of the staff scheduling for multiple ticket windows to provide the lowest possible costs to Oakland Athletics and to keep the customers moving through the line. We proposed 3 different integer linear programming models for the non-game days and game days that the game starts at 1pm and 7pm with the effective combination of the Oakland A full-time, Oakland A part-time and StaffPro employees. One-way sensitivity analyses are run on the model to assess the impact of a change in employee requirement constraints on daily costs. The results demonstrated that on non-game days, even the Oakland A's part-time employees have the most competitive hourly rates, StaffPro employees dominate the schedule due to their flexible work hours and shorter shifts. However, on game days, since Oakland A's needs employees to work at least 3.5 hours around game time, instead of StaffPro employees', part-time employees' lower rate and flexibility are taken advantage.

From the provided background regarding the Oakland A's Baseball Stadium relocation project, we have successfully created a decision tree that allows us to identify the best decision while taking into consideration factors such as proposal cost & probability, total development cost that includes both stadium and surrounding mixed use development and probability of Raiders leaving the Bay Area together with respective projected 5-year profits for each location. Based on the analysis, we can make an informed decision that Oakland A's management proceed with applying for Jack London Square Proposal since this has the highest EMV at 478,087,500. This EMV is true for the current proposal approval probabilities of 60% & 70% for Howard Terminal & Jack London Square respectively. Moreover, we have identified that if the probability of Jack London Proposal Approval is greater than 30%, the decision to proceed with Jack London remains the same. Also, Oakland A's management can expect that all decisions have a positive 5-year revenue projection which should provide some confidence that all

scenarios have good opportunity. Lastly, we have identified that the most likely consequent scenario to occur after proceeding with the identified decision is that Jack London Square proposal is approved & Raiders leave the Bay Area; this scenario has a 49% chance of occurring with an expected 5-year revenue of $642,500,000.

Introduction

The Oakland A's are at a crossroads in their organizational timeframe. They are a low-budget organization and are struggling to stay afloat in today's professional baseball status. They rank at the bottom of the league in terms of revenue, ticket sales, attendance, and payroll (for players, coaches, and employee payroll). With these struggling times, they now face the decision of how many employees to schedule each game.

The first issue they would like to combat is in terms of staffing. The Oakland Coliseum is the only sports complex left in the United States that is home to both a professional baseball (MLB) team, the Oakland Athletics, and professional football (NFL) team, the Oakland Raiders. The Oakland Coliseum has multiple ticket windows which hold different numbers of employees for game day sales. Some of the windows are open during the season during non-game days as well. The Oakland Athletics (A's) would like to find a way to cut costs, while keeping as many employees working the ticket sales windows to keep the customers moving through the line and not keeping them waiting.

Along with their need to optimize their employee scheduling situation, the Oakland A's need to begin building their new stadium. The Oakland Coliseum is the only sports complex left in the United States that is home to both a professional baseball (MLB) team, the Oakland Athletics, and professional football (NFL) team, the Oakland Raiders. The Coliseum was built in1965, which is very old when considering the lifespan of the average pro sports stadiums, which is roughly 35 years. With the Coliseum nearing the end of its lifespan and fans unhappy with the current situation, they need to get a plan in place soon to raise optimism for their die-hard fans.

The city of Oakland is at a crossroads, with two other professional sports franchises

nearing a departure within the next two years. The Golden State Warriors (Oakland's professional basketball team) are leaving the Oracle Arena and building a new arena in the Mission Bay neighborhood of San Francisco. The Oracle Arena is located on the same site as the Oakland Coliseum, both stadiums have easy access to the Coliseum BART site. The Oakland Raiders (Oakland's professional football team) are in negotiations with the National Football League in regards to relocating the team to Las Vegas, Nevada. If the Oakland Raiders leave then the A's will be the last team in Oakland, it would be devastating to the city if all three of its pro sports teams leave.

The commissioner of Major League Baseball has mentioned the importance of keeping the A's in Oakland, which is promising news to the city and A's fans everywhere. The new revenue that a new stadium would bring would be a major benefit for the Oakland A's franchise in the future. Time is of the essence in this decision, the attendance at the Coliseum is very low, leaving the A's with a very low revenue stream. A new stadium will lead to higher attendance of games, in turn providing a much higher revenue stream for the team to invest in the team and field a winning team for years to come.

Based on popular opinion from surveys and geographic analysis, the Oakland A's ownership group and staff has come up with a list of possible options for the team to build a new stadium. Each stadium has its own different appeal, which makes this decision very difficult. The A's hired a new president, David Kaval, in December 2016 to lead this stadium project. Per Elliott Almond of the San Jose Mercury News, "Kaval, who joined the Athletics in December to lead the stadium project, said his staff is examining four sites, including the current Coliseum location. The others: Howard Terminal, north of Jack London Square, Laney College near the Lake Merritt BART station and Brooklyn Basin along the water west of Interstate 880,"

(Almond, 2017).

In regards to the Coliseum site, “That’s the only site right now that we know is really viable,” Kaval said. “We have to keep that as an option. We could have a great ballpark with a village around it there too.” Kaval has promised to announce the location in 2017. Once he does, he said, “We’re going all in.” The A’s must base their choice to build a new stadium all the while considering the ownership of the team, the city of Oakland, the fans, and Major League Baseball. The A’s have narrow the possible options to these three choices:

- Howard Terminal
- Jack London Square
- Oakland Coliseum

Kaval, when speaking about picking the location “In this day and age, it is where development is,” he said. “Special interest and ‘NIMBY’ (Not In My Back Yard) groups can throw a wrench in everything. We’re trying to take all that collective intelligence how to get a stadium built and channel it for this new and special project.” The site analysis has led to a list of so-called pros and cons that continue to evolve. Some locations might need an additional BART station. The Howard Terminal development would require state approval because of the California Tidelands Trust doctrine. “We’re trying to get out ahead of it and understand how the location could be planned to make sure those concerns were dealt with initially,” Kaval said. “It might be a little different way to approach this project but it’s probably the only way to do it.” (Almond, 2017)

I. Oakland A's Labor Scheduling Optimization

The first issue they would like to combat is in terms of staffing. The Oakland Coliseum is the only sports complex left in the United States that is home to both a professional baseball (MLB) team, the Oakland Athletics, and professional football (NFL) team, the Oakland Raiders. The Oakland Coliseum has multiple ticket windows which hold different numbers of employees for game day sales. Some of the windows are open during the season during non-game days as well. To cut costs, the Oakland Athletics (A's) would like to find a way to cut costs, while keeping as many employees working the ticket sales windows to keep the customers moving through the line and not keeping them waiting. The different ticket windows are as follows:

- A Gate
- B Gate
- C Gate
- D Gate
- BART Ramp Gate
- Ticket Services
- Advanced Ticket Sales

The A's also must consider the staffing requirements that must be satisfied with their third-party staffing agency, StaffPro they signed a contract with back in 2003. StaffPro is a union based organization that provides professional sports organizations with employees in the areas of: ticket sales, concession sales, janitorial services, and security.

Each full-time Oakland A's employee makes $17.00 per hour. Each part-time Oakland A's employee makes $12.55 per hour (the minimum wage for Oakland, CA). Each StaffPro employee makes $16.00 per hour under the union wage requirement. Any employee, whether Oakland A's or StaffPro must take a 30-minute lunch break after working 5 hours. StaffPro employees cannot work more than 5 hours in any one day. Oakland A's full-time employees should work during the

day if the ticket windows are open less than 8 hours but they cannot work more than 8 hours. Oakland's A's part-time employers and StaffPro employees cannot work more than 5 hours in any one day. StaffPro employees must work a minimum of 3 hour shifts. Oakland A's employees must work a minimum of 4 hours for each shift. All employees start on the hour.

There are 162 regular season games played each year, 81 home games and 81 road games. The staffing requirements for each window during game days are as follows:

- A Gate (6 employees maximum): At least 2 Oakland A's employees 2 hours prior to the start of each game and 2 hours after the start of each game. At least 2 StaffPro employees working 1.5 hours prior to the start of the game and two hours after the start of each game.
- B Gate (6 employees maximum): At least 2 Oakland A's employees 2 hours prior to the start of each game and 2 hours after the start of each game. At least 2 StaffPro employees working 1.5 hours prior to the start of the game and two hours after the start of each game.
- C Gate (8 employees maximum): At least one Oakland A's employee working from 9am – 5pm. At least 2 Oakland A's employees 2 hours prior to the start of each game and 2 hours after the start of each game. At least 2 StaffPro employees working 1.5 hours prior to the start of the game and two hours after the start of each game.
- D Gate (8 employees maximum): At least one Oakland A's employee working from 9am – 5pm. At least 2 Oakland A's employees 2 hours prior to the start of each game and 2 hours after the start of each game. At least 2 StaffPro employees working 1.5 hours prior to the start of the game and two hours after the start of each game.
- BART Ramp Gate (3 employees maximum): Exactly 3 Oakland A's employees 2 hours prior to the start of each game and 2 hours after the start of each game.
- Ticket Services (5 employees maximum): At least 3 Oakland A's employees working each day from 9am – 5pm. Four employees working 2 hours prior to the start of each game until game ends (3.5 hours)
- Advanced Ticket Sales (2 employees Maximum): At least 1 Oakland A's employee

working 1 hour prior to the start of each game and 3.5 hours after the start of each game. The staffing requirements for each window during non-game days (road trips) are as follows:

- C Gate (2 employees maximum): At least 1 employee working 10am-4pm
- D Gate (2 employees maximum): At least 1 employee working 10am-4pm
- Ticket Services (5 employees maximum): At least 3 employees working 10am-4pm
- At least 1 full-time Oakland A's employee should work in the ticket services

Games can begin at any of the following times:

- 7:00 pm (PST)
- 1:00 pm (PST)

The Oakland A's would like to save as much money as they possibly can in terms of staffing, while still not sacrificing on the great customer service provided at the ticket windows.

Staff Scheduling for each window during non-game days (road trips)

Integer linear programming was employed to determine the effective combination of the Oakland A full-time, Oakland A part-time and StaffPro employees for the non-game days that would keep the customers moving through the line while providing the lowest possible cost to the Oakland Athletics.

Integer Programming Model for Non-Game Days

Regarding the constraints for 3 types of employees, there are 15 different possible types of shifts for the non-game days.

Decision Variables:

F10:	# of Full-time employees -start at 10:00 (5:30 hours)
P105:	# of Part-time employees -start at 10:00 (5 hours)
P115:	# of Part-time employees -start at 11:00 (5 hours)
P104:	# of Part-time employees -start at 10:00 (4 hours)

P114:	# of Part-time employees -start at 11:00 (4 hours)
P124:	# of Part-time employees -start at 12:00 (4 hours)
S105:	# of StaffPro employees -start at 10:00 (5 hours)
S115:	# of StaffPro employees -start at 11:00 (5 hours)
S104:	# of StaffPro employees -start at 10:00 (4 hours)
S114:	# of StaffPro employees -start at 11:00 (4 hours)
S124:	# of StaffPro employees -start at 12:00 (4 hours)
S103:	# of StaffPro employees -start at 10:00 (3 hours)
S113:	# of StaffPro employees -start at 11:00 (3 hours)
S123:	# of StaffPro employees -start at 12:00 (3 hours)
S013:	# of StaffPro –employees start at 01:00 (3 hours)

Table 3.1. Types of shifts – start time and duration

Objective of the scheduling is to minimize the daily cost of the employees while respecting all the constraints.

MINIMIZE

94*F10+62.75*(P105+P115)+50.20(P104+P114+P124)+80*(S105+S115)+64*(S104+S114+S124) +48*(S103+S113+S123+S013)

The **constraints** that must be satisfied are the following:

- Ca: At least 1 employee should work in Gate C between 10:00 to 4:00 pm
- Cb: At least 1 employee should work in Gate D between 10:00 to 4:00 pm
- Cc: At least 3 employees should work in the ticket services between 10:00 to 4:00 pm

For the sake of readability, we can combine these three constraints into one;

- **C1:** At least 5 employees should work in Gate C, D and ticket services between 10:00 to 4:00 pm.
- **C2:** At least 1 full time employee should work in the ticket services.
- **C3:** At least 1 of the employees in non-game days should be chosen from Oakland's A part-time employee.

- **C4:** number of employees start at various times should be equal or greater than zero (Non-negativity and integer)

Model Solution:

The model is solved using Excel Solver with Simplex Algorithm using integer constraints. As the optimal solution shown in Fig. 3.1 suggests that Oakland Athletics should schedule 1 full-time and 1 part-time Oakland A's employee and 8 StaffPro employees for the non-game days with total daily cost of $528.

Decision Variables		Value (hours)	Cost
# of Full-time employees -starts at 10:00 (5:30 hours)	F10	1	$94
# of Part-time employees -starts at 10:00 (5 hours)	P105	0	$62.75
# of Part-time employees -starts at 11:00 (5 hours)	P115	0	$62.75
# of Part-time employees -starts at 10:00 (4 hours)	P104	0	$50.20
# of Part-time employees -starts at 11:00 (4 hours)	P114	0	$50.20
# of Part-time employees -starts at 12:00 (4 hours)	P124	1	$50.20
# of StaffPro -starts at 10:00 (5 hours)	S105	0	$80.00
# of StaffPro -starts at 11:00 (5 hours)	S115	0	$80.00
# of StaffPro -starts at 10:00 (4 hours)	S104	0	$64.00
# of StaffPro -starts at 11:00 (4 hours)	S114	0	$64.00
# of StaffPro -starts at 12:00 (4 hours)	S124	0	$64.00
# of StaffPro -starts at 10:00 (3 hours)	S103	4	$48.00
# of StaffPro -starts at 11:00 (3 hours)	S113	0	$48.00
# of StaffPro -starts at 12:00 (3 hours)	S123	0	$48.00
# of StaffPro -starts at 01:00 (3 hours)	S013	4	$48.00
Objective to minimize daily cost ($)		528	

Fig. 3.1 Optimal Solver Solution

Since the optimal solution dominated by the working with StaffPro employees, sensitivity analysis involved examining how the cost changes as the number of required Oakland A's employees increases.

As shown in the Fig. 3.2, there is a drastic increase in the daily cost with the increase in the full-time Oakland A's employee requirement. Even there is a $1 difference in the hourly costs of these two employees, there is a $46 increase in the daily cost for the minimum number of full-time employees between 0 to 4 and for the range 5 to 8 this difference reaches up to $94. Even though hourly costs of full-time and StaffPro employees, flexible working hours and short shifts of the StaffPro staff gives a tremendous advantage to the company.

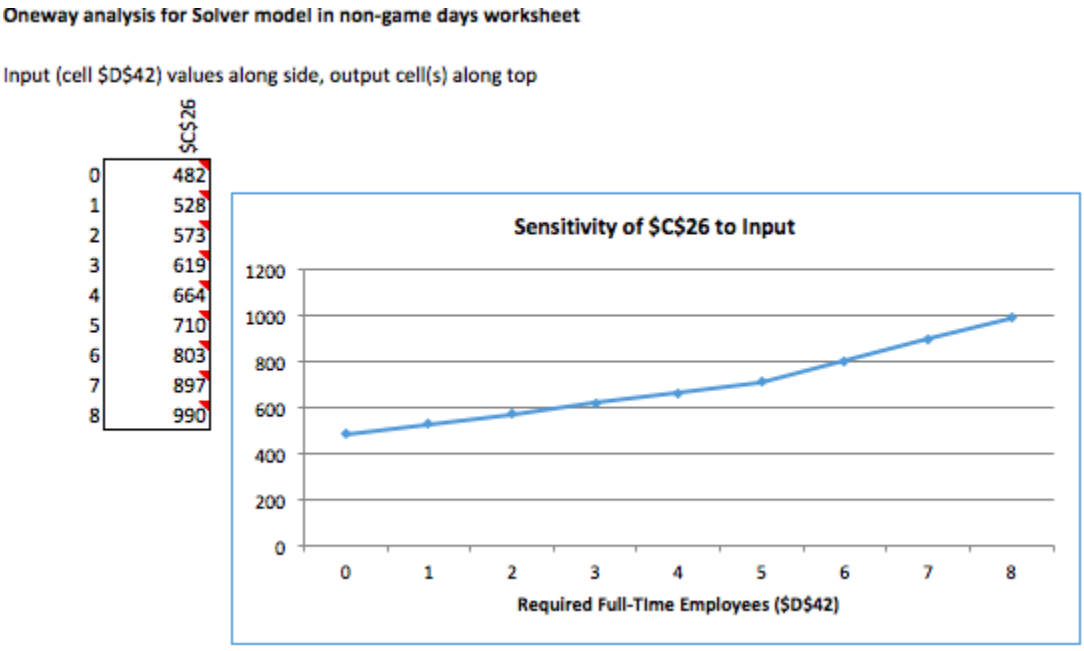


Fig. 3.2 One-way Sensitivity Analysis for Full-Time Employee Constraint

Another sensitivity analysis performed to illustrate how to total cost is affected by changing the number of Oakland A's part-time employees scheduled. Even the part-time employees have a very competitive hourly rate ($12.55) in comparison the other employee types ($16 and $17), sensitivity analysis results reveal that for every 1 unit increase in the part-time employee constraint, the daily cost increase by $2. Even though the Oakland A's part-time employees have a flexible

schedule as StaffPro employees, we see that minimum hours shift constraint has a great effect on the optimal solution.

Oakland A's Full-time employees need to work 8 hours on game days, starting at 9a, 12p or 2p	
F09	# of Full-time employees -starts at 9:00am (8 hours)
F12	# of Full-time employees -starts at 12:00pm (8 hours)
F02	# of Full-time employees -starts at 02:00pm (8 hours)
Oakland A's Part-time employees need to work 4-hour or 5 hour-shifts, starting on the hours	
P095	# of Part-time employees -starts at 9:00am (5 hours)
P105	# of Part-time employees -starts at 10:00am (5 hours)
P115	# of Part-time employees -starts at 11:00am (5 hours)
P125	# of Part-time employees -starts at 12:00pm (5 hours)
P015	# of Part-time employees -starts at 1:00pm (5 hours)
P025	# of Part-time employees -starts at 2:00pm (5 hours)
P035	# of Part-time employees -starts at 3:00pm (5 hours)
P045	# of Part-time employees -starts at 4:00pm (5 hours)
P055	# of Part-time employees -starts at 5:00pm (5 hours)
P094	# of Part-time employees -starts at 9:00am (4 hours)
P104	# of Part-time employees -starts at 10:00am (4 hours)
P114	# of Part-time employees -starts at 11:00am (4 hours)
P124	# of Part-time employees -starts at 12:00pm (4 hours)
P014	# of Part-time employees -starts at 1:00pm (4 hours)
P024	# of Part-time employees -starts at 2:00pm (4 hours)
P034	# of Part-time employees -starts at 3:00pm (4 hours)
P044	# of Part-time employees -starts at 4:00pm (4 hours)
P054	# of Part-time employees -starts at 5:00pm (4 hours)
P064	# of Part-time employees -starts at 6:00pm (4 hours)
StaffPro employees need to work minimum of 3 hours and maximum of 5 hours, starting on the hours	
S115	# of StaffPro employees -starts at 11:00am (5 hours)
S125	# of StaffPro employees -starts at 12:00pm (5 hours)

S015	# of StaffPro employees -starts at 01:00pm (5 hours)
S025	# of StaffPro employees -starts at 02:00pm (5 hours)
S035	# of StaffPro employees -starts at 03:00pm (5 hours)
S045	# of StaffPro employees -starts at 04:00pm (5 hours)
S055	# of StaffPro employees -starts at 05:00pm (5 hours)
S114	# of StaffPro employees -starts at 11:00am (4 hours)
S124	# of StaffPro employees -starts at 12:00pm (4 hours)
S014	# of StaffPro employees -starts at 01:00pm (4 hours)
S024	# of StaffPro employees -starts at 02:00pm (4 hours)
S034	# of StaffPro employees -starts at 03:00pm (4 hours)
S044	# of StaffPro employees -starts at 04:00pm (4 hours)
S054	# of StaffPro employees -starts at 05:00pm (4 hours)
S064	# of StaffPro employees -starts at 06:00pm (4 hours)
S113	# of StaffPro employees -starts at 11:00am (3 hours)
S123	# of StaffPro employees -starts at 12:00pm (3 hours)
S013	# of StaffPro employees -starts at 01:00pm (3 hours)
S023	# of StaffPro employees -starts at 02:00pm (3 hours)
S033	# of StaffPro employees -starts at 03:00pm (3 hours)
S043	# of StaffPro employees -starts at 04:00pm (3 hours)
S053	# of StaffPro employees -starts at 05:00pm (3 hours)
S063	# of StaffPro employees -starts at 06:00pm (3 hours)
S073	# of StaffPro employees -starts at 07:00pm (3 hours)

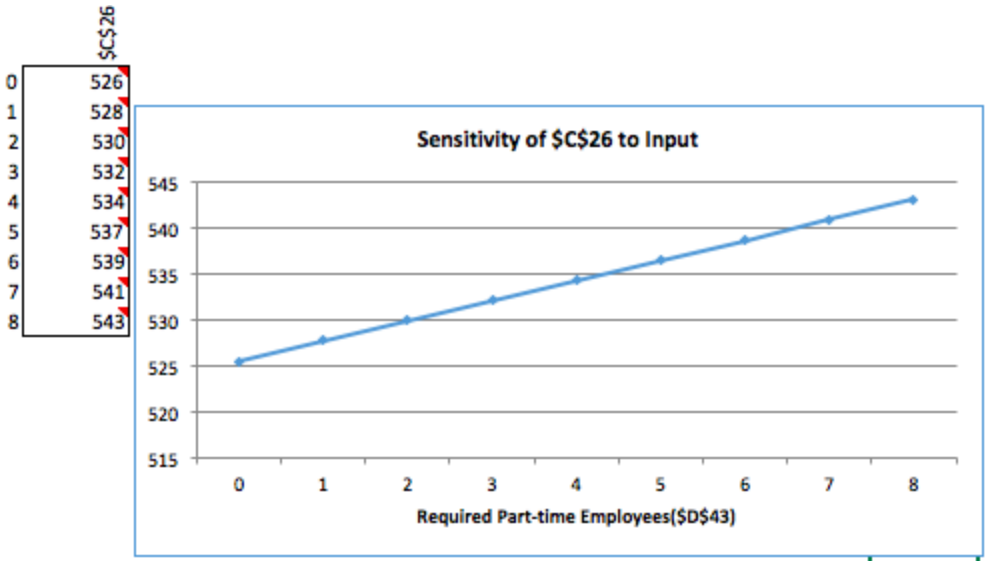


Fig. 3.3 One-way Sensitivity Analysis for Part-Time Employee Constraint

Integer Programming Model for Game Days

Considering all the constraints, there are 46 different possible types of shifts for the non-game days.

Decision Variables:

Objective function

Objective function is to minimize the labor cost daily.

MINIMIZE

136*(F09+F12+F02)+63.75*(P095+P105+P115+P125+P015+P025+P035+P045+P055)+50.20*(P094+P104+P114+P124+P014+P024+P034+P044+P054+P064)+80*(S095+S105+S115+S125+S015+S025+S035+S045+S055)+64*(S094+S104+S114+S124+S014+S024+S034+S044+S054+S064)+48*(S093+S103+S113+S123+S013+S023+S033+S043+S053+S063+S073)

Constraints

The following are the constraints:

- Gate A, at least 2 Oakland A's employees work 2 hours before and 2 hours after a game
- Gate A, at least 2 StaffPro employees work 1.5 hours before and 2 hours after a game
- Gate B, at least 2 Oakland A's employees work 2 hours before and 2 hours after a game
- Gate B, at least 2 StaffPro employees work 1.5 hours before and 2 hours after a game
- Gate C, At least 1 Oakland A's employee works from 09:00am-05:00pm
- Gate C, at least 2 Oakland A's employees work 2 hours before and 2 hours after a game
- Gate C, at least 2 StaffPro employees work 1.5 hours before and 2 hours after a game
- Gate D, At least 1 Oakland A's employee works from 09:00am-05:00pm
- Gate D, at least 2 Oakland A's employees work 2 hours before and 2 hours after a game
- Gate D, at least 2 StaffPro employees work 1.5 hours before and 2 hours after a game
- Gate BART Ramp, at least 3 Oakland A's employees work 2 hours before and 2 hours after a game
- Ticket services, at least 3 Oakland A's employees works from 09:00am-05:00pm
- Ticket services, at least 4 Oakland A's employees work 2 hours before and 3.5 hours after a game
- Advance Ticket Sales, at least 1 Oakland A's employees work 2 hours before and 3.5 hours after a game
- At least one full-time employee working at anytime

To formulate the model easily, all the constraints are combined as following:

- At least 5 Oakland A's employees work from 9:00am - 05:00pm
- At least 16 Oakland A's employees work 2 hours before
- At least 11 Oakland A's employees work 2 hours after
- At least 5 Oakland A's employees work 3.5 hours after a game
- At least 8 StaffPro employees work 1.5 hours before and 2 hours after a game

GAMES START AT 1PM

a. **Optimal Solution**

Decision variables	Value	Cost
F09	1	$136.00
F02	1	$136.00
P094	4	$200.80
P114	11	$552.20
P034	3	$150.60
P064	4	$200.80
S114	8	$512.00
Total	32	$1888.40

Applying Excel Solver, the best schedule is to have 32 employees: 2 full-time employees, in which one starts at 9am and another one starts at 2pm, 22 part-time employees who work on 4-hour-shifts (4 start at 9am, 11 start at 11am, 3 start at 3pm and 4 start at 6pm) and 8 StaffPro employees, who work on 4-hour-shift start at 11am. With this schedule, the optimal cost on a game day, on which the game starts at 1pm is $1888.40

b. One-way sensitivity analysis

Using Solver Table sensitivity analysis, we study the effect on the optimal solution of changing the number of Oakland A's employees from 3:30pm – 04:00pm from 0 to 10.
The output indicates that within the range from 1 to 10, when the number of Oakland A's employees decreases by 1, the labor cost will also go down by $50.20.

GAMES START AT 7PM

a. Optimal solution

Decision Variables	Value	Cost
F09	1	136.00
F12	1	136.00

F02	5	680.00
P095	3	188.25
P094	1	50.20
P054	10	502.00
S054	8	512.00
Total	29	$2204.45

Using Excel Solver, the optimal solution is to have 29 workers in total: 7 full-time employees, in which one starts at 9am, one starts at 2pm, and 5 start at 2pm; 14 part-time employees which include 3 part-time employees who work from 9am to 2pm (5-hour-shift), 1 part-time employee who work from 9am to 1pm and 10 part-time employees who work from 5pm to 9pm; and 8 StaffPro employees who work from 5 till 9pm. The optimal cost is $2204.45 which is $316.05 higher than the optimal cost of game days, on which games start at 1pm. Even though on 7pm game days, the total number of employees is fewer than the total number on 1pm game days, the cost is higher since the number of full-time workers increases significantly.

b. Sensitivity Analysis

Using one-way sensitivity analysis of SolverTable for the RHS of the constraint "At least 5 Oakland A's employees work 3.5 hours after a game, (10:00pm - 10:30pm)", we investigate the change of optimal cost when the number of Oakland A's employees varies.

The result of the analysis reveals that within the selected range, the optimal cost increase when the number of Oakland A's employee increases. Take a closer look at when the number of employees is 4 during this period, a change of $73.25 is caused by the replacement of a full-time worker by a part-time worker. This change means there will only 4 full-time employees work from 10-10.30pm at Ticket Services and Advance Ticket Sales. Considering that full-time employees are more experienced than part-time employees, this decrease may not affect its

services. Besides, while the Oakland A’s is struggling to stay on the market, a reduction of $73.25 for one game days will make a big saving after a year.

II. Oakland A's Stadium Development Decision Tree

The ownership team and front office management worked with the development team to develop an estimate for each of the possible choices for the new stadium location. A stadium at Howard Terminal $800 million stadium cost and $200 million for the surrounding mixed-use development, totaling $1 billion. A stadium in Jack London Square: $750 million stadium and $350 million for the surrounding mixed-use development, totaling $1.1 billion. The team can also build a new stadium on the current Coliseum site costing $500 million for the stadium and $400 million for the surrounding mixed-use development, totaling $900 million.
Each site proposal requires a non-refundable proposal cost of $5,000,000, which covers the building the proposed 3-D model, design, site inspection, architectural drawings, and fees to the city. Proposals for stadiums near water (Howard Terminal and Jack London Square) require an additional structural testing fee of $2,500,000 is added, due to the proximity the stadiums would be to The Bay.

The A's management team then made developed a profile for each of the stadium sites in regards to popular public opinion, access to Bay Area Rapid Transit (BART), access to parking lots, future development of surrounding areas, possible stadium size, and projected yearly revenue from each site. This chart shows how each stadium site scored against one another.

After having a conversation with some city officials, the A's have determined that the Jack London Square site has a 70% chance of being approved. The proposed location at Howard Terminal has a 60% chance of being approved. It should also be noted that the current Oakland Coliseum site is guaranteed to be approved (100%) by the city, though it is the least favorable of the three stadium choices. Building on the Coliseum site would be the easier development of the three, due to the large empty area that the Coliseum and Oracle Arena share now. This gives the

A’s organization many different routes for which to apply for permits and develop their best choice. With the pending departure of the Raiders looking more probable, the A’s have some uncertainty in their choices. The City of Oakland has determined that if the Raiders are to move to Las Vegas, the earning potential of each site increases by 25% rather than if the Raiders stay. Howard Terminal’s 5-year earning potential if the Raiders leave or stay are $1.63 billion and $1.22 billion respectively. Jack London Square’s 5-year earning potential if the Raiders leave or stay are $1.75 billion and $1.32 billion respectively. The Oakland Coliseum stadium site’s 5-year earning potential if the Raiders leave or stay are $1.25 billion and $937 million respectively.

With these decisions, the A’s ownership group has left themselves with the possibility to apply for a different permit for a different stadium if one is rejected. The organization would like to minimize its total cost to build, while still getting the maximum annual revenue per year.

For the following discussion involving the Decision Tree for Oakland A’s Stadium Development, a snippet is provided in FIG 4.1 below. If a better resolution of the entire Decision Tree is needed, please refer to the provided Excel Spreadsheet.

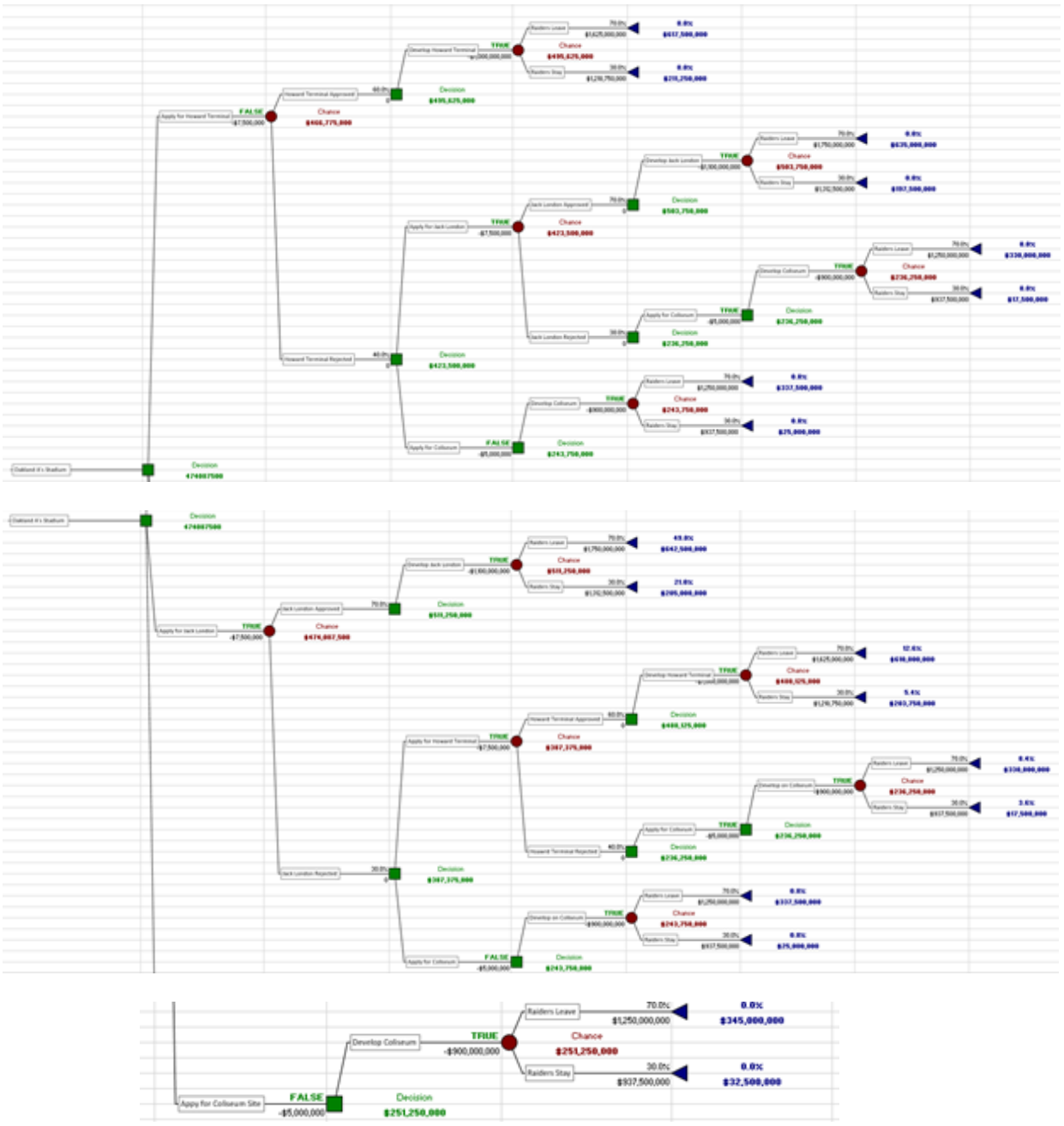


Fig 4.1

Based on available data, Oakland A's must decide on where to develop their future baseball stadium. There are three possible end scenarios for the described situation -- First is that Oakland A's relocate & develop to a new location within the Bay Area at Howard Terminal; Second is that they relocate & develop to a new location at Jack London Square; Third is that

they redevelop the current Oakland A's Coliseum. Moreover, before developing on each site Oakland A's management must first apply for the necessary proposals for each location which have respective costs and probabilities of approval. It should be noted that each location has respective development budgets which take into consideration stadium cost and surrounding mixed use development. Lastly, each location also has respective projected 5-year revenues which are based on the Oakland Raider's decision to leave the Bay Area. To summarize costs, probabilities and forecasted revenues for each location, a snippet of the table used in the decision tree is provided in FIG 4.2 below.

	Howard Terminal	*Jack London Square*	*Oakland Coliseum Site*
Proposal Cost, $	$ 7,500,000	$ 7,500,000	$ 5,000,000
Probability:			
Approved	0.6	0.7	1.0
Rejected	0.4	0.3	0
Cost to Build Stadium			
Stadium Cost	$ 800,000,000	$ 750,000,000	$ 500,000,000
Surrounding Mixed Use Development	$ 200,000,000	$ 350,000,000	$ 400,000,000
Total Cost to Build	$ 1,000,000,000	$ 1,100,000,000	$ 900,000,000
Raiders Uncertainty			
Probability:			
Raiders Leave	0.7		
Raiders Stay	0.3		
5-Year Earning Potential, $			
Raiders Leave	$ 1,625,000,000.00	$ 1,750,000,000.00	$ 1,250,000,000.00
Raiders Stay	$ 1,218,750,000.00	$ 1,312,500,000.00	$ 937,500,000.00

Fig 4.2

After running Precision Tree, we have arrived at the Optimal Tree that provides us with the best choice while taking into consideration all previously described data. From the Optimal Tree included in FIG 4.3 below, we find that the best decision would be to proceed with a proposal application for Jack London Square as this decision has the highest EMV at $474,087,500 as compared to Howard Terminal proposal application EMV & Coliseum

application EMV which have lower values of 466,775,000 & 251,250,000 respectively.

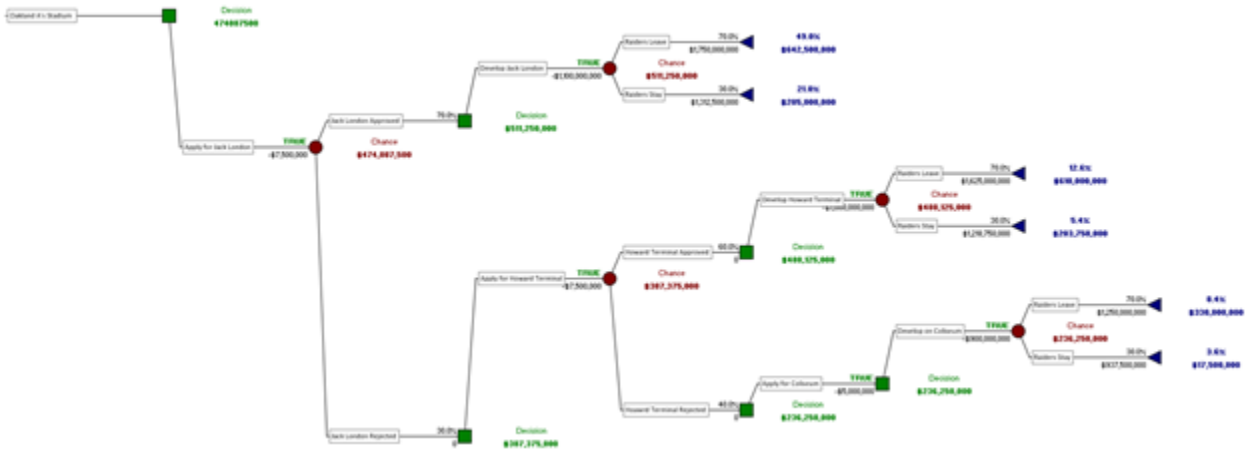
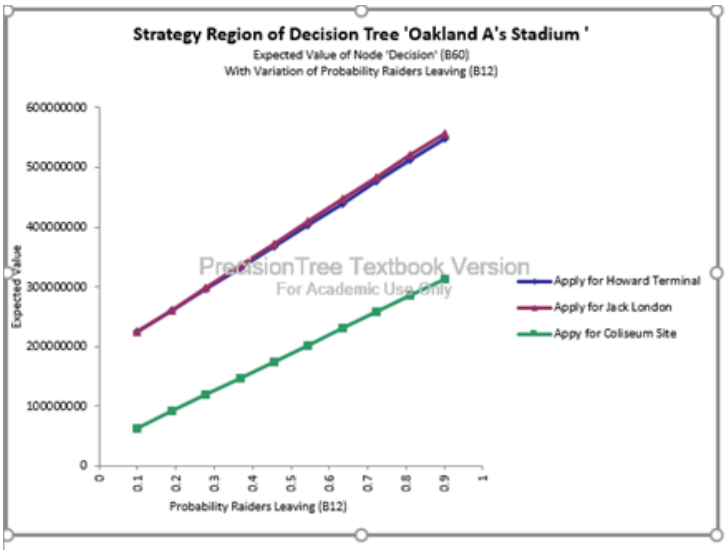


Fig 4.3

Moreover, Precision Tree provides us with all consequential scenarios that may arise once Oakland A's management decides to proceed with the proposal application for Jack London Square. We identify that the most likely consequential scenario is that the proposal for Jack London Square is approved and Raiders leave the Bay Area; this scenario has a 49% chance of occurring with a 5-year projected profit (revenue – total development cost) of $642,500,000. The second scenario that is likely to happen is that Jack London Square application proposal is approved and Raiders remain in the bay area which has a 21% chance of occurring with a 5-year projected profit of $205,000,000. The third scenario that is likely to occur is that Jack London Square proposal is rejected but Howard Terminal is approved and Raiders leave the Bay Area; this scenario has a 12.6% chance of occurring with a 5-year projected profit of $610,000,000. The fourth scenario is that both Howard Terminal and Jack London Square proposal applications are rejected and current Oakland Coliseum is redeveloped and Raiders Leave the bay area; this scenario has an 8.4% chance of occurring and a $330,000,000 projected profit. The fifth scenario that is likely to occur is that Jack London Square proposal is rejected but Howard Terminal is approved and Raiders remain in the bay area; this scenario has a 5.4% chance of occurring with

an expected 5-year profit of $203,750,000. Lastly, the scenario least likely to occur is that both Howard Terminal and Jack London Square are rejected and current Oakland Coliseum is redeveloped and Raiders remain in the bay area; this scenario has a 3.6% chance of occurring with an expected 5-year profit of $17,500,000.

Precision Tree provides us with information that the highest possible 5-year profit to be gained is $642,500,000 (most likely to occur) and the lowest possible 5-year profit gained is $17,500,000 (least likely to occur). Moreover, we can provide Oakland A's with a guarantee that based on projected costs and revenues, all investments have a positive return after 5-years of operation. We can safely recommend that the best decision for Oakland A's is that they proceed with a proposal for Jack London Square and expect that the application is approved and that Raiders leave the Bay Area.

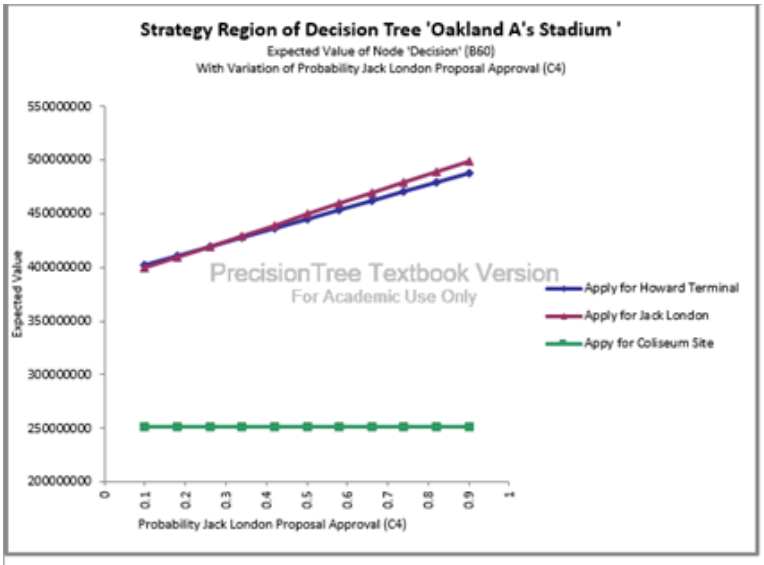


Strategy Region Data

	Input		Apply for Howard Terminal		Apply for Jack London		Appy for Coliseum Site	
	Value	Change (%)	Value	Change (%)	Value	Change (%)	Value	Change (%)
#1	0.1	-85.71%	224525000	-52.64%	223962500	-52.76%	63750000	-86.55%
#2	0.188888889	-73.02%	260413888.9	-45.07%	261018055.6	-44.94%	91527777.78	-80.69%
#3	0.277777778	-60.32%	296302777.8	-37.50%	298073611.1	-37.13%	119305555.6	-74.83%
#4	0.366666667	-47.62%	332191666.7	-29.93%	335129166.7	-29.31%	147083333.3	-68.98%
#5	0.455555556	-34.92%	368080555.6	-22.36%	372184722.2	-21.49%	174861111.1	-63.12%
#6	0.544444444	-22.22%	403969444.4	-14.79%	409240277.8	-13.68%	202638888.9	-57.26%
#7	0.633333333	-9.52%	439858333.3	-7.22%	446295833.3	-5.86%	230416666.7	-51.40%
#8	0.722222222	3.17%	475747222.2	0.35%	483351388.9	1.95%	258194444.4	-45.54%
#9	0.811111111	15.87%	511636111.1	7.92%	520406944.4	9.77%	285972222.2	-39.68%
#10	0.9	28.57%	547525000	15.49%	557462500	17.59%	313750000	-33.82%

Fig 4.4

As seen in FIG 4.4 above, we ran a one-way sensitivity analysis to see the effect of varying the probability of raiders leaving from 0.1 to 0.9. From the generated output, we find that when the probability of Raiders leaving the Bay Area is from 0.188 to 0.9 the best decision (highest EMV) remains to be to proceed with Jack London Square. However, when probability is below 0.188 the best decision appears to be to relocate to Howard Terminal. It should be noted that as the probability of Raiders leaving increases, all EMV values experience a linear increase as well. This is true because all EMV values for every decision -- Howard Terminal, Jack London Square and Coliseum Site are directly proportional to this probability since projected revenues are based on whether Raiders leave or remain in the Bay Area.



Strategy Region Data

	Input		Apply for Howard Terminal		Apply for Jack London		Appy for Coliseum Site	
	Value	Change (%)	Value	Change (%)	Value	Change (%)	Value	Change (%)
#1	0.1	-85.71%	402575000	-15.08%	399762500	-15.68%	251250000	-47.00%
#2	0.18	-74.29%	411135000	-13.28%	409672500	-13.59%	251250000	-47.00%
#3	0.26	-62.86%	419695000	-11.47%	419582500	-11.50%	251250000	-47.00%
#4	0.34	-51.43%	428255000	-9.67%	429492500	-9.41%	251250000	-47.00%
#5	0.42	-40.00%	436815000	-7.86%	439402500	-7.32%	251250000	-47.00%
#6	0.5	-28.57%	445375000	-6.06%	449312500	-5.23%	251250000	-47.00%
#7	0.58	-17.14%	453935000	-4.25%	459222500	-3.14%	251250000	-47.00%
#8	0.66	-5.71%	462495000	-2.45%	469132500	-1.05%	251250000	-47.00%
#9	0.74	5.71%	471055000	-0.64%	479042500	1.05%	251250000	-47.00%
#10	0.82	17.14%	479615000	1.17%	488952500	3.14%	251250000	-47.00%
#11	0.9	28.57%	488175000	2.97%	498862500	5.23%	251250000	-47.00%

Fig 4.5

As seen in FIG 4.5 above, we ran a one-way sensitivity analysis to see the effect of varying the probability of Jack London Proposal approval from 0.1 to 0.9. From the generated output, we find that when the probability of Raiders leaving the Bay Area is from 0.18 to 0.9 the best decision (highest EMV) is to proceed with Jack London Square. However, when probability is below 0.18 the best decision is to relocate to the Howard Terminal. It should be noted that the probability that the Jack London Proposal is approved has no effect on the EMV for the decision to apply for current Coliseum Site redevelopment. This is because the probability of Jack London proposal approval has no relation to the decision of redeveloping the current site.

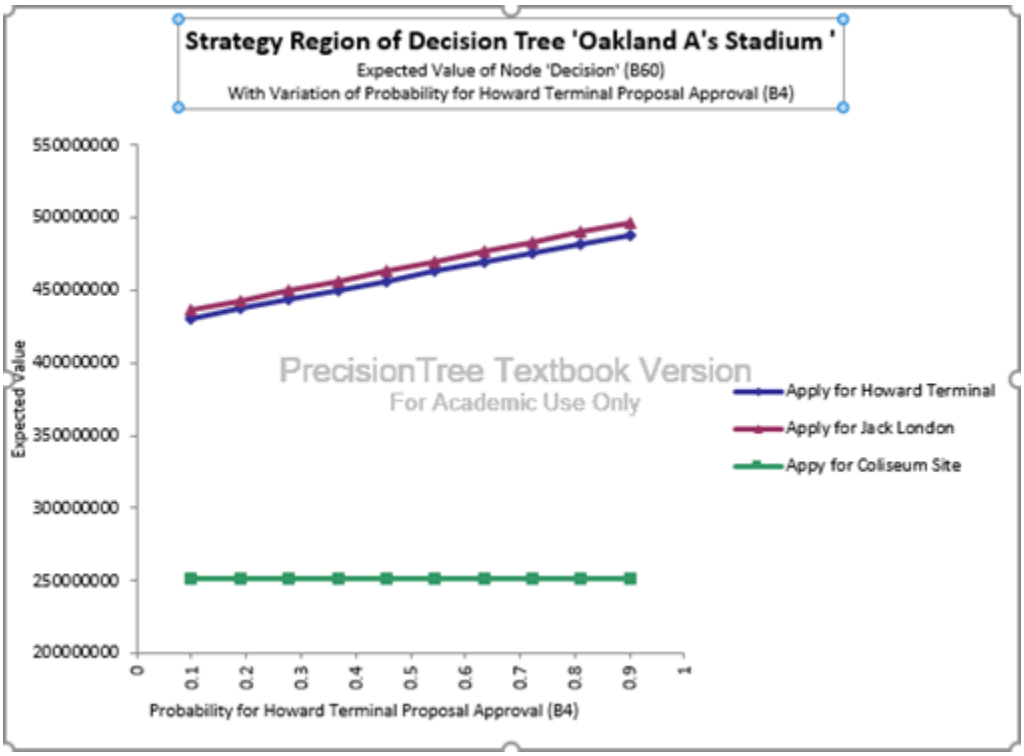


Fig 4.6

As seen in FIG 4.6 above, we ran a one-way sensitivity analysis to see the effect of varying the probability of Howard Terminal Proposal approval from 0.1 to 0.9. From the generated output, we find that applying for Jack London proposal remains to be the best decision

for all varying probabilities. It should be noted that as the probability of Raiders leaving increases, EMV values for both Howard Terminal & Jack London decisions experience a linear increase as well. This is true because EMV values for these decisions are directly proportional to the probability since projected revenues are based on whether Raiders leave or remain in the Bay Area.

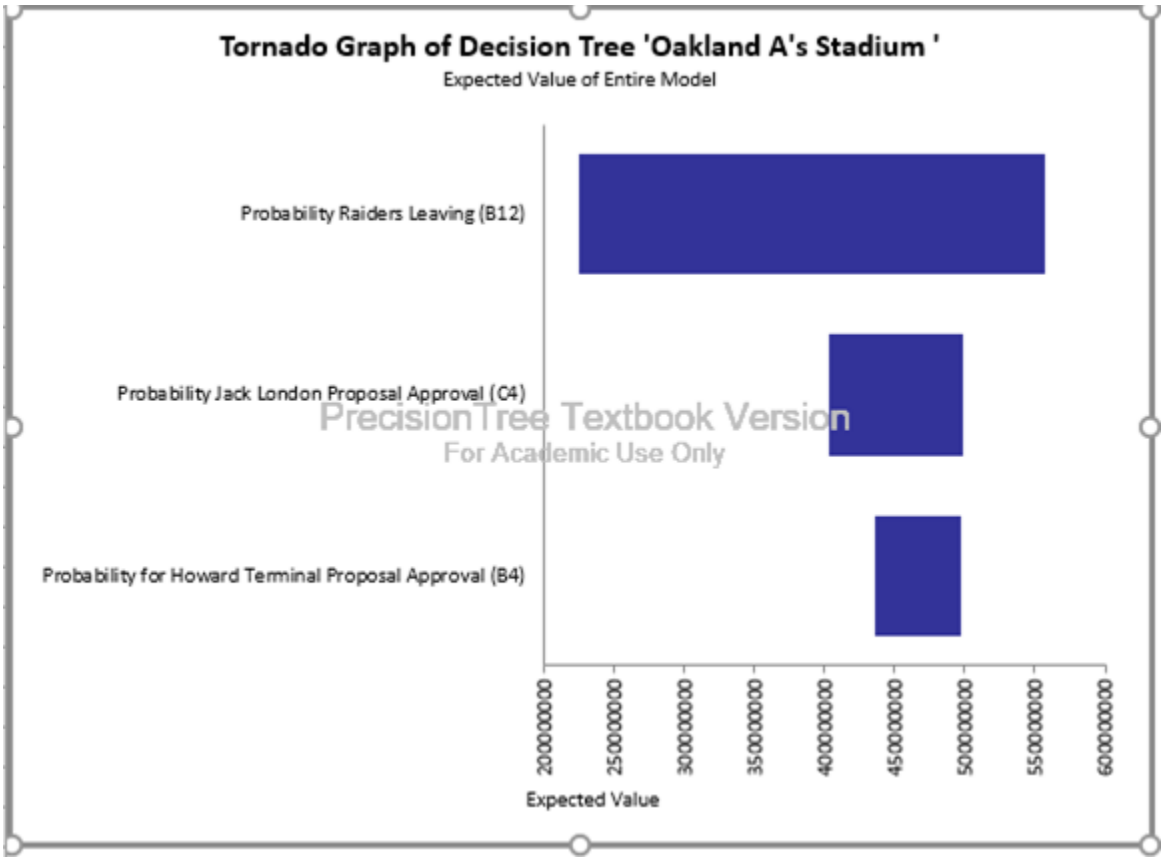


Fig 4.7

As seen in FIG 4.7 above, we ran analysis through a Tornado Graph to see which probability described in the scenario has the largest effect on the overall EMV. From the generated output, we find that the Probability of Raiders Leaving has the most observable effect. This is true because this probability is used in every decision and plays a vital role in projected profits for each decision.

Lastly, as seen in FIG 4.8 below is a two-way analysis (Strategy Region Output) that involves both Probability of Jack London Proposal Approval & Probability of Howard Terminal Proposal Approval. From the generated output, we can observe that when probability of Howard Terminal Proposal being approved is greater than 0.38 & when probability of Jack London Square Proposal being approved is below 0.3, we find that Howard Terminal is the best decision. However, when probability of Jack London Square Proposal being approved is above 0.3, we consistently find that Jack London Square is the best decision.

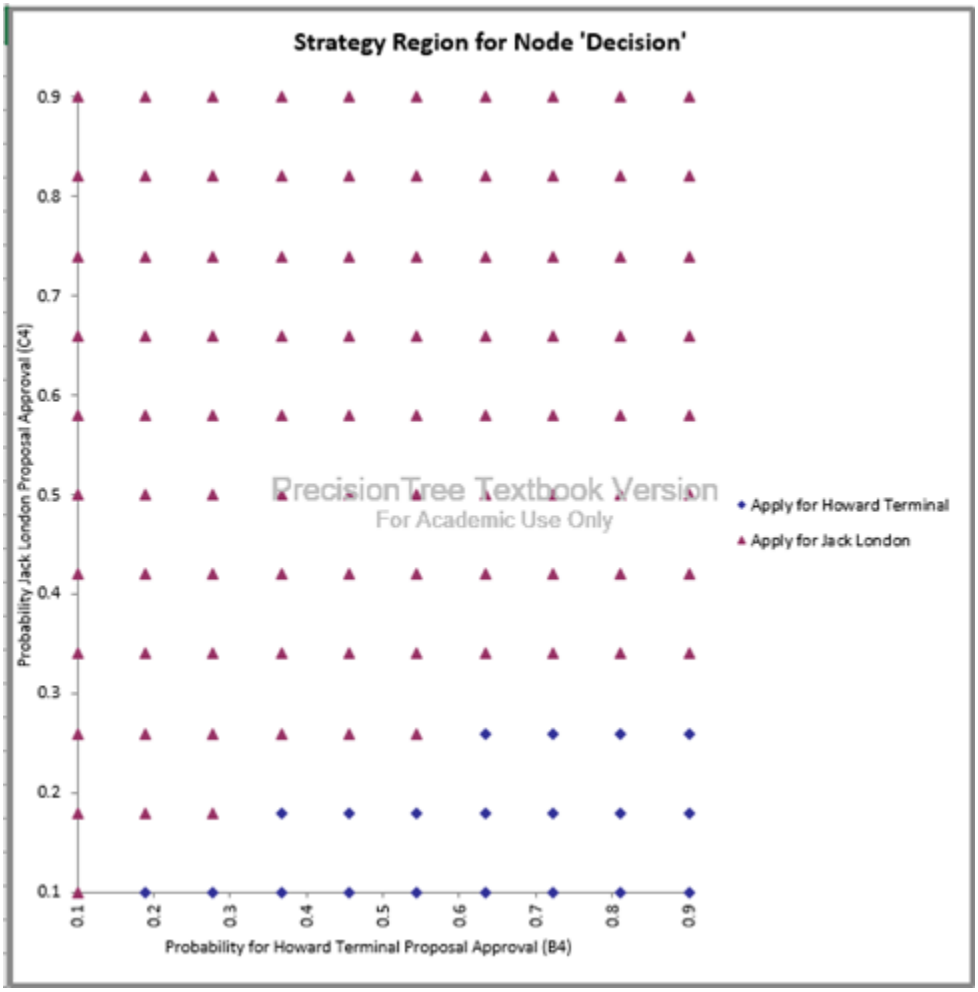


Fig 4.8

Oakland A's Schedule Optimizations Conclusion

We have presented a generic model with the use of linear integer programming for scheduling the ticket sales staff. The models assign mix of StaffPro and Oakland A's full-time and part-time employees while considering the requirement constraints for each window. Non-game days scheduling model assigned 1 full-time and 1 part-time Oakland A's employee and 8 StaffPro employees to the ticket windows with the total daily cost of $528. Although StaffPro employees ($16) and full-timers ($17) have close hourly wages, model opted to schedule StaffPro employees due to their flexible working hours. Surprisingly, even though Oakland A's part-time employees has a great hourly rate advantage with $12.55 over full-timers and StaffPro employees, in the sensitivity analyses we realized that scheduling more part-time employees increases the total daily cost. This result stems from the fact that even though they have both flexible working hours, Oakland A part-time employees' minimum shift hours is 4 hours while StaffPro employee can work in 3 hours shifts. If the management can decrease the minimum hourly shift to 3 hours for the part-time employees, total daily cost changes drastically from $528 to $377 which adds up to $15,471 for 81 non-game day sales. Another option can be reconsidering the need of one full-time and one-part time employee during the non-game day sales. If these constraints are removed from the model the daily cost decrease by $48.

On game days, as Oakland A's has two game times 1pm and 7pm, it needs to have two different schedules. On days when games start at 7pm, the daily cost is $316.05 more expensive than the cost on days when games start at 1pm because full-time employees are needed outside their normal working hours (from 5 till 10.30 pm) and part-time employees finish their shifts at 10pm while Oakland A's still needs at least 5 employees to work until 10.30pm. If Oakland A's managers can

modify the starting hours for part-time employees on the half hour, the cost can change significantly.

Oakland A's Decision Tree Conclusion

In conclusion, we have created a Decision Tree for the Oakland A's that allows us to run analysis to identify the best decision for their development project. From the Optimal Tree, we can confidently recommend that Oakland A's management proceeds with the initial action of applying for Jack London Square proposal as this has the highest EMV for all decisions. Moreover, we have identified that the probability of the Raiders leaving has the largest effect on the EMV. Due to this finding, we recommend that Oakland A's management pays close attention to the latest news regarding the Raider's decision to leave or remain in the Bay Area due to its large effect on projected 5-year profits. Also, we currently observe that the probability of Jack London Proposal being approved is 70% and that the best decision is to proceed with Jack London Square Proposal. This is true for if the Jack London proposal probability remains higher than 30%. When this probability is below 30% and the probability of Howard Terminal is greater than 38% management can expect that the best decision switches to Howard Terminal proposal application. Due to this finding, we recommend that management keeps consistently notified of any changes in city policies to have an accurate depiction of approval probabilities. Oakland A's management can expect that for all decisions for relocation, they can expect a positive 5-year revenue projection. Lastly, we can inform Oakland A's management that the most likely scenario to occur after proceeding with applying for Jack London proposal is that the Jack London proposal is approved and that the raiders leave the bay area. From the Optimal Tree analysis, we

observe that this scenario has 49% chance of occurring with an expected 5-year revenue of $642,500,000.

References

Almond, E. (2017, February 19). *A's spending millions to find best site for new Oakland ballpark.* Retrieved from Bay Area News Group: http://www.mercurynews.com/2017/02/18/as-spending-millions-to-find-best-site-for-new-oakland-ballpark/