

## **Economic Analysis Of A Monorail Link Between The Stratosphere Tower And Downtown Las Vegas**

Andrew S. Jakes

### **Abstract**

The “Economic Feasibility of a Monorail Link between the Stratosphere Tower and Downtown Las Vegas” study was sponsored by the Stratosphere Corporation in association with Boyd Gaming Corporation, the City of Las Vegas, and Nevada Power Company. The Stratosphere Tower is evolving as a mega-resort on Las Vegas Boulevard; however, in a location which is distant both from Downtown Las Vegas and the “Strip”. The downtown property owners, including Boyd Gaming Corporation, are experiencing increasing competition from the “Strip” mega-casinos which is now offset with the success of the Fremont Street Experience.

The overall objective of the study participants was to assess the feasibility of developing a monorail transit system between the Stratosphere Tower and Downtown Las Vegas. This objective, supported by available resources of the study sponsors and possibly other property owners, presents a unique opportunity for the City of Las Vegas to assume a leadership role in a venture which would make an impact in the emerging trend of public/private ventures. In addition, the overall marketing for the properties along the study corridor and in the downtown area could be planned comprehensively to maximize mobility between the properties through the application of appropriate transit technology. The ultimate goal is to initiate a Las Vegas wide monorail transit system which would serve the properties of the participants and other selected locations.

Jakes Associates, Inc. developed a custom economic model in order to derive the projected return on investment. This model included a patronage projections with and without induced trips. Our extensive cost analysis, in addition to the typically assessed life cycle costs, included revenue projections both from fare collection and induced revenues to our clients. Our work resulted in a specific net present value analysis of the return on investment which proved that significant economic value could be achieved. Our report generated extensive publicity in the local press.

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<sup>1</sup> President, Jakes Associates, Inc. and a strategic and procurement management consultant to the consortium of Stratosphere Corporation, Boyd Gaming Corporation, the City of Las Vegas, and Nevada Power Company. Jakes Plaza, 1940 The Alameda, San Jose, California 95126-1427, USA, 408 249-7200

## **Strategic Reasons for Transit to Downtown**

The Stratosphere Tower, as an emerging mega-resort, could benefit from a direct transit link to Downtown Las Vegas and to the other mega-resorts located on the “Strip”, the Las Vegas Convention Center and possibly McCarran International Airport. Similarly, Downtown Core Hotel/Casinos, could also improve their competitive position by linking to the same destinations with an intermediate stop at the Stratosphere Tower. Both the Tower and Downtown, with its recently opened Fremont Street Experience, are becoming ‘must-see’ attractions for everyone who visits Las Vegas and can benefit from each other by attracting additional visitors from other Las Vegas activity centers using a jointly developed transit system.

In addition, a Downtown transit station(s) could consolidate selected properties into a single gaming complex by having an attractive and efficient transit link. This link could be extended to the North to the planned domed sports stadium, Boulder Highway gaming destinations, and other remote destinations such as Cashman Field. This link could be further extended to the South with a candidate intermediate stop at Sahara Hotel/Casino to link with the Las Vegas Convention Center and highly competitive “Strip” gaming centers.

In addition to relieving traffic congestion, improving accessibility and visitor convenience, this strategy would capture a substantial number of additional customers making the system economically desirable. With proper planning, the transit system itself may become an attraction resulting in additional revenues. This is particularly important, since the employment and revenue base of the City of Las Vegas has been increasingly threatened by gaming expansion on the “Strip”, Laughlin and Stateline, and by neighboring casinos. To compete, a substantial investment is essential, including an attractive and efficient transit system. This concept presents an incredible opportunity for the City of Las Vegas to assume a leadership role in facilitating the implementation process.

## **The Study Area and Primary Destinations**

The study area encompasses the distance between the Stratosphere Tower and Downtown Las Vegas where several Boyd Gaming properties are located. The City of Las Vegas, through its Downtown Redevelopment Agency Board, has become proactive in its efforts to revitalize the Downtown Redevelopment Area. This area, which comprises 2,635 acres in the heart of the city, includes Downtown Las Vegas, from Sahara Boulevard to Bonanza Road where the study corridor is situated. This area includes the casino complex which employs 17,000 workers and represents 47 percent of the tax increment revenues in the Redevelopment Area. The Redevelopment Area also includes Las Vegas Boulevard which serves as the most significant entryway into Downtown Las Vegas.

Among the primary destinations for monorail transit are the properties of the study sponsors in coordination with the overall objectives of the City of Las Vegas. Stratosphere Corporation operates the Stratosphere Tower, Casino & Hotel, a major destination resort containing a fully integrated casino/hotel, observation tower and entertainment complex, located at the north end of the Las Vegas “Strip”. Boyd Gaming owns five properties in the downtown area. Several hotels line Fremont Street from Main to Fourth.

## **Routings And Station Locations**

A number of alternative alignments were reduced to alignments serving the most vital destinations. Table 1 summarizes the monorail system characteristics by providing the number of stations, guideway length, number of track switches, type of service and approximate end-to-end trip time for alternatives (coded by colors) in full and reduced configurations. All alternatives consist of a double concrete guideway supported by a single column with bi-directional capabilities. All stations should be elevated. System expandability will be assured by considering expansion capability on each end of the system which must include preserving a right-of-way. To accommodate extensions, the monorail transit system would be equipped with train by-pass sections with track switches.

**Table 1: Alternative Alignment Characteristics**

<b>DESCRIPTION</b>	<b>GREEN LINE</b>		<b>YELLOW LINE</b>		<b>BLUE LINE</b>
	<b>END STATION: FREMONT STREET GARAGE</b>	<b>END STATION: MAIN STREET STATION</b>	<b>END STATION: FREMONT STREET GARAGE</b>	<b>END STATION: MAIN STREET STATION</b>	
<b>Number of Stations</b>	2	3	2	3	2
<b>Approximate Main Line Guideway Length (km)</b>	2.35	3.31	2.33	2.13	2.59
<b>Approximate Maintenance and Storage Guideway Length (km)</b>	0.35	0.35	0.35	0.35	0.60
<b>Number of Track Switches (to the Maintenance and Storage Facility)</b>	4	4	4	4	0
<b>Type of Track and Service</b>	Elevated, Double Guideway, Shuttle				
<b>Approximate End-to-end Trip Time-min (40 second dwells)</b>	3.03	4.83	3.03	4.97	3.23
<b>Approximate End-to-end Trip Time-min (80 second dwells)</b>	3.70	6.17	3.70	6.30	3.90

## **Economic Impact**

We characterized the economic impact of a monorail system implementation from the following two perspectives:

- Tangible Elements
  - Patronage Projections
  - Capital and Life Cycle Costs (investment)
  - Revenues
  - Project Schedule
- Intangible Elements
  - Risks
  - Property and Area Value Enhancements (indirect revenue)
  - System Extension Potential.

## **Patronage Estimates**

We needed to project the number of potential riders per peak hour in order to determine the minimum number of trains and their size requirements. In addition, for the purpose of the economic analysis, we established whether the implementation of the monorail link would attract additional visitors both to the Stratosphere Tower as well as Boyd Gaming properties. To supplement theoretical analysis, we conducted a limited survey of downtown patrons to determine whether a convenient, passenger friendly transit link would greatly increase the likelihood of patrons to visit all destinations and also to augment quantitative patronage forecast assumptions and validate our estimates for “added value” of the monorail. The survey results indicate that the monorail would attract significant ridership.

It is also important to assume additional induced travel previously foregone because of the lack of monorail, and new trips created by the area becoming a more attractive destination for visitors. Both types of induced travel may also involve new trips associated with the novelty value particularly associated with the monorail. That is, resident as well as visitors may ride the system to experience its novelty even if they would normally choose another mode or not make the trip. Therefore, the likelihood of people riding the monorail system simply to experience the technology was considered. To accommodate for the induced travel, we made the assumption of additional 9% of induced trips to reflect the potential of the monorail. This percentage is well supported by the findings of the survey.

The average daily boardings without and with induced travel for a sample Green Line Alternative with the end station at the Main Street Station Hotel/Casino is 23,478/25,591.

All alternatives offer very high ridership potential (23-25,000 passengers per day). A review of the average daily boardings per system Kilometer reveals that the additional 0.8-1.0 Kilometer of the guideway and station (less than 30% of the total system length), results in over 2,000 additional riders (less than 10% of the total system ridership) for the Yellow and Green Line Alternatives ending at the Main Street Station Hotel/Casino. This may not seem to be the best investment at the moment; however, with Boyd Gaming developing its vacant land into new hotel/casinos, that ratio may greatly change in favor of extending the monorail to the Main Street Station.

Table 2 summarizes our findings by providing the range (low-high) of peak hour boardings per station and also the range of total boarding per alignment alternative. The average peak hour boardings without and with induced travel for a sample Green Line Alternative with the end station at the Main Street Station Hotel/Casino is 2,453/2,674. The boardings represent passenger per hour per direction (pphpd) capacity for the “free ride” system in 1999. For the purpose of determining the required number of trains, we have rounded up the alternative capacities for the range between 2,300 and 2,700 pphpd. In the U.S., most people mover systems typically do not require a fare charge. In our case, the projected very high ridership may justify introduction of a reasonable fare to offset the investment and operational costs.

It is reasonable to assume that the convenience of the monorail link to visitors with a strong desire to visit the Stratosphere Tower, Fremont Street Experience, and other Downtown destinations will overcome the fare expenses to a great extent for low fares.

Station	Green Line Alternative		Yellow Line Alternative		Blue Line Alternative
	End Station: Fremont Street Garage	End Station: Main Street Station	End Station: Fremont Street Garage	End Station: Main Street Station	
Stratosphere Tower	923 - 1,161	923 - 1,161	923 - 1,161	923 - 1,161	923 - 1,161
Fremont Street Experience Garage	1,086 - 1,328	1,086 - 1,328	1,086 - 1,328	1,086 - 1,328	N/A
Main Street	N/A	N/A	N/A	N/A	992 - 1,217
Main Street Station Hotel / Casino	N/A	184 - 224	N/A	184 -224	N/A
<b>Total Boardings</b>	<b>2,009 - 2,489</b>	<b>2,193 - 2,713</b>	<b>2,009 - 2,489</b>	<b>2,193 - 2,713</b>	<b>1,915 - 2,378</b>
<b>Boardings / Mile</b>	<b>1,376 - 1,704</b>	<b>1,065 - 1,317</b>	<b>1,386 - 1,717</b>	<b>1,102 - 1,363</b>	<b>1,189 - 1,477</b>

For the study destinations, the free versus fare criterion may escalate with raising fares. This conclusion is well supported by the findings of our survey. We assumed the following percent trip reduction with the varying one way fares:

\$1 - 10%                      \$2 - 50%                      \$3 - 80%.

The \$1 fare is equal to the current public bus system fare. This assumption should be subjected to a test during the initial operation of the system. In order to promote the monorail, the system may open with a free of charge operation for the initial weeks and then based on the ridership an appropriate fares shall be determined. The above factors are used to estimate the impact of the fare charges on monorail patronage estimates:

<u>Fare Level</u>	<u>Passengers per Direction</u>	
	<u>Daily (Rounded Up)</u>	<u>Peak Hourly (pphpd)</u>
Free Ride	25,600	2,700
\$1	23,040	2,430
\$2	12,800	1,350
\$3	5,120	540

The projected average daily visitor level at the Stratosphere complex is 24,350. This represents a 74% increase resulting from the implementation of the monorail and an 82% increase during peak hours. Similarly, based on the annual Fremont Street Experience average daily visitors of 13,699, we can estimate an increase of 78% due to the monorail. These percentages should be divided by two to reflect the bi-directional nature of the overall benefit resulting in an average of 38%.

### **Order Of Magnitude Capital Cost Analysis**

We needed to determine whether to purchase and refurbish the existing Mark IV trains (currently in storage in Lake Buena Vista, Florida) or purchase new M VI trains (or equivalent) from Bombardier Corporation or other candidate suppliers. The advantage of refurbishing the used trains is rapid implementation (trains are on the critical path of the schedule) and lower initial system costs.

The cost saving associated with Mark IV trains results from eliminating an expensive train and central control system as required for the M VI trains. It is also a cost saving from the larger capacity of Mark IV trains (240 versus 160 passengers per train). It is a cost saving resulting from the economy of scale in the procurement process and also the lack of interest of train builders to develop new tooling just for a two train order.

Table 3 summarizes the projected costs for all alternatives. There is practically no cost difference between the Green and Yellow Line alternatives for both two and three station options. The cost for the two station option is in the range of \$46-47 million and for the three station option is \$63-64 million. The difference of \$1.4 million between Mark IV and M VI options appears negligible considering the magnitude of the project. The difference between the two and three station options of almost \$17 million is substantial for a short extension. This results from the need for additional train, track switches, and more complex controls. However, this additional cost may be off-set by the land value for the maintenance facility and land value increase around the end station. The Blue Line represents a compromise between alternatives with a cost over \$50 million.

**TABLE 3**  
**Order-of-Magnitude Monorail System Costs**

Description	Green Line Alternative				Yellow Line Alternative				Blue Line Alternative	
	End Station: Fremont Street Garage		End Station: Main Street Station		End Station: Fremont Street Garage		End Station: Main Street Station			
	MV1*	Mark IV**	MV1*	Mark IV**	MV1*	Mark IV**	MV1*	Mark IV**	MV1*	Mark IV**
Guideway	15.1	15.1	20.5	Not Recommended	15.0	15.0	19.8	Not Recommended	17.8	17.8
Stations	3.6	3.6	5.4		3.6	3.6	5.4		3.6	3.6
Trains	7.8	8.0	11.5		7.8	8.0	11.5		7.8	8.0
Systemwide	5.3	3.9	7.2		5.3	3.9	7.0		6.3	4.7
Maint. Facility/Equipment	2.2	2.2	2.6		2.2	2.2	2.6		2.2	2.2
Running Costs	1.5	1.5	1.7		1.5	1.5	1.7		1.6	1.6
Miscellaneous	2.0	2.0	2.3		2.0	2.0	2.3		2.1	2.1
Design/Engineering	2.5	2.5	3.0		2.5	2.5	3.0		2.5	2.5
<b>Subtotal:</b>	40.0	38.8	54.2		39.9	38.7	53.3		43.9	42.5
Pre-Start up: 3%	1.2	1.2	1.6		1.2	1.2	1.6		1.3	1.3
Contingency: 15%	6.2	6.0	8.4	6.2	6.0	8.2	6.8	6.6		
<b>Total:</b>	47.4	46.0	64.2	47.3	45.8	63.1	52.0	50.3		

*Notes:*

\* Or equivalent

\*\* Refurbished

## **Revenues**

Monorail investment costs should not be taken out of a potential system revenue context. There are three distinctive revenues types. The first source is derived directly from the Monorail System, the second is from added revenues to the casino operations coming from additional visitors attracted by the monorail system, and the third is an intangible enhancement of the properties and surrounding areas.

Sponsorship revenue has been calculated based upon the estimated range of revenues per a study prepared for MGM Grand at \$318,000. The amount of advertising will have to be determined by corporate policies and marketing strategies of the consortium. This may require joint decisions in the case of on-board advertising (TV monitors, interior and exterior advertising displays) or individual decisions in the case of advertising at stations. We performed an analysis of potential advertising revenues (\$400,000) which are based on advertising rates on transit stations and trains in California. We considered a variety of advertising options including: backlit square panels; backlit concourse and platform posters of various sizes; cards, LED scrolling system and video advertising on large flat screens.

We projected a total of \$718,000.- non-fare collection revenue. We projected total annual revenues of the proposed monorail as follows (sample calculation for the Green Line Alternative with the end station at the Main Street Station Hotel/Casino):

<u>Fare Level</u>	<u>Daily Passengers</u>	<u>Annual Fare Collection Revenue</u>	<u>Total Annual Revenue</u>
Free Ride	25,600	None	\$718,000.-
\$1	23,040	\$8,409,600.-	\$9,127,600.-
\$2	12,800	\$9,344,000.-	\$10,062,000.-
\$3	5,120	\$5,606,400.-	\$6,324,400.-

In addition to fare collection, a system of surcharges could be incorporated into the parking and/or room fees to further enhance the financial return schedule.

Further, we estimated an approximate monetary value of each additional captured visitor resulting from monorail implementation. The total amount each visitor spends while in Las Vegas is \$505, excluding gaming spending. In 1995, the total gaming revenues in Clark County were \$5.7 billion which, divided by 29 million visitors, equals \$197 in gaming expenditures per visitor. The average length of stay is 3.1 nights. This results in expenditures of \$163 per visitor per day for lodging, restaurants, local transportation, entertainment, miscellaneous and \$66 per visitor per day on gambling. We established \$30 per day for meals and \$20 for entertainment is realistic. As a result, an average visitor has \$116 per day to offer to the Stratosphere and Boyd Gaming casinos. To be conservative, let's further assume, that this average visitor may spend 70% of his/her daily allowance at the "strip" (high concentration/probability), 15% at the Stratosphere, and 15% at Downtown properties which results in \$17.

We established that the additional daily casino/entertainment patronage attracted by the monorail at the end stations is 5,263 visitors or 38% of the projected average of 13,850 visitors per day. Accordingly, we calculated the following additional average revenues which apply to all alternatives:

<u>Fare Level</u>	<u>Additional Daily Visitors</u>	<u>Additional Annual Revenue</u>
Free Ride	5,263	\$32,656,915.-
For \$1	4,737	\$29,393,085.-
For \$2	2,632	\$16,331,560.-
For \$3	1,053	\$6,533,865.-

We projected the total revenues generated by the implementation of the monorail as follows (sample calculation for the Green Line Alternative with the end station at the Main Street Station Hotel/Casino):

<u>Fare Level</u>	<u>Total Annual Projected Revenue</u>
Free Ride	\$33,374,915.-
\$1	\$38,520,685.-
\$2	\$26,393,560.-
\$3	\$12,858,265.-

Due to the similar projection levels for the Stratosphere Complex and Downtown properties, we can assume that approximately 1/2 of the above amounts will be collected by Stratosphere Corporation and the other half will be split between the Downtown properties with the Boyd Gaming having more properties than other companies. It clearly appears that the \$1 fare options make the most economic sense. In addition, charging a fee will discourage undesired riders from constantly riding on the monorail system.

There are several additional potential contributors to the overall revenues. Among them are land value increases, hotel room value increases, image enhancement, and other. All these contributors will be further enhanced with continuing extensions of the monorail. Our analysis does not take into account additional patronage to be generated by the monorail if it is extended to the “strip”, convention center, and to the planned stadium.

The projected annual revenue needs to take into consideration the annual operation and maintenance cost. We assumed an annual Operation and Maintenance expenditure of \$2.7 million per year with an 8% cost escalation factor. The adjusted annual revenue for the \$1 fare for a sample Green Line Alternative with the end station at the Main Street Station Hotel/Casino is **\$35.8 million**.

### **Necessary Investment**

Based on the very attractive revenue projections and the overall image and magnitude-of-the project regardless of either Mark IV or M VI technology selection, we recommend to eliminate the Mark IV technology alternative resulting from minimal savings, inadequate image, and added liability risks.

We allow an additional \$5 million for the three stations and \$3.3 million for the two station options for integration of stations into casinos and various beautification measures along the guideway, unforeseen utility relocation, legal, public relation, marketing, and lobbying costs, engineering fees, and numerous other related expenses. The capital cost of building the monorail system based on the M VI technology for a sample Green Line Alternative with the end station at the Main Street Station Hotel/Casino is **\$69.2** million.

The implementation of a custom built monorail in a urban environment presents an array of risks, including schedule, hardware, cost overrun, liability, conflict of interest, long term commitment and exposure, and other. It is difficult to assign any specific tangible value to these risks; however, they have to be taken into consideration during the entire decision making process.

Order-of-Magnitude Return on Investment

We tabulated our findings to determine financial surplus/deficit (financial commitment versus return on investment). Table 4 presents the order-of-magnitude net present value (NPV) analysis at year end for the next 10 years and discounted to the base year. We considered a 10% discount rate for our analysis which is based on an associated financial risk for guideway transit, the cost of money, inflation, and other concerns. A small margin is included to cover necessary fees and disbursements. We realize that the project participants may be able to improve this rate based on their leveraged “borrowing power”.

**TABLE 4**  
Return on Investment Analysis

Alternatives:	Net Present Value at Year End										Return on Investment
	1	2	3	4	5	6	7	8	9	10	
Green Line Alternative with the end station at the Fremont Street Experience	(\$4.61)	(\$21.37)	(\$40.42)	(\$16.44)	\$5.35	\$25.17	\$43.18	\$59.55	\$74.44	\$87.97	174%
Green Line Alternative with the end station at the Main Street Station Hotel/Casino	(\$6.29)	(\$29.17)	(\$55.16)	(\$30.71)	(\$8.48)	(\$11.73)	\$30.10	\$46.80	\$61.98	\$75.78	110%
Yellow Line Alternative with the end station at the Fremont Street Experience	(\$4.60)	(\$21.33)	(\$40.34)	(\$16.36)	\$5.43	\$25.25	\$43.26	\$59.63	\$74.52	\$88.05	174%
Yellow Line Alternative with the end station at the Main Street Station Hotel/Casino	(\$6.19)	(\$28.70)	(\$54.29)	(\$29.83)	(\$7.60)	\$12.60	\$30.97	\$47.68	\$62.86	\$76.66	113%
Blue Line Alternative with the end station at the Main Street	(\$5.03)	(\$23.31)	(\$44.08)	(\$20.18)	\$1.56	\$21.31	\$39.27	\$55.60	\$70.44	\$83.94	152%

Notes: Figures are in Millions  
Assumed Discount Rate of 10.00%

Our analysis shows that the entire investment will be returned as follows for each alternative:

- Green Line Alternative with the end station at the Fremont Street Experience: **in the middle of the 8th year**
- Green Line Alternative with the end station at the Main Street Station Hotel/Casino: **in the middle of the 10th year**
- Yellow Line Alternative with the end station at the Fremont Street Experience: **in the middle of the 8th year**
- Yellow Line Alternative with the end station at the Main Street Station Hotel/Casino: **in the middle of the 10th year**
- Blue Line Alternative with the end station at Main Street: **at the end of the 8th year.**

The time interval necessary to realize the economic benefits of the system implementation is short and, therefore, uniquely attractive. The above high return on investment is generated from both monorail and additional casino revenues. In addition, this return will be divided accordingly to individual investments and subject to applicable taxes. We did not take into account any expenses to be incurred by casino operators resulting from an increased number of visitors (more staff and maintenance). This will marginally reduce the return on investment. However, this type of expenses are welcomed. In addition based on the life cycle cost analysis, we also projected project cash flow.

### **Conclusion: Sound and Balanced Investment**

Based on our purposely conservative analysis, we are pleased to report that it is advisable to expend the monies for the monorail. The Stratosphere Tower-Downtown monorail could rapidly become cost effective for participants. Its investment success will be determined by the substantial number of additional patrons captured by the project participants. To further support the above conclusions, we offer the following comparison. Stratosphere Corporation is investing over \$475 million in the Stratosphere Complex which will attract a projected 5 million visitors per year. The \$50 to \$68 million (\$59 average) capital investment in the monorail system is projected to result in an additional 1.8 million annual visitors (average). Of course, the second result would not be possible without the first one. Considering that 1.8 million is approximately 38% of 5 million visitors or represents a \$181 million investment based on \$475 million of the base capital investment, it clearly appears that \$59 million is a sound investment. Particularly that \$59 million may be shared among all project participants respectively.

The monorail project is definitely worth further immediate consideration. The monorail transit solution appears very promising in both solving passenger transportation needs along the study corridor as well as generating measurable profits for the project participants and the Downtown area in general. It will enhance the city's destination resort image, provide unparalleled visitor convenience, and eventually improve the transportation linkage with the rest of the "strip" and the Las Vegas Convention Center. It appears attainable in a short time frame without major technical constraints.