## Results of Benefit-Cost Analysis

The replacement of the bridge and reconfiguration of the railway segment is expected to cost approximately $21.3 million over 30 years. The initial capital investment is estimated to be approximately $21.2 million while incremental recurring operating and maintenance expenses associated with the second track are expected to be approximately $0.1 million over 30 years. PHA will provide $10.65 million in matching funds ($10.55 million for construction and $0.1 million in annual maintenance expenditures over 30 years), which will be funded through a contribution from PTRA. PTRA is also responsible for maintaining the new rail segment.

Completing the bridge replacement and reconfiguration of the railway track will provide significant economic benefits between $36.1 and $63.0 million, resulting in a benefit cost ratio of between 1.69 and 2.95, depending on the discount rate chosen (7 percent or 3 percent). The greatest benefits of the project are derived from the reduction in transportation costs due to the decrease in railroad delay and improvements to local air quality. Air quality improvements come from a reduction in the time that diesel locomotives idle on the track as well as the reduction in truck traffic enabled by the increase in capacity on the new double-track segment.

The project is also expected to create a number of direct, indirect, and induced jobs although these economic benefits are not reflected in the benefits value used for the benefit cost ratio calculation.

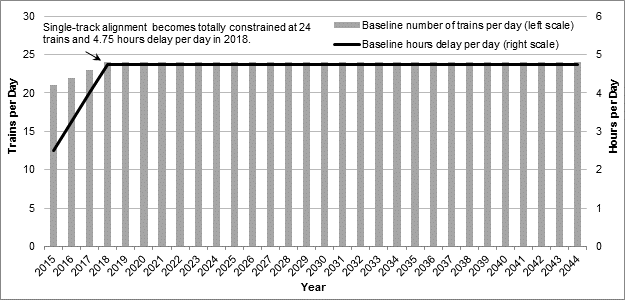
This section of the report provides an overview of the baseline conditions associated with the rail segment as well as the costs and benefits associated with replacing the Broadway Street Bridge and adding a second segment of track to the railroad alignment. The analysis covers a 30 year period, starting in 2015 when construction of the project is expected to occur.

### Baseline

The current single-track configuration on the Broadway Street Bridge is designed to accommodate 18 trains per day with no delay. Current utilization of the single-track segment, based on data collected by PTRA, is 21 trains per day and this number is expected to grow. These trains, on average, handle over 1,000 rail cars per day. The overutilization of the track is creating congestion in the corridor, which increases the cost of transportation by introducing delay into the network and lowers the local air quality by increasing harmful emissions. This section of the report describes the baseline, or no-investment scenario, for the single-track railroad segment bridge.

Data collected by the PTRA indicates that the existing single-track configuration creates 2.5 hours of delay per day for railroads operating on the segment. As freight shipments on the alignment are forecast to grow, delays are expected to become worse in the baseline scenario if no action is taken. Figure 2 displays baseline daily train traffic and delay estimates from 2015 to 2044. Note that in 2018, the rail alignment becomes completely constrained and accommodates 24 trains with 4.75 hours delay per day. Once the alignment becomes constrained, freight moving into and out of the Port will need to move by other means, including truck and other modes of transportation.

Figure : Baseline Daily Train Traffic and Delay



Source: PTRA data and PHA estimates

According to PTRA, the average cost of delay for railroads operating on the corridor is estimated to be $1,000 per hour. This cost includes expenditures associated with fuel, crew, and maintenance. In the absence of a second track, the baseline cost of delay is expected to reach between $21.5 and $33.4 M over a 30 year period. See Table 6.

Table : Baseline Cost of Delay

|  |  |  |
| --- | --- | --- |
|  | **30 Year Present Value** | |
| **Baseline Cost of Delay** | **Discounted at 7%** | **Discounted at 3%** |
| $21.5 million | $33.4 million |

Source: PTRA data and PHA estimates

Delays created by the “bottleneck” at the single-track segment prevent freight trains from operating in an optimal manner, resulting in increased fuel consumption and increased emissions. Emissions from diesel locomotive engines include particulate matter, volatile organic compounds, nitrogen oxide, sulfur dioxide, and carbon dioxide. Table 7 presents the cost of baseline emissions over a 30 year period.

Table : Baseline Cost of Emissions from Delayed Diesel Locomotives

|  |  |  |
| --- | --- | --- |
|  | **30 Year Present Value** | |
| **Baseline Cost of Emission from Delayed Diesel Locomotives** | **Discounted at 7%** | **Discounted at 3%** |
| $0.1 million | $0.1 million |

Source: PTRA data and PHA estimates

As shown in the figures above, the “bottleneck” created by the single-track rail configuration imposes significant costs on Port of Houston stakeholders. Investment to replace the bridge and bring a second track to the alignment will yield significant benefits.

### Benefits

When compared to the status quo, replacing the Broadway Street Bridge and adding a second track will yield significant economic benefits for the railroads, the Port, and the greater Houston region. Reductions in railroad delay will lower the cost of transportation and reduce pollutants that harm local air quality. Moreover, by increasing the capacity of the rail alignment, shippers will be able to ship more freight via train, which is a cleaner form of transportation compared with trucks. Table 8 provides an overview of the benefits of the investment.

Table : Benefit Summary

|  |  |  |  |
| --- | --- | --- | --- |
| **Benefit** | | **30-Year Present Value** | |
| **7%** | **3%** |
| 1 | Reduction in transportation costs due to reduced train delay | $20.55 million | $32.50 million |
| 2 | Reduction in diesel locomotive emissions due to reduced train delay | $0.09 million | $0.14 million |
| 3 | Reduction in truck emissions due to increased train capacity | $15.45 million | $30.34 million |
| **Total** | | **$36.09 million** | **$62.98 million** |

Source: PTRA Data and PHA estimates

#### Reduction in Train Delay

The construction of the new bridge and second track, which will accommodate up to 40 trains per day, will eliminate delay on the Broadway Street Bridge. If construction begins in 2015, then the alignment will become operational in 2016 and the cost of delay described in the baseline will be reduced to zero. This cost savings, which will provide significant value to stakeholders of the Port, is shown in Table 9.

Table : Savings from Reduction in Train Delay

|  |  |  |  |
| --- | --- | --- | --- |
|  | **30-Year Delay** | **30-Year Present Value Cost of Delay** | |
|  | **7%** | **3%** |
| **Baseline Scenario** | 50,370 Hours | $21.5 million | $33.4 million |
| **Investment Scenario** | 913 Hours | $0.9 million | $0.9 million |
| **Benefit (Savings)** | **49,458 Hours** | **$20.6 million** | **$32.5 million** |

Source: PTRA data and PHA estimates

When compared to the baseline, delays with the bridge and second track investment are reduced dramatically, reducing transportation costs for rail operators on the alignment.

#### Reduction in Diesel Locomotive Emissions

Reductions in delay on the track will lead to reductions in emissions as trains consume less fuel. As trains spend less time idling due to the addition of the second track, locomotives will emit less particulate matter, volatile organic compounds, nitrogen oxides, sulfur dioxide, and carbon dioxide. These pollutants impose a cost on society. To monetize the value of reducing these emissions, the PHA relied on research conducted by the National Highway Traffic Safety Administration (NHTSA). Table 10 compares emission on the alignment from diesel locomotives under the baseline and investment scenario.

Table : Savings from Reduction in Diesel Locomotive Emissions

|  |  |  |
| --- | --- | --- |
|  | **30-Year Present Value Cost of Emissions** | |
|  | **7%** | **3%** |
| **Baseline Scenario** | $0.1 million | $0.1 million |
| **Investment Scenario** | $0.0 million | $0.0 million |
| **Benefit (Savings)** | **$0.1 million** | **$0.1 million** |

Source: PTRA data and PHA estimates

#### Reduction in Emissions from Substitution of Train Shipments for Truck Shipments

The new double track will also allow shippers that utilize the POH to send more freight via rail. The substitution of rail transportation for truck transportation, in particular, will generate additional reductions in emissions as trains are more energy efficient than trucks on average. Based on PTRA data, the PHA estimates that 24 percent of the new freight train traffic enabled by the new alignment could have been shipped via truck without the investment. Moving that freight volume from trucks to trains will reduce emissions in the Houston area and improve local air quality.

Figure : Savings from Reduced Emissions from Substitution of Train for Truck Traffic

|  |  |  |
| --- | --- | --- |
|  | **30-Year Present Value Cost of Emissions** | |
|  | **7%** | **3%** |
| **Benefit (Savings)** | $15.5 million | $30.3 million |

#### Total Benefits

Combining the three types of benefits described above results in total benefits between $36.1 and $63.0 million over 30 years. Table 11 displays total monetized benefits over the period of analysis.

Table : Total Benefits

| **Benefit** | | **30-Year Present Value** | |
| --- | --- | --- | --- |
| **7%** | **3%** |
| 1 | Reduction in transportation costs due to reduced train delay | $20.55 million | $32.50 million |
| 2 | Reduction in diesel locomotive emissions due to reduced train delay | $0.09 million | $0.14 million |
| 3 | Reduction in truck emissions due to increased train capacity | $15.45 million | $30.34 million |
| **Total** | | **$36.09 million** | **$62.98 million** |

In addition to the monetized benefits displayed in Table 11, the project will produce ancillary benefits important to the economy of the region.

First and foremost, by expanding capacity and increasing the competitiveness of the POH, the Broadway Second Main Track Project is expected to generate jobs. As noted elsewhere in the report, the existing alignment accommodates over 1,000 rail cars per day; the cars include plastic pellet hoppers, tank cars, intermodal cars, coal hoppers, and others. Adding a second main line is projected to add capacity sufficient to handle the anticipated increase rail traffic throughput of 50 percent over the next 30 years. This yields an increase of 246,375 cars per year, which is expected to increase manufacturing and transportation jobs.

Additionally, construction of the project will generate jobs. In 2011, the Council of Economic Advisors estimated that every $76,923 in transportation infrastructure spending would equate to one job a year. The project, therefore, should yield significant employment benefits during construction.

### Costs

Construction costs for the project are estimated to be $21.2 million. The construction of the bridge and second track are expected to take less than one year to complete. Table 12 provides an overview of the capital costs of the project. A more detailed capital cost estimate is available as an attachment to the application.

Table : Project Capital Costs

| **Item** | | **Description** |  | **Expenditure** |
| --- | --- | --- | --- | --- |
| **1.0** | **Mobilization** | |  | **$1,344,952.36** |
| **2.0** | **Subgrade/Earthworks** | |  | **$1,366,253.60** |
| **3.0** | **Track Work** | |  | **$2,208,270.00** |
| **4.0** | **Signals** | |  | **$4,100,000.00** |
| **5.0** | **Miscellaneous** | |  | **$5,775,000.00** |
|  |  |  | **Subtotal** | **$14,794.475.96** |
| **6.0** | **Engineering Services** | |  | **$910,000.00** |
|  | 6.1 | Engineering Design | $310,000 |  |
|  | 6.2 | Engineering CM | $50,000 |  |
|  |  |  | Contingency | 35% |
|  |  |  | **Total** | **$21,201,042.55** |

In additional to the capital costs shown in Table 12, the second main track is expected to have operating and maintenance costs of approximate $8,000 per year or $0.1 million over 30 years. This amount was factored into the total cost of the project over the period of analysis.

Table : Total Project Costs

|  |  |  |
| --- | --- | --- |
|  | **30-Year Present Value Cost** | |
|  | **7%** | **3%** |
| **Capital Costs** | $21.2 million | $21.2 million |
| **Operating Costs** | $0.1 million | $0.1 million |
| **Total Costs** | **$21.3 million** | **$21.3 million** |

### Results of Analysis

Table 14 provides an overview of the economic merits of the project over a 30-year period.

Table : Summary of Project Economics

|  |  |  |
| --- | --- | --- |
|  | **30-Year Present Value** | |
|  | **7%** | **3%** |
| **Costs** | $21.30 million | $21.35 million |
| **Benefits** | $36.09 million | $62.98 million |
| **Net Present Value** | $14.79 million | $41.63 million |
| **Benefit Cost Ratio** | 1.69 | 2.95 |