

Honolulu High-Capacity Transit Corridor Project

Examination of Fixed Guideway Minimum Operable Segment (MOS) Options

January 29, 2007

City and County of Honolulu
Department of Transportation Services

Executive Summary

Ordinance 07-001 defines a Locally Preferred Alternative (LPA) for a fixed guideway transit system and authorized development of a minimum operable segment (MOS). Four alternative MOS options were examined that meet financial constraints and operational requirements:

- East Kapolei to Ala Moana Center, via Farrington Highway/Airport
- East Kapolei to Ala Moana Center, via North-South Road/Airport
- East Kapolei to Ala Moana Center, via Farrington Highway/Salt Lake Boulevard
- East Kapolei to Ala Moana Center, via North-South Road/Salt Lake Boulevard

Capital costs, transit vehicle requirements, operations and maintenance (O&M) costs, population and employment served, ridership, and cost-effectiveness were evaluated for the MOS options. The following table presents results for these key evaluation criteria.

| MOS | Capital Costs (millions of 2006 dollars) | Total O&M Cost¹ (millions of 2006 dollars) | Total 2030 Employees & Population (within 1/2 Mile of Stations) | Total 2030 Daily Transit Trips² | Cost-Effectiveness (Cost per User Benefit) ³ |
|----------------------------|--|---|---|---|---|
| Farrington Hwy – Airport | 3,547 | 262.03 | 543,200 | 279,800 | \$23.81 |
| North-South Rd – Airport | 3,584 | 262.58 | 549,600 | 283,500 | \$22.56 |
| Farrington Hwy – Salt Lake | 3,430 | 262.98 | 532,200 | 278,400 | \$24.13 |
| North-South Rd – Salt Lake | 3,467 | 264.65 | 538,600 | 282,000 | \$22.92 |

¹ Includes bus and fixed guideway O&M costs. Handi-Van O&M costs are not included.
² Includes bus and fixed guideway trips.
³ Cost-effectiveness threshold of “Medium” or higher rating is \$22.99/user benefit. Any proposed New Start project receiving less than a “Medium” rating for cost-effectiveness will not be recommended for funding by FTA.

The North-South Road/Airport option is recommended as the MOS for the following reasons:

- It serves the highest number of combined population and employees.
- It results in the highest level of both fixed guideway and total transit ridership.
- It avoids a number of construction difficulties which are associated with the Salt Lake MOSs.
- While it would have a higher initial project implementation cost as compared to the other MOS options it would best meet FTA’s threshold for receiving a necessary “Medium” or better cost-effectiveness rating which is needed to qualify for FTA’s recommendation for federal funding.

The alternative analyzed in the EIS includes the recommended MOS plus the following anticipated future extensions which are consistent with the overall Locally Preferred Alternative (LPA) selected by Council:

- Kalaeloa extension to West Kapolei
- Salt Lake Boulevard extension
- Waikīkī extension
- UH Mānoa extension

These extensions are included because they represent the most promising alignments beyond the MOS, and public input requested their inclusion.

Background

Ordinance 07-001 defines a Locally Preferred Alternative (LPA) for a fixed guideway transit system. Additionally, in regards to a minimum operable segment (MOS), the ordinance states:

“The city administration is authorized to proceed with preparation of an environmental impact statement for the locally preferred alternative (LPA), and with planning and preliminary engineering for that portion of the LPA (including any portion of any section of the LPA listed in section 2 above) that may be constructed within financial constraints (capital cost and any interest to finance that capital cost shall be paid entirely from general excise and use tax surcharge revenues, interest earned on the revenues, and any federal, state, or private revenues); provided that this portion shall constitute a minimum operable segment (MOS) for purposes of Federal New Starts funding eligibility; and provided further that the proposed MOS shall be subject to Council approval by resolution.”

The purpose of this report is to document the development and evaluation of various MOSs and identify the technically most feasible MOS. The financial constraint is assumed to be \$3.6 billion, in 2006 dollars, which is the upper amount specified in the financial analysis section of the *Honolulu High-Capacity Transit Corridor Project Alternatives Analysis Report*. It was determined that the western terminus of the MOS would need to be in the Kapolei area for the following reasons:

- The alignment would need to connect to a maintenance yard, and the two possible maintenance yard sites are just ‘Ewa of Leeward Community College, and on the mauka side of Farrington Highway between Fort Weaver Road and the future North-South Road;
- The terminus location would require ample space for a major bus interface as well as a substantial park-and-ride lot—only the areas out in Kapolei provide this space; and
- The Koko Head terminus needs to provide opportunity for substantial fixed guideway to bus transfers.

Based on these factors, and based on the full corridor options defined in Section 2 of the ordinance, the following four alternative MOS options have been identified and evaluated:

- Farrington Highway/Airport MOS: Beginning on Farrington Highway at Kapolei Golf Course Road – Farrington Highway/Kamehameha Highway/Aolele Street/Dillingham Boulevard/Halekauwila Street to Ala Moana Center. This MOS is 20.1 miles in length.
- North-South Road/Airport MOS: Beginning on North-South Road near the makai edge of the proposed UH West O‘ahu campus – North-South Road/Farrington Highway/Kamehameha Highway/Aolele Street/Dillingham Boulevard/Halekauwila Street to Ala Moana Center. This MOS is 20.4 miles in length.
- Farrington Highway/Salt Lake MOS: Beginning on Farrington Highway at Kapolei Golf Course Road – Farrington Highway/Kamehameha Highway/Salt Lake Boulevard/Dillingham Boulevard/Halekauwila Street to Ala Moana Center. This MOS is 19.4 miles in length.

- North-South Road/Salt Lake MOS: Beginning on North-South Road near the makai edge of the proposed UH West O‘ahu campus – North-South Road/Farrington Highway/ Kamehameha Highway/Salt Lake Boulevard/Dillingham Boulevard/Halekauwila Street to Ala Moana Center. This MOS is 19.7 miles in length.

Evaluation

These four MOSs were evaluated based on capital costs, transit vehicle requirements, operations and maintenance (O&M) costs, population and employment served, ridership, and cost-effectiveness.

Capital Cost Estimates

As shown below, the capital costs to implement a fixed guideway system for the four potential MOSs would range between approximately \$3.43 billion and \$3.58 billion, in 2006 dollars. The Farrington Highway/Salt Lake MOS is the shortest in length and would cost \$3.43 billion, while the North-South Road/Airport MOS is the longest in length and would be \$3.58 billion. All four MOSs are estimated to cost less than \$3.6 billion.

| MOS | Capital Costs (millions of 2006 dollars) |
|----------------------------|---|
| Farrington Hwy – Airport | 3,547 |
| North-South Rd – Airport | 3,584 |
| Farrington Hwy – Salt Lake | 3,430 |
| North-South Rd – Salt Lake | 3,467 |

Transit Vehicle Requirements

As shown below, the two Salt Lake MOSs would require more buses than the two Airport MOSs. This is because additional bus service is required to connect surrounding areas into the fixed guideway station. The fixed guideway vehicle requirements are also shown below.

| MOS | Buses | Fixed Guideway Vehicles |
|----------------------------|-------|-------------------------|
| Farrington Hwy – Airport | 612 | 68 |
| North-South Rd – Airport | 612 | 69 |
| Farrington Hwy – Salt Lake | 623 | 65 |
| North-South Rd – Salt Lake | 623 | 66 |

Estimated Year 2030 Annual Transit Operating and Maintenance Costs

As shown below, the North-South Road/Salt Lake MOS would have the highest transit O&M costs, in year 2030, of any of the alternatives. This is because of higher bus O&M costs due to the need for the additional bus service described above.

| MOS | Bus O&M Cost | Fixed Guideway O&M Cost (millions of 2006 dollars) | Total O&M Cost ¹ |
|----------------------------|-------------------------|--|--|
| Farrington Hwy – Airport | 201.17 | 60.86 | 262.03 |
| North-South Rd – Airport | 200.94 | 61.64 | 262.58 |
| Farrington Hwy – Salt Lake | 205.37 | 57.61 | 262.98 |
| North-South Rd – Salt Lake | 205.37 | 59.28 | 264.65 |

¹ Handi-Van O&M costs are not included.

Estimated Year 2030 Population and Employment Served

One criterion the Federal Transit Administration (FTA) uses to assess the potential effectiveness of a proposed fixed guideway system is the total amount of future population and employment near the proposed system. This is measured in terms of total projected population and employment within ½ mile of the proposed fixed guideway stations. These measurements are made at the detailed transportation analysis zone (TAZ) level. As an example, Attachment 1 shows the TAZs within a ½ mile radius of the Salt Lake and Airport area stations. Note that where a TAZ is only partially included within a ½ mile station radius, the population and employment numbers from the TAZ which are attributed to that station are apportioned accordingly.

As shown in the table below, the North-South Road/Airport MOS is projected to serve the most employees as a result of its proximity to the employment sites of Pearl Harbor, Hickam Air Force Base and the Airport; while the North-South Road/Salt Lake MOS, due to its proximity to the residential areas of the Salt Lake neighborhood, would serve the most population. In aggregate, the North-South Road/Airport MOS serves the highest number of combined employees and population of the four proposed MOSs. A more detailed breakdown of population and employees served by station is contained in Attachment 2 to this report.

| MOS | 2030 Population within ½ mile of Stations | 2030 Employees within ½ Mile of Stations | Total 2030 Employees and Population |
|----------------------------|--|---|--|
| Farrington Hwy – Airport | 208,300 | 334,900 | 543,200 |
| North-South Rd – Airport | 215,200 | 334,400 | 549,600 |
| Farrington Hwy – Salt Lake | 220,200 | 312,000 | 532,200 |
| North-South Rd – Salt Lake | 227,100 | 311,500 | 538,600 |

Estimated Year 2030 Daily Transit Ridership

As shown below, the North-South Road/Airport MOS would have the most total and fixed guideway transit trips of any of the MOSs. This is due to the better service it provides to the East Kapolei, ‘Ewa and ‘Ewa Beach communities, as well as to the employment centers of Pearl Harbor and the Airport.

| MOS | Fixed Guideway Trips | Total Transit Trips | Total Transit Boardings |
|----------------------------|----------------------------|---------------------------|----------------------------|
| Farrington Hwy – Airport | 90,600 | 279,800 | 449,600 |
| North-South Rd – Airport | 93,500 | 283,500 | 454,700 |
| Farrington Hwy – Salt Lake | 84,700 | 278,400 | 444,100 |
| North-South Rd – Salt Lake | 87,600 | 282,000 | 449,400 |

FTA Cost-Effectiveness Calculations – Transportation System Costs and Transit User Benefits Compared to TSM

Cost-effectiveness compared to the performance of the TSM Alternative is one of the required measures used by FTA in evaluating projects seeking New Starts funds. Any proposed New Start project receiving a “Medium-Low” or “Low” rating for cost-effectiveness will not be recommended for funding by FTA. As shown below, the North-South Road/Airport MOS would be the most cost-effective of the four MOS options, i.e. lower cost per user benefit than the other MOSs. The two Farrington Highway MOSs are projected to have “medium-low” ratings and hence would not receive FTA’s recommendation.

| Measure | TSM Alternative | Farrington Hwy – Airport | | North-South Rd – Airport | | Farrington Hwy – Salt Lake | | North-South Rd – Salt Lake | |
|---|--------------------|-----------------------------|-------------------------|-----------------------------|-----------------------|-------------------------------|-------------------------|-------------------------------|-----------------------|
| | | Value | Incremental Change | Value | Incremental Change | Value | Incremental Change | Value | Incremental Change |
| Annualized Capital Cost (Millions of 2006 Dollars) | \$59.79 | \$308.59 | \$248.80 | \$311.13 | \$251.34 | \$300.56 | \$240.77 | \$303.27 | \$243.48 |
| Year 2030 Systemwide O&M Cost (Millions of 2006 Dollars) | \$234.16 | \$262.03 | \$27.87 | \$262.58 | \$28.42 | \$262.98 | \$28.82 | \$264.65 | \$30.49 |
| Total 2030 Annualized Cost (Millions of 2006 Dollars) | \$293.95 | \$570.62 | \$276.67 | \$573.71 | \$279.76 | \$563.54 | \$269.59 | \$567.92 | \$273.97 |
| Year 2030 Incremental User Benefits (Hours of Benefit) | | | 11,620,500 | | 12,398,000 | | 11,173,800 | | 11,951,000 |
| Cost-Effectiveness (Cost per User Benefit) ¹ | | | \$23.81 | | \$22.56 | | \$24.13 | | \$22.92 |
| FTA Cost-Effectiveness Rating | N/A | N/A | Medium-Low ² | N/A | Medium | N/A | Medium-Low ² | N/A | Medium |

N/A = Not Applicable. Transit user benefits are calculated relative to the performance of the TSM Alternative.

¹ Cost-effectiveness threshold of “Medium” or higher rating is \$22.99/user benefit.

² Any proposed New Start project receiving a “Medium-Low” or “Low” rating for cost-effectiveness will not be recommended for funding by FTA.

Other Considerations

Another factor to consider when assessing the potential MOSs is input from affected agencies. The State of Hawaii Department of Transportation Airports Division has indicated a preference for a North-South Road/Airport MOS because it directly serves the Honolulu International Airport and is closest to the Kalaeloa Airport in Kapolei.

Additional considerations include the following:

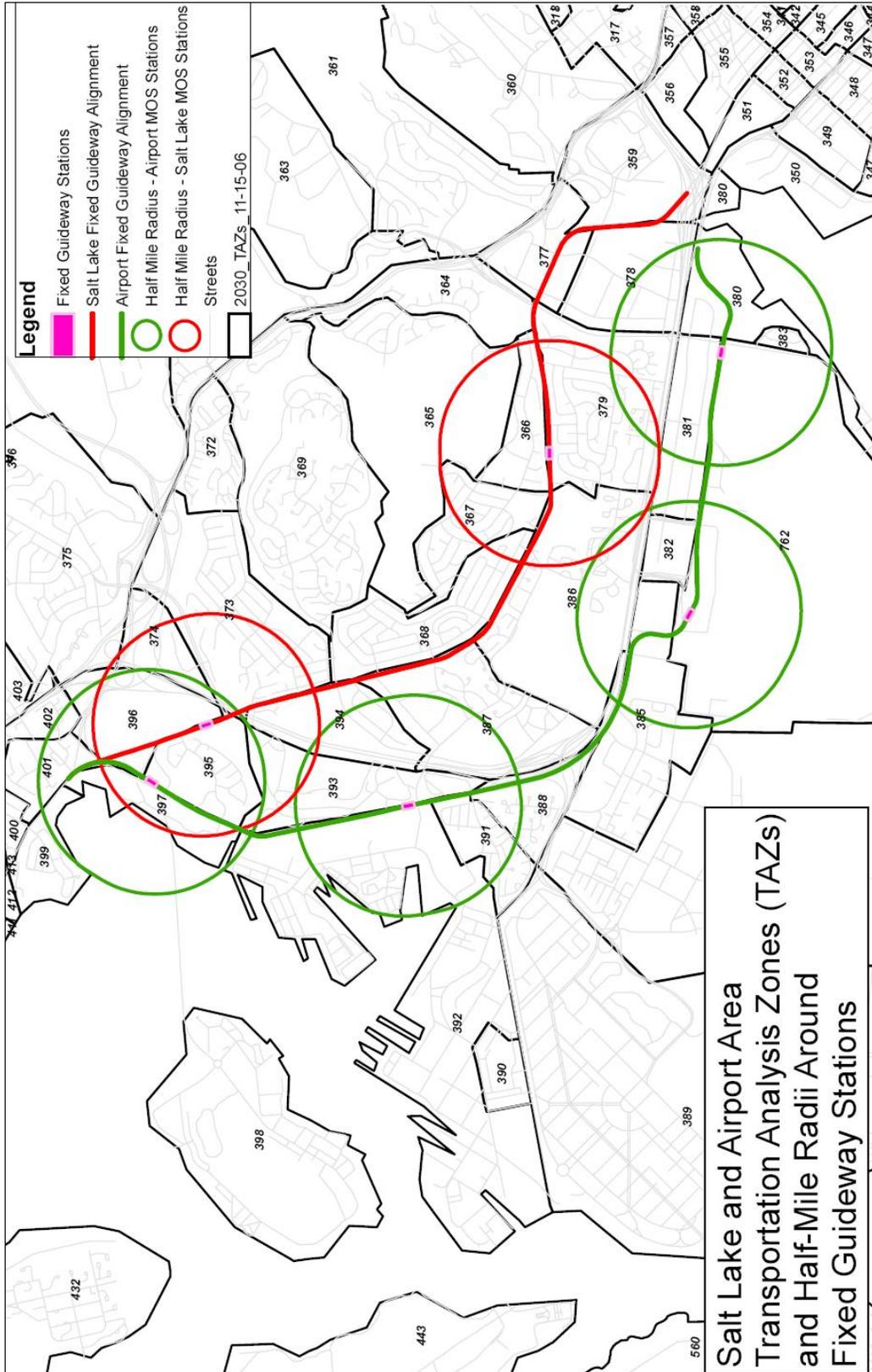
- The Salt Lake MOSs require passing through US Army property (Fort Shafter) on the Koko Head side of Moanalua Stream. The ability to acquire the necessary right-of-way from the Army is uncertain, and the coordination time required to do so is anticipated to be significant.
- If the MOS were altered to avoid Fort Shafter property and traverse the ‘Ewa side of Moanalua Stream, it would affect five additional property parcels.
- The crossing of the Ke‘ehi Interchange required by the Salt Lake MOSs imposes added difficulty due to:
 - The increased elevation of the fixed guideway required to cross the interchange.
 - The multiple freeway ramps in close proximity to each other which could restrict movement of construction equipment.
- The geological conditions along Moanalua Stream are poor, including weak soil foundation material.

Conclusions and Recommendation

The North-South Road/Airport MOS (see Attachment 3) is recommended as the preferred MOS. This alignment serves the highest number of combined population and employees, and results in the highest level of both fixed guideway and total transit ridership. It also does not involve a number of construction difficulties associated with the Salt Lake MOSs, i.e., requiring right-of-way from Fort Shafter, constructing on top of the unstable soils along Moanalua Stream, and crossing the Ke‘ehi Interchange from the mauka side.

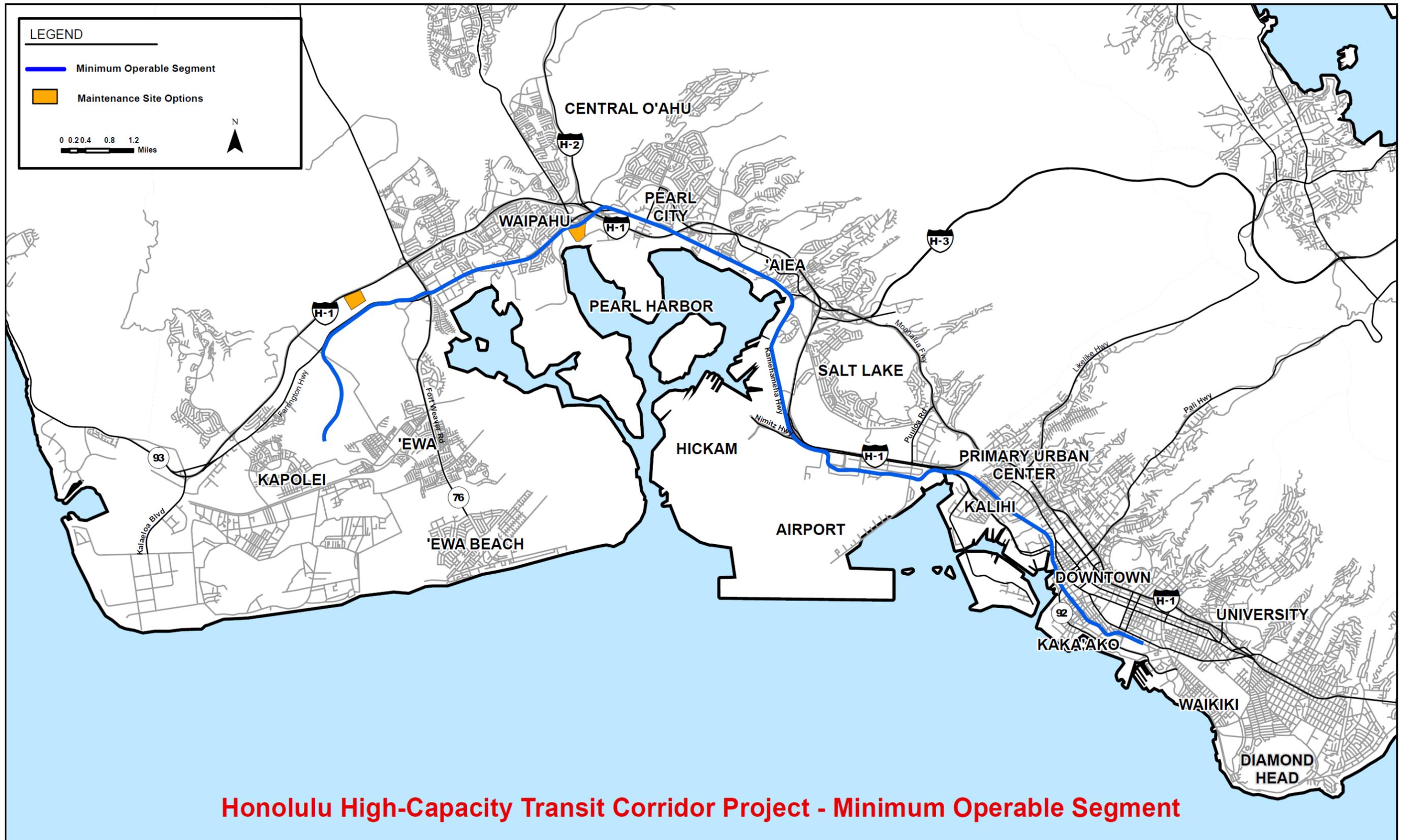
While the North-South Road/Airport MOS would have a higher initial project implementation cost as compared to the other MOS options, O&M costs would be lower and, most importantly, it would meet FTA’s under-\$23 threshold for receiving a necessary “Medium” or better cost-effectiveness rating. It is critical to receive this rating in order to qualify as the FTA’s recommended project for funding.

Attachment 1: Map of Transportation Analysis Zones (TAZs) and 1/2 Mile Radii Around Stations in the Salt Lake and Airport Areas



Attachment 2: Year 2030 Population and Employment within ½ mile of Stations by Station and by MOS Option

| Station | MOS Alignment Option | | | | | | | |
|--|----------------------------|-----------------|----------------------------|-----------------|------------------------------|-----------------|------------------------------|-----------------|
| | Farrington Highway-Airport | | North-South Road - Airport | | Farrington Highway-Salt Lake | | North-South Road - Salt Lake | |
| | 2030 Jobs | 2030 Population | 2030 Jobs | 2030 Population | 2030 Jobs | 2030 Population | 2030 Jobs | 2030 Population |
| UH West O'ahu at Farrington Highway | 1,800 | 4,000 | | | 1,800 | 4,000 | | |
| Farrington Highway near North-South Road | 2,600 | 5,600 | | | 2,600 | 5,600 | | |
| UH West O'ahu Makai | | | 2,000 | 7,300 | | | 2,000 | 7,300 |
| UH West O'ahu at Farrington Highway | | | 1,900 | 9,200 | | | 1,900 | 9,200 |
| Farrington Highway Koko Head of North-South Road | 1,600 | 8,400 | 1,600 | 8,400 | 1,600 | 8,400 | 1,600 | 8,400 |
| Farrington Highway at Leoku Street | 4,100 | 7,600 | 4,100 | 7,600 | 4,100 | 7,600 | 4,100 | 7,600 |
| Farrington Highway at Mokuola Street | 2,800 | 7,700 | 2,800 | 7,700 | 2,800 | 7,700 | 2,800 | 7,700 |
| Leeward Community College | 1,200 | 3,300 | 1,200 | 3,300 | 1,200 | 3,300 | 1,200 | 3,300 |
| Kamehameha Highway at Kuala Street | 4,300 | 4,100 | 4,300 | 4,100 | 4,300 | 4,100 | 4,300 | 4,100 |
| Kamehameha Highway at Kaonohi Street | 7,600 | 5,800 | 7,600 | 5,800 | 7,600 | 5,800 | 7,600 | 5,800 |
| Aloha Stadium | 1,100 | 4,300 | 1,100 | 4,300 | | | | |
| Kamehameha Highway at Radford Drive | 5,200 | 1,100 | 5,200 | 1,100 | | | | |
| Honolulu International Airport | 12,600 | 1,300 | 12,600 | 1,300 | | | | |
| Aolele Street at Lagoon Drive | 8,900 | 900 | 8,900 | 900 | | | | |
| Salt Lake Boulevard at Kahuapa'ani Street | | | | | 3,600 | 5,700 | 3,600 | 5,700 |
| Salt Lake Boulevard at Ala Nioi Place | | | | | 1,300 | 13,800 | 1,300 | 13,800 |
| Dillingham Boulevard at Middle Street Transit Center | 9,800 | 4,900 | 9,800 | 4,900 | 9,800 | 4,900 | 9,800 | 4,900 |
| Dillingham Boulevard at Mokauea Street | 13,800 | 14,100 | 13,800 | 14,100 | 13,800 | 14,100 | 13,800 | 14,100 |
| Dillingham Boulevard at Kokea Street | 16,600 | 9,300 | 16,600 | 9,300 | 16,600 | 9,300 | 16,600 | 9,300 |
| Ka'aahi Street | 24,500 | 24,000 | 24,500 | 24,000 | 24,500 | 24,000 | 24,500 | 24,000 |
| Nimitz Highway at Kekaulike Street | 46,600 | 21,500 | 46,600 | 21,500 | 46,600 | 21,500 | 46,600 | 21,500 |
| Nimitz Highway at Fort Street | 52,400 | 14,800 | 52,400 | 14,800 | 52,400 | 14,800 | 52,400 | 14,800 |
| Halekauwila Street at South Street | 49,800 | 19,300 | 49,800 | 19,300 | 49,800 | 19,300 | 49,800 | 19,300 |
| Halekauwila Street at Ward Street | 31,800 | 23,900 | 31,800 | 23,900 | 31,800 | 23,900 | 31,800 | 23,900 |
| Ala Moana Center | 35,800 | 22,400 | 35,800 | 22,400 | 35,800 | 22,400 | 35,800 | 22,400 |
| Total | 334,900 | 208,300 | 334,400 | 215,200 | 312,000 | 220,200 | 311,500 | 227,100 |



Attachment 3: Recommended MOS

Minimum Operable Segment (MOS) Options
 Honolulu High-Capacity Transit Corridor