

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #12 Ane Keohokalole Hwy / Kealakehe Pkwy

Cycle (sec): 100 Critical Vol./Cap.(X): 0.583
Loss Time (sec): 0 (Y+R=4.0 sec) Average Delay (sec/veh): 15.0
Optimal Cycle: 35 Level Of Service: B

Table with columns for Street Name, Approach, Movement, Control, Rights, Min. Green, and Lanes. Rows include Ane Keohokalole Hwy and Kealakehe Pkwy with North, South, East, and West bounds.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume. Rows include Ane Keohokalole Hwy and Kealakehe Pkwy.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat. Rows include Ane Keohokalole Hwy and Kealakehe Pkwy.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ. Rows include Ane Keohokalole Hwy and Kealakehe Pkwy.

Note: Queue reported is the number of cars per lane.

CUMULATIVE PLUS PROJECT CONDITIONS WITH MITIGATION – CONCEPT B

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Intersection #3 Kamakaeha Ave / Palani Rd

Cycle (sec): 100 Critical Vol./Cap.(X): 0.582
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 4.9
Optimal Cycle: 42 Level Of Service: A

Table with columns for Street Name (Kamakaeha Ave, Palani Rd), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control (Permitted), Rights (Include, Ignore), and Lanes.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #4 Henry St / Palani Rd

Cycle (sec): 100 Critical Vol./Cap.(X): 0.899
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 36.8
Optimal Cycle: 97 Level Of Service: D

Table with columns for Street Name (Henry St, Palani Rd), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control (Permitted, Prot+Permit), Rights (Ovl, Include), Min. Green, and Lanes.

Volume Module: Table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume.

Saturation Flow Module: Table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat.

Capacity Analysis Module: Table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #7 Ane Keohokahole/Main Gate

Cycle (sec): 100 Critical Vol./Cap.(X): 0.687
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 21.0
Optimal Cycle: 52 Level Of Service: C

Table with columns: Street Name, Approach, Movement, Control, Rights, Min. Green, Lanes. Rows include Ane Keohokahole Hwy and Main Gate with various movement and control details.

Volume Module: Table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, Final Volume. Rows include Ane Keohokahole Hwy and Main Gate.

Saturation Flow Module: Table with columns for Sat/Lane, Adjustment, Lanes, Final Sat. Rows include Ane Keohokahole Hwy and Main Gate.

Capacity Analysis Module: Table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, HCM2kAvgQ. Rows include Ane Keohokahole Hwy and Main Gate.

Note: Queue reported is the number of cars per lane.

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Intersection #8 Palihioolo St/Palani Rd

Cycle (sec): 100 Critical Vol./Cap.(X): 0.984
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 33.5
Optimal Cycle: 175 Level Of Service: C

Table with columns for Street Name (Palihioolo St, Palani Rd), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control, Rights, Min. Green, and Lanes.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #10 Palani Rd / Uluaoa St

Cycle (sec): 100 Critical Vol./Cap.(X): 0.759
Loss Time (sec): 0 (Y+R=4.0 sec) Average Delay (sec/veh): 13.8
Optimal Cycle: 60 Level Of Service: B

Table with columns for Street Name (Palani Rd, Uluaoa St), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control (Permitted), Rights (Include), Min. Green, and Lanes.

Table for Volume Module showing Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume across various movements.

Table for Saturation Flow Module showing Sat/Lane, Adjustment, Lanes, and Final Sat. values.

Table for Capacity Analysis Module showing Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #12 Ane Keohokalole Hwy / Kealakehe Pkwy

Cycle (sec): 100 Critical Vol./Cap.(X): 0.760
Loss Time (sec): 0 (Y+R=4.0 sec) Average Delay (sec/veh): 20.2
Optimal Cycle: 60 Level Of Service: C

Table with columns for Street Name, Approach, Movement, Control, Rights, Min. Green, and Lanes. Rows include Ane Keohokalole Hwy and Kealakehe Pkwy with North, South, East, and West bounds.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume. Rows include Ane Keohokalole Hwy and Kealakehe Pkwy.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat. Rows include Ane Keohokalole Hwy and Kealakehe Pkwy.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ. Rows include Ane Keohokalole Hwy and Kealakehe Pkwy.

Note: Queue reported is the number of cars per lane.

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Intersection #3 Kamakaeha Ave / Palani Rd

Cycle (sec): 100 Critical Vol./Cap.(X): 0.669
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 10.3
Optimal Cycle: 50 Level Of Service: B

Table with columns for Street Name (Kamakaeha Ave, Palani Rd), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control (Permitted), Rights (Include, Ignore), and Lanes.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #4 Henry St / Palani Rd

Cycle (sec): 100 Critical Vol./Cap.(X): 1.009
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 40.6
Optimal Cycle: 180 Level Of Service: D

Table with columns for Street Name (Henry St, Palani Rd), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control (Permitted, Prot+Permit), Rights (Ovl, Include), and Lanes.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #7 Ane Keohokahole/Main Gate

Cycle (sec): 100 Critical Vol./Cap.(X): 0.679
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 18.6
Optimal Cycle: 51 Level Of Service: B

Table with columns: Street Name, Approach, Movement, Control, Rights, Min. Green, Lanes. Rows include Ane Keohokahole Hwy and Main Gate with North, South, East, and West bound movements.

Volume Module: Table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, Final Volume across various movement categories.

Saturation Flow Module: Table with columns for Sat/Lane, Adjustment, Lanes, Final Sat. across various movement categories.

Capacity Analysis Module: Table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, HCM2kAvgQ across various movement categories.

Note: Queue reported is the number of cars per lane.

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Intersection #8 Paliholo St/Palani Rd

Cycle (sec): 100 Critical Vol./Cap.(X): 1.045
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 44.9
Optimal Cycle: 180 Level Of Service: D

Table with columns for Street Name (Paliholo St, Palani Rd), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control, Rights, Min. Green, and Lanes.

Table for Volume Module showing Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume across various movements.

Table for Saturation Flow Module showing Sat/Lane, Adjustment, Lanes, and Final Sat. for each movement.

Table for Capacity Analysis Module showing Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #10 Palani Rd / Uluaoa St

Cycle (sec): 100 Critical Vol./Cap.(X): 0.746
Loss Time (sec): 0 (Y+R=4.0 sec) Average Delay (sec/veh): 4.8
Optimal Cycle: 57 Level Of Service: A

Table with columns for Street Name (Palani Rd, Uluaoa St), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control (Permitted), Rights (Include), Min. Green, and Lanes.

Table for Volume Module showing Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume across various movements.

Table for Saturation Flow Module showing Sat/Lane, Adjustment, Lanes, and Final Sat. values.

Table for Capacity Analysis Module showing Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #12 Ane Keohokalole Hwy / Kealakehe Pkwy

Cycle (sec): 100 Critical Vol./Cap.(X): 0.634
Loss Time (sec): 0 (Y+R=4.0 sec) Average Delay (sec/veh): 16.1
Optimal Cycle: 39 Level Of Service: B

Table with columns for Street Name, Approach, Movement, Control, Rights, Min. Green, and Lanes. Rows include Ane Keohokalole Hwy and Kealakehe Pkwy with North, South, East, and West bounds.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume. Rows include Ane Keohokalole Hwy and Kealakehe Pkwy.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat. Rows include Ane Keohokalole Hwy and Kealakehe Pkwy.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ. Rows include Ane Keohokalole Hwy and Kealakehe Pkwy.

Note: Queue reported is the number of cars per lane.

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Intersection #3 Kamakaeha Ave / Palani Rd

Cycle (sec): 100 Critical Vol./Cap.(X): 0.589
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 5.0
Optimal Cycle: 43 Level Of Service: A

Table with columns for Street Name (Kamakaeha Ave, Palani Rd), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control, Rights, Min. Green, and Lanes.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #4 Henry St / Palani Rd

Cycle (sec): 100 Critical Vol./Cap.(X): 0.923
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 38.7
Optimal Cycle: 109 Level Of Service: D

Table with columns for Street Name (Henry St, Palani Rd), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control (Permitted, Prot+Permit), Rights (Ovl, Include), Min. Green, and Lanes.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #7 Ane Keohokahole/Main Gate

Cycle (sec): 100 Critical Vol./Cap.(X): 0.718
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 22.4
Optimal Cycle: 57 Level Of Service: C

Table with columns: Street Name, Approach, Movement, Control, Rights, Min. Green, Lanes. Rows include North Bound, South Bound, East Bound, West Bound movements and their respective controls and lane configurations.

Volume Module: Table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, Final Volume. Rows represent different traffic movements and their volume adjustments.

Saturation Flow Module: Table with columns for Sat/Lane, Adjustment, Lanes, Final Sat. Rows show saturation flow rates and adjustments for each movement.

Capacity Analysis Module: Table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, HCM2kAvgQ. Rows provide detailed capacity and delay analysis for each movement.

Note: Queue reported is the number of cars per lane.

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Intersection #8 Palihioolo St/Palani Rd

Cycle (sec): 100 Critical Vol./Cap.(X): 0.983
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 33.3
Optimal Cycle: 174 Level Of Service: C

Table with columns for Street Name (Palihioolo St, Palani Rd), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control, Rights, Min. Green, and Lanes.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #10 Palani Rd / Uluaoa St

Cycle (sec): 100 Critical Vol./Cap.(X): 0.758
Loss Time (sec): 0 (Y+R=4.0 sec) Average Delay (sec/veh): 13.8
Optimal Cycle: 60 Level Of Service: B

Table with columns for Street Name (Palani Rd, Uluaoa St), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control (Permitted), Rights (Include), Min. Green, and Lanes.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #12 Ane Keohokalole Hwy / Kealakehe Pkwy

Cycle (sec): 100 Critical Vol./Cap.(X): 0.779
Loss Time (sec): 0 (Y+R=4.0 sec) Average Delay (sec/veh): 20.6
Optimal Cycle: 65 Level Of Service: C

Table with columns for Street Name, Approach, Movement, Control, Rights, Min. Green, and Lanes. Rows include Ane Keohokalole Hwy and Kealakehe Pkwy with North, South, East, and West bound movements.

Volume Module table showing Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume for various movements.

Saturation Flow Module table showing Sat/Lane, Adjustment, Lanes, and Final Sat. for various movements.

Capacity Analysis Module table showing Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ for various movements.

Note: Queue reported is the number of cars per lane.

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Intersection #3 Kamakaeha Ave / Palani Rd

Cycle (sec): 100 Critical Vol./Cap.(X): 0.670
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 10.3
Optimal Cycle: 50 Level Of Service: B

Table with columns for Street Name (Kamakaeha Ave, Palani Rd), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control (Permitted), Rights (Include, Ignore), and Lanes.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #4 Henry St / Palani Rd

Cycle (sec): 100 Critical Vol./Cap.(X): 1.014
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 41.6
Optimal Cycle: 180 Level Of Service: D

Table with columns for Street Name (Henry St, Palani Rd), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control (Permitted, Prot+Permit), Rights (Ovl, Include), Min. Green, and Lanes.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #7 Ane Keohokahole/Main Gate

Cycle (sec): 100 Critical Vol./Cap.(X): 0.706
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 18.9
Optimal Cycle: 55 Level Of Service: B

Table with columns for Street Name, Approach, Movement, Control, Rights, Min. Green, and Lanes. Rows include North Bound, South Bound, East Bound, and West Bound movements.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume. Rows list various volume and adjustment factors.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat. Rows show saturation flow rates and adjustments.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ. Rows provide detailed capacity and delay analysis.

Note: Queue reported is the number of cars per lane.

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Intersection #8 Palihioolo St/Palani Rd

Cycle (sec): 100 Critical Vol./Cap.(X): 1.048
Loss Time (sec): 10 (Y+R=4.0 sec) Average Delay (sec/veh): 45.6
Optimal Cycle: 180 Level Of Service: D

Table with columns for Street Name (Palihioolo St, Palani Rd), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control, Rights, Min. Green, and Lanes.

Volume Module: Table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume.

Saturation Flow Module: Table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat.

Capacity Analysis Module: Table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #10 Palani Rd / Uluaoa St

Cycle (sec): 100 Critical Vol./Cap.(X): 0.749
Loss Time (sec): 0 (Y+R=4.0 sec) Average Delay (sec/veh): 4.9
Optimal Cycle: 57 Level Of Service: A

Table with columns for Street Name (Palani Rd, Uluaoa St), Approach (North Bound, South Bound, East Bound, West Bound), Movement (L, T, R), Control (Permitted), Rights (Include), Min. Green, and Lanes.

Volume Module table with columns for Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume.

Saturation Flow Module table with columns for Sat/Lane, Adjustment, Lanes, and Final Sat.

Capacity Analysis Module table with columns for Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

Note: Queue reported is the number of cars per lane.

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Intersection #12 Ane Keohokalole Hwy / Kealakehe Pkwy

Cycle (sec): 100 Critical Vol./Cap.(X): 0.640
Loss Time (sec): 0 (Y+R=4.0 sec) Average Delay (sec/veh): 16.3
Optimal Cycle: 40 Level Of Service: B

Table with columns for Street Name, Approach, Movement, Control, Rights, Min. Green, and Lanes. Rows include Ane Keohokalole Hwy (North/South Bound) and Kealakehe Pkwy (East/West Bound).

Volume Module:

Table showing traffic volume metrics: Base Vol, Growth Adj, Initial Bse, User Adj, PHF Adj, PHF Volume, Reduct Vol, Reduced Vol, PCE Adj, MLF Adj, and Final Volume.

Saturation Flow Module:

Table showing saturation flow metrics: Sat/Lane, Adjustment, Lanes, and Final Sat.

Capacity Analysis Module:

Table showing capacity analysis metrics: Vol/Sat, Crit Moves, Green/Cycle, Volume/Cap, Uniform Del, IncremntDel, InitQueuDel, Delay Adj, Delay/Veh, User DelAdj, AdjDel/Veh, LOS by Move, and HCM2kAvgQ.

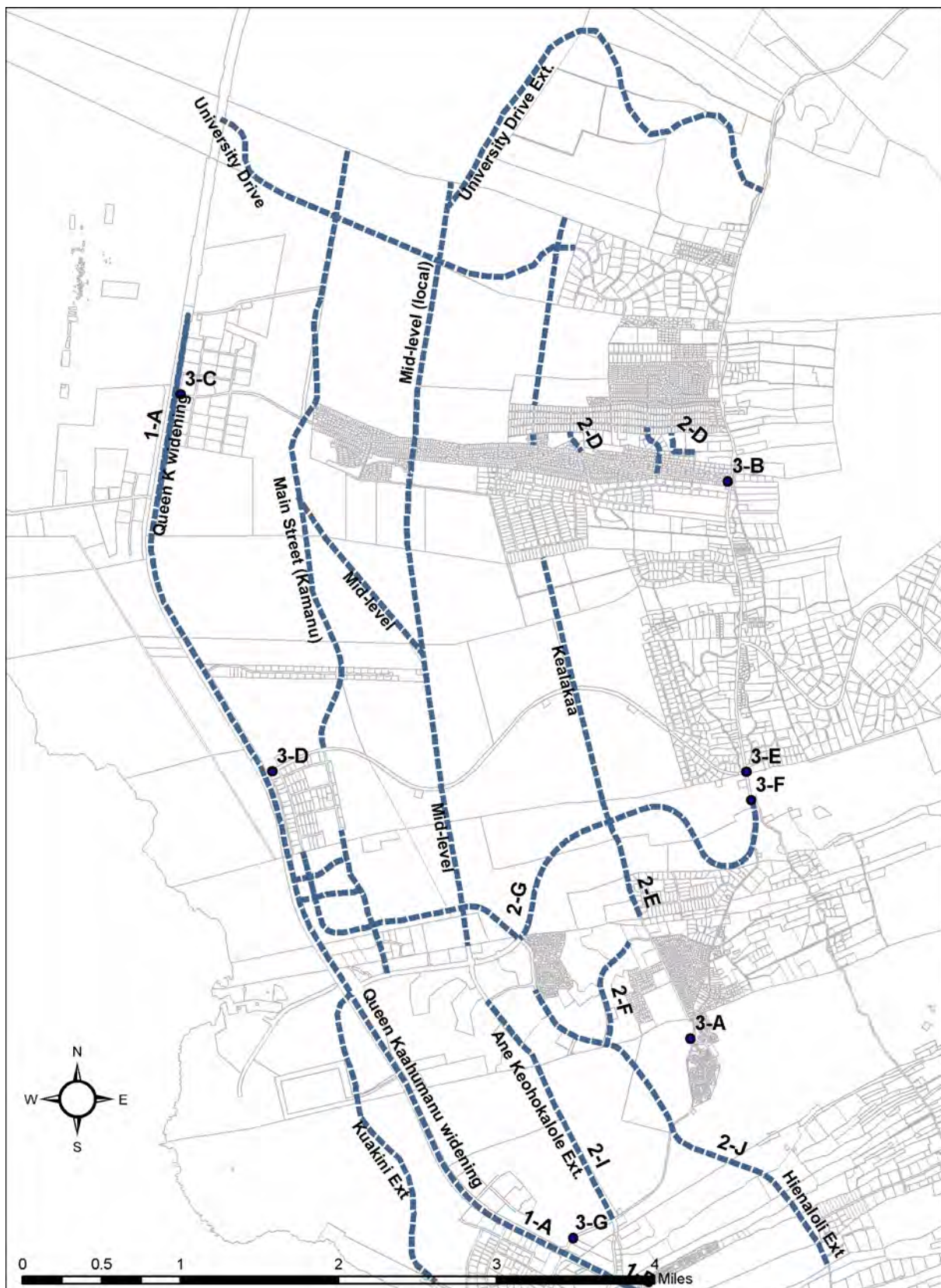
Note: Queue reported is the number of cars per lane.

APPENDIX D

EXCERPTS FROM

***KEAHOLE TO HONAUNAU REGIONAL CIRCULATION PLAN
COUNTY ACTION PLAN
(County of Hawaii Planning Department, August 14, 2006)***

FIGURE 4. Projects Map-- North of Palani Road



- Funding/Status: private

1-A Kuakini Highway improvements. The purpose of this improvement is to widen this road from 2 to 4 lanes to improve the traffic flow in downtown Kailua-Kona, as well as add sidewalks and bicycle lanes. The project will be done in two phases: Phase I (Palani to Hualalai) and Phase II (Hualalai to Alii Parkway). Eventually, there will be a Phase III widening from Alii Parkway to the Hawaii Belt Road.

- Lead Responsible: Department of Public Works

- Funding/Status

- Phase I :

- Planning/Design: Completed.

- Construction: STIP 2004-06 80% federal-aid (\$10.4M) and 20% County CIP (\$2.6M). Construction underway with estimated completion in October 2006.

- Phase II:

- Planning: STIP 2004-06 (\$0.33M total, \$0.24M Federal, \$0.306M County). Underway.

- Design: STIP 2004-06 \$0.5M County

- Construction: Estimated \$5M, not programmed

4.1.2 Strategy #2: Improve connectivity with a road network that spreads the traffic rather than funneling all the traffic to the major arterials.

2-A Lako Street Extension. The extension of Lako Street would provide a mauka-makai connection from Kuakini Highway to Alii Highway to Alii Drive. Lako Street will serve as the northern terminus of the Alii Highway Southern Phase.

- Lead Responsible: County Department of Public Works

- Funding/Status

- Planning: EA completed, but stuck in litigation

- Design/ROW: CIP appropriated, but cannot start until litigation resolved

- Construction: CIP appropriated

2-B Lako Street Mauka Connection. Mauka of Kuakini Highway, a private developer is constructing a connection of Lako Street to complete a continuous route from Kuakini to Hualalai.

- Lead Responsible: Private developer

- Funding/Status

- Planning/Design/ROW: Completed; privately funded

- Construction: Privately funded. Estimated completion is September 2006.

2-C Laaloa Avenue Extension. The extension of Laaloa Avenue would provide another mauka-makai connection from Kuakini Highway to Alii Highway to Alii Drive. Besides improving overall traffic circulation, these mauka-makai connectors provide alternative evacuation routes from coastal areas. A private developer is funding the preliminary engineering and EA in satisfaction of rezoning and SMA permit conditions.

- Lead Responsible: County Department of Public Works

- Funding/Status

- Planning: Private developer

- Design/ROW/Construction: County CIP appropriated (\$3.6 million), with County commitment for additional funding as needed to complete construction

2-D Kalaoa Connector Roads. Between two major subdivisions in Kalaoa (Kona Palisades and Coastview), internal roads extend to the subdivision boundaries in anticipation of connection, but have never been connected, thereby forcing traffic onto Mamalahoa Highway. Through a combination of private development and County action, four connections will be established to Kaiminani Drive: Nana-Holoholo, Ahiahi-Kauhale, Holu-Keokeo, and Iiili-Kiekie.

- Lead Responsible: County Department of Public Works

- Funding/Status

- Planning/ROW: Condemnation is necessary for Ahiahi-Kauhale, Holu-Keokeo, and Iiili-Kiekie. Appraisals and title reports have been completed. Awaiting resolution of condemnation issues. Fair share contribution funds are being used to fund this phase.

- Design/ROW/Construction: Nana/Holoholo has been completed by a private developer, dedicated to the County, and opened. Appropriated \$0.5 million CIP funds to design and construct Ahiahi-Kauhale. Holu-Keokeo is an existing road that meets County standards. A private developer will construct Iiili-Kiekie.

2-E Kealakaa Street Extension. The extension of Kealakaa Street would connect to Kealakehe Parkway (as extended, see 2-G below), Hina Lani Street, and Holoholo Street thereby providing an essential link to the Kealakehe elementary, middle, and high school without having to use the main highways (Mamalahoa, Palani, and Queen Kaahumanu).

- Lead Responsible: Planning Department (planning phase)

- Funding/Status

- Planning: The Planning Department has been holding meetings with the affected landowners to determine available information, potential alternative alignments, and issues. The Planning Department will procure a consultant for project coordination and environmental studies. CIP funds have been appropriated (\$1.5 million).

- Design/ROW: Funding sources to be determined upon negotiations with affected landowners.

- Construction: Funding sources to be determined upon negotiations with affected landowners.

2-F Keanalehu/Manawalea Street Extension. The connection of Manawalea to Keanalehu would provide another link between the Kealakehe elementary, middle and high schools for the residents of Laiopua and Kealakehe (in the vicinity of the elementary and middle schools). These roads are nearly “construction-ready” since the EIS has been completed, and the design is almost complete. The County will advance the funds and DHHL will reimburse the County its proportionate share.

- Lead Responsible: County Department of Public Works (with Department of Hawaiian Home Lands)

- Funding/Status

- Planning: Completed.

- Design/ROW/Construction: Design is 80% complete, with estimated bid date of February 2007. DHHL will convey (by license) the rights-of-way to the County. The County will use appropriated CIP funds to complete design (\$0.5 million).

- Construction: The County has appropriated \$7.6M.

2-G Kealakehe Parkway Extension (to Kealakaa). Kealakehe Parkway, a State road, currently dead-ends just mauka of Kealakehe High School. The connection of the parkway to the extended Kealakaa Street would complete a vital link to enable traffic to flow from Hina Lani to Queen Kaahumanu.

- Lead Responsible: DOT

- Funding/Status

- Planning: The EIS has been completed.

- Design/ROW: 2006-08 STIP HS-20, Design (\$0.5 million), Right-of-Way (\$1 million)

- Construction: Not programmed.

2-H Kamanu Street Extension. Kamanu Street currently dead-ends in Kaloko Industrial Park just mauka of Costco. This project will extend Kamanu to connect with Kealakehe Parkway. As a north-south road parallel to Queen Kaahumanu Highway, Kamanu Street will partially relieve Queen Kaahumanu of some traffic for that segment.

- Lead Responsible: County Department of Public Works

- Funding/Status

- Planning: EIS complete (by private landowner)

- Design/ROW: Currently underway by private developer as fulfillment of rezoning condition

- Construction: County will advance funds with proportionate reimbursement by landowner. Appropriated CIP funds available (\$3 million), with County commitment to supplement as necessary.

2-I Ane Keohokalole Extension (aka Henry Street Extension or Mid-Level Road). This project will extend Henry Street from Palani Road to the existing terminus of Ane Keohokalole makai of Kealakehe High School. The 2006 State legislature appropriated \$6 million for this project. Once constructed, this road will enable someone to drive from Kailua Village to the Kaloko Industrial Park via Henry Street and the Kamanu Street Extension, without having to drive on Queen Kaahumanu Highway.

- Lead Responsible: Planning Department (planning phase), Department of Public Works (design and construction)

- Funding/Status

- Planning/Design/ROW: \$6M State CIP funds appropriated.

- Construction: Not programmed.

2-J Hienaloli Street Extension. This project will extend Hienaloli Street to connect with Palani Road. At the intersection with Palani, the motorist will have a choice to turn onto Palani or to continue straight through onto the extended Keanalehu Street. Keanalehu Street will eventually connect with the planned Mid-Level Road. The ultimate plan is to enable residents in the area mauka of Kuakini and south of Palani to access Palani Road, Kealakehe High School, Kaloko Industrial Park, and eventually the West Hawaii University campus and the airport without having to load onto Kuakini or Queen Kaahumanu.

- Lead Responsible: Planning Department (planning phase)
- Funding/Status
 - Planning: CIP funds appropriated ((\$1.7 million) for preliminary engineering and environmental studies.
 - Design/ROW: Not programmed.
 - Construction: Not programmed.

2-K Nani Kailua Extension. The existing makai terminus of Nani Kailua Drive is Hualalai Road. There are two segments to extend this road to Alii Drive: Hualalai to Kuakini, (mauka segment), and Hualalai to Alii Drive (makai segment). The proposed extension would connect Nani Kailua to Alii Drive to provide another mauka-makai route closer to Kailua Village. The initial priority is to construct the makai segment.

- Lead Responsible: Planning Department (planning phase); DPW (makai segment design and construction phases)
- Funding/Status
 - Planning/ROW/Design: CIP-appropriated funds (\$1.5 million) (makai segment)
 - Construction: Construction funding to be determined among County and private parties.

2-L Puapuanui Street. This road is entirely privately funded and will provide a more direct mauka-makai connector (compared to Hualalai) from the mauka segments of Hualalai Road to Queen Kaahumanu through the Pualani Estates subdivision. A traffic signal at that intersection will enable crossing Queen Kaahumanu through a proposed commercial area to connect with Kuakini.

- Lead Responsible: Private
- Funding/Status
 - Planning/Design/Construction: Private. Mauka segment from Queen Kaahumanu to Hualalai nearly complete.

4.1.3 Strategy #3: Use existing roadways more efficiently by improving traffic flow and turning movements.

3-A Palani Street Safety Improvments. This project will realign Kealakaa to intersect Palani Road at Palihilo Street to create a new and safer signalized intersection.

- Lead Responsible: County Department of Public Works
- Funding/Status
 - Planning/Design/Construction: CIP funds (\$1 million) with federal matching (\$4 million); EA and design nearly complete. Estimated construction start is March 2007.

3-B Kaiminani right turn lane to Mamalahoa Highway. The right turn lane improvements will increase the capacity of that intersection.

- Lead Responsible: County Department of Public Works
- Funding/Status
 - Planning/Design/Construction: Design and construction inhouse by DPW staff. Awaiting utility relocation by HELCO and Oceanic to complete construction, with estimated completion in June 2007.

3-C Kaiminani right turn lane to Queen Kaahumanu Highway

- Lead Responsible: County Department of Public Works
- Funding/Status
 - Planning/Design/Construction: Design completed inhouse by DPW staff. CIP funds of \$0.4 million appropriated for construction.

3-D Hina Lani right turn lane to Queen Kaahumanu Highway. This improvement will increase the capacity of this intersection.

- Lead Responsible: County Department of Public Works
- Funding/Status
 - Planning/Design/Construction: Design and construction completed inhouse by DPW staff.

3-E Traffic signal at Hina Lani/Mamalaho. This traffic signal will improve the safety of left turns at this intersection.

- Lead Responsible: County Department of Public Works
- Funding/Status
 - Planning/Design/Construction: Design completed inhouse by DPW staff. CIP funds of \$0.3 million appropriated for construction. Construction completed in June 2006.

3-F Palani Junction left turn pocket to Mamalaho Highway. This project will provide capacity improvements by allowing makai-bound traffic to flow more efficiently through this intersection.

- Lead Responsible: County Department of Public Works
- Funding/Status
 - Planning/Design/Construction: Design completed inhouse by DPW staff. CIP funds of \$1 million appropriated for construction. Estimated completion by November 2006.

3-G Palani left turn pocket to Kamakaeha. This project will provide capacity improvements to mauka-bound traffic on Palani Road.

- Lead Responsible: County Department of Public Works
- Funding/Status
 - Planning/Design/Construction: Design completed inhouse by DPW staff. CIP funds of \$1 million appropriated for construction. Estimated construction start by January 2007 and estimated completion by January 2008.

3-H Mamalaho Highway, Honalo to Captain Cook. The County will consult and work closely with the community to develop workable solutions. Suggested improvements to date include left turn pockets, peak-period onstreet parking restrictions, designated bus stop pull-outs, County parking lot, coordination of traffic signal timing, park & ride facility, and roundabouts.

- Lead Responsible: County Department of Public Works
- Funding/Status
 - Planning/Design/Construction: CIP funds of \$12 million appropriated for design, right-of-way acquisition, and construction.

APPENDIX E

SIGNAL WARRANT ANALYSIS

**TRAFFIC SIGNAL WARRANTS
 FOUR HOUR VEHICULAR VOLUME (MUTCD Warrant 2, Caltrans Warrant 9)
 PEAK HOUR VEHICULAR VOLUME (MUTCD Warrant 3, Caltrans Warrant 11)**

| | | | |
|---|------------|---|------------|
| Major Street: Palani Road Minor Street: Kamakaeha Avenue Scenario: FUTURE(CUM+PROJ: CONCEPT A) WEEKDAY - P.M. PEAK HOUR (2020) Urban/Rural: u (U=urban, R=rural [a]) | | | |
| FOUR HOUR VOLUME (MUTCD Warrant 2, Caltrans Warrant 9) | | | |
| Number of Lanes on Each Approach | | | |
| Major Street: | 1 | | |
| Minor Street: | 2 | | |
| Vehicles Per Hour (4th Highest Hour) | | | |
| Major Street (Approach 1): | 760 | Major Street Left Turn (see note [b]): | 0 |
| Major Street (Approach 2): | <u>525</u> | Minor Street (Higher Volume App.): | <u>162</u> |
| Major Street Total (Both Approaches): | 1,285 | Minor Street Total: | 162 |
| Minimum Volume on Major Street to Satisfy Warrant (see note [c]): | 390 | Minimum Volume on Minor Street to Satisfy Warrant (see note [c]): | 115 |
| FOUR HOUR VOLUME WARRANT SATISFIED? | | YES | |
| PEAK HOUR VOLUME (MUTCD Warrant 3, Caltrans Warrant 11) | | | |
| Number of Lanes on Each Approach | | | |
| Major Street: | 1 | | |
| Minor Street: | 2 | | |
| Vehicles Per Hour (Peak Hour) | | | |
| Major Street (Approach 1): | 894 | Major Street Left Turn (see note [b]): | 0 |
| Major Street (Approach 2): | <u>618</u> | Minor Street (Higher Volume App.): | <u>190</u> |
| Major Street Total (Both Approaches): | 1,512 | Minor Street Total: | 190 |
| Minimum Volume on Major Street to Satisfy Warrant (see note [d]): | 510 | Minimum Volume on Minor Street to Satisfy Warrant (see note [d]): | 150 |
| PEAK HOUR VOLUME WARRANT SATISFIED? | | YES | |

Notes:

- a. May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000.
- b. Heavier left-turn movement from the major street may be included with minor street volume if a separate signal phase is proposed for left-turn movements.
- c. From: USDOT, FHWA, "Manual on Uniform Traffic Control Devices," 2001, Figure 4C-1.
- d. From: USDOT, FHWA, "Manual on Uniform Traffic Control Devices," 2001, Figure 4C-3.

Adopted from: U.S. Department of Transportation, Federal Highway Administration, "Manual on Uniform Traffic Control Devices, Millennium Edition," 2001; and Caltrans, "Traffic Manual," 2002.

**TRAFFIC SIGNAL WARRANTS
 FOUR HOUR VEHICULAR VOLUME (MUTCD Warrant 2, Caltrans Warrant 9)
 PEAK HOUR VEHICULAR VOLUME (MUTCD Warrant 3, Caltrans Warrant 11)**

| | | | |
|---|------------|---|------------|
| Major Street: ANE KEOHOKALOLE HIGHWAY | | | |
| Minor Street: MAJOR SITE ACCESSS ROAD | | | |
| Scenario: FUTURE(CUM+PROJ: CONCEPT A) WEEKDAY - A.M. PEAK HOUR (2020) | | | |
| Urban/Rural: U (U=urban, R=rural [a]) | | | |
| FOUR HOUR VOLUME (MUTCD Warrant 2, Caltrans Warrant 9) | | | |
| Number of Lanes on Each Approach | | | |
| Major Street: | 2 | | |
| Minor Street: | 2 | | |
| Vehicles Per Hour (4th Highest Hour) | | | |
| Major Street (Approach 1): | 527 | Major Street Left Turn (see note [b]): | 161 |
| Major Street (Approach 2): | <u>380</u> | Minor Street (Higher Volume App.): | <u>209</u> |
| Major Street Total (Both Approaches): | 907 | Minor Street Total: | 370 |
| Minimum Volume on Major Street to Satisfy Warrant (see note [c]): | 470 | Minimum Volume on Minor Street to Satisfy Warrant (see note [c]): | 230 |
| FOUR HOUR VOLUME WARRANT SATISFIED? | | YES | |
| PEAK HOUR VOLUME (MUTCD Warrant 3, Caltrans Warrant 11) | | | |
| Number of Lanes on Each Approach | | | |
| Major Street: | 2 | | |
| Minor Street: | 2 | | |
| Vehicles Per Hour (Peak Hour) | | | |
| Major Street (Approach 1): | 620 | Major Street Left Turn (see note [b]): | 189 |
| Major Street (Approach 2): | <u>447</u> | Minor Street (Higher Volume App.): | <u>246</u> |
| Major Street Total (Both Approaches): | 1,067 | Minor Street Total: | 435 |
| Minimum Volume on Major Street to Satisfy Warrant (see note [d]): | 620 | Minimum Volume on Minor Street to Satisfy Warrant (see note [d]): | 340 |
| PEAK HOUR VOLUME WARRANT SATISFIED? | | YES | |

Notes:

- a. May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000.
- b. Heavier left-turn movement from the major street may be included with minor street volume if a separate signal phase is proposed for left-turn movements.
- c. From: USDOT, FHWA, "Manual on Uniform Traffic Control Devices," 2001, Figure 4C-1.
- d. From: USDOT, FHWA, "Manual on Uniform Traffic Control Devices," 2001, Figure 4C-3.

Adopted from: U.S. Department of Transportation, Federal Highway Administration, "Manual on Uniform Traffic Control Devices, Millennium Edition," 2001; and Caltrans, "Traffic Manual," 2002.

**TRAFFIC SIGNAL WARRANTS
 FOUR HOUR VEHICULAR VOLUME (MUTCD Warrant 2, Caltrans Warrant 9)
 PEAK HOUR VEHICULAR VOLUME (MUTCD Warrant 3, Caltrans Warrant 11)**

| | | | |
|---|------------|---|------------|
| Major Street: ULUAOA STREET | | | |
| Minor Street: PALANI ROAD | | | |
| Scenario: FUTURE(CUM+PROJ: CONCEPT A) WEEKDAY - P.M. PEAK HOUR (2020) | | | |
| Urban/Rural: u (U=urban, R=rural [a]) | | | |
| FOUR HOUR VOLUME (MUTCD Warrant 2, Caltrans Warrant 9) | | | |
| Number of Lanes on Each Approach | | | |
| Major Street: | 1 | | |
| Minor Street: | 1 | | |
| Vehicles Per Hour (4th Highest Hour) | | | |
| Major Street (Approach 1): | 865 | Major Street Left Turn (see note [b]): | 25 |
| Major Street (Approach 2): | <u>629</u> | Minor Street (Higher Volume App.): | <u>170</u> |
| Major Street Total (Both Approaches): | 1,494 | Minor Street Total: | 195 |
| Minimum Volume on Major Street to Satisfy Warrant (see note [c]): | 380 | Minimum Volume on Minor Street to Satisfy Warrant (see note [c]): | 80 |
| FOUR HOUR VOLUME WARRANT SATISFIED? | | YES | |
| PEAK HOUR VOLUME (MUTCD Warrant 3, Caltrans Warrant 11) | | | |
| Number of Lanes on Each Approach | | | |
| Major Street: | 1 | | |
| Minor Street: | 1 | | |
| Vehicles Per Hour (Peak Hour) | | | |
| Major Street (Approach 1): | 1,018 | Major Street Left Turn (see note [b]): | 29 |
| Major Street (Approach 2): | <u>740</u> | Minor Street (Higher Volume App.): | <u>200</u> |
| Major Street Total (Both Approaches): | 1,758 | Minor Street Total: | 229 |
| Minimum Volume on Major Street to Satisfy Warrant (see note [d]): | 450 | Minimum Volume on Minor Street to Satisfy Warrant (see note [d]): | 100 |
| PEAK HOUR VOLUME WARRANT SATISFIED? | | YES | |

Notes:

- a. May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000.
- b. Heavier left-turn movement from the major street may be included with minor street volume if a separate signal phase is proposed for left-turn movements.
- c. From: USDOT, FHWA, "Manual on Uniform Traffic Control Devices," 2001, Figure 4C-1.
- d. From: USDOT, FHWA, "Manual on Uniform Traffic Control Devices," 2001, Figure 4C-3.

Adopted from: U.S. Department of Transportation, Federal Highway Administration, "Manual on Uniform Traffic Control Devices, Millennium Edition," 2001; and Caltrans, "Traffic Manual," 2002.

**TRAFFIC SIGNAL WARRANTS
 FOUR HOUR VEHICULAR VOLUME (MUTCD Warrant 2, Caltrans Warrant 9)
 PEAK HOUR VEHICULAR VOLUME (MUTCD Warrant 3, Caltrans Warrant 11)**

| | | | |
|---|------------|---|------------|
| Major Street: KEALAKEHE PARKWAY | | | |
| Minor Street: ANE KEOHOKALOLE HIGHWAY | | | |
| Scenario: FUTURE(CUM+PROJ: CONCEPT A) WEEKDAY - A.M. PEAK HOUR (2020) | | | |
| Urban/Rural: U (U=urban, R=rural [a]) | | | |
| FOUR HOUR VOLUME (MUTCD Warrant 2, Caltrans Warrant 9) | | | |
| Number of Lanes on Each Approach | | | |
| Major Street: | 3 | | |
| Minor Street: | 3 | | |
| Vehicles Per Hour (4th Highest Hour) | | | |
| Major Street (Approach 1): | 342 | Major Street Left Turn (see note [b]): | 198 |
| Major Street (Approach 2): | <u>304</u> | Minor Street (Higher Volume App.): | <u>382</u> |
| Major Street Total (Both Approaches): | 646 | Minor Street Total: | 580 |
| Minimum Volume on Major Street to Satisfy Warrant (see note [c]): | 470 | Minimum Volume on Minor Street to Satisfy Warrant (see note [c]): | 360 |
| FOUR HOUR VOLUME WARRANT SATISFIED? | | YES | |
| PEAK HOUR VOLUME (MUTCD Warrant 3, Caltrans Warrant 11) | | | |
| Number of Lanes on Each Approach | | | |
| Major Street: | 3 | | |
| Minor Street: | 3 | | |
| Vehicles Per Hour (Peak Hour) | | | |
| Major Street (Approach 1): | 402 | Major Street Left Turn (see note [b]): | 233 |
| Major Street (Approach 2): | <u>358</u> | Minor Street (Higher Volume App.): | <u>449</u> |
| Major Street Total (Both Approaches): | 760 | Minor Street Total: | 682 |
| Minimum Volume on Major Street to Satisfy Warrant (see note [d]): | 620 | Minimum Volume on Minor Street to Satisfy Warrant (see note [d]): | 500 |
| PEAK HOUR VOLUME WARRANT SATISFIED? | | YES | |

Notes:

- a. May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000.
- b. Heavier left-turn movement from the major street may be included with minor street volume if a separate signal phase is proposed for left-turn movements.
- c. From: USDOT, FHWA, "Manual on Uniform Traffic Control Devices," 2001, Figure 4C-1.
- d. From: USDOT, FHWA, "Manual on Uniform Traffic Control Devices," 2001, Figure 4C-3.

Adopted from: U.S. Department of Transportation, Federal Highway Administration, "Manual on Uniform Traffic Control Devices, Millennium Edition," 2001; and Caltrans, "Traffic Manual," 2002.

F-2
August 2008

TECHNICAL MEMORANDUM

Date: August 8, 2008

To: Lee Sichtler, Belt Collins

From: Netai Basu and Natalie Porter

Subject: *Planning Level Cost Estimates and Fair-Share Cost Contribution Calculations for Off-Site Mitigation Measures for the Keahuolu Affordable Housing Master Plan Project*

LA07-2145

The *Traffic Study for the Keahuolu Affordable Housing Master Plan North Kona, Island of Hawaii, Hawaii* (Fehr & Peers/Kaku Associates, January 2008), included as Appendix F to the *Keahuolu Affordable Housing Project Kailua-Kona, Hawaii Draft Environmental Impact Statement (DEIS)* (Belt Collins, February 2008), identified seven study intersections and three roadway segments that would be significantly impacted under cumulative plus project conditions in 2020. Analysis of an alternative future scenario, which assumed that the future street network in the vicinity of the project would be slightly more developed, was also conducted and is documented in a separate technical memorandum (*Analysis of an Alternative Future Scenario - Addendum to the Traffic Study for the Keahuolu Affordable Housing Master Plan, North Kona, Island of Hawaii, Hawaii* [Fehr & Peers, May 21, 2008]). Mitigation measures were developed for each location to achieve acceptable level of service conditions. Two of the three impacted street segments lie adjacent to impacted intersections on Palani Road (State Route [SR] 190) and the intersection-level mitigation measures would also mitigate the segment-level impacts there. Thus, the recommended improvement program includes improvements at seven intersections and one street segment. Each improvement is described below. The purpose of this technical memorandum is to document planning level cost estimates and the fair-share contribution calculations that have been prepared for each improvement.

INTERSECTIONS

- Intersection 3: Kamakaeha Avenue & Palani Road (SR 190) – Install traffic signal and interconnect/coordinate with adjacent intersections of Queen Kaahumanu Highway and Henry Street/Ane Keohokalole Highway.
- Intersection 4: Henry Street/Ane Keohokalole Highway & Palani Road (SR 190) – Widen makai-bound approach to provide two left-turn lanes, one through lane and one shared through/right-turn lane; widen the northbound approach to

- provide one left-turn lane, one through lane and one shared through/right-turn lane and construct the southbound approach with one left-turn lane, one through lane and one shared through/right-turn lane. A signal modification will be needed to accommodate the change in lane configurations.
- Intersection 5: Palani Road (SR 190) & Minor Site Access Road – Add makai-bound deceleration lane into the project site and a makai-bound acceleration lane out from the project, separated by a raised island to channelize traffic. A second makai-bound lane would be added to receive traffic exiting the project site.
 - Intersection 7: Ane Keohokalole Highway & Major Site Access Road – Install a traffic signal and have the future lane configuration provide one left-turn lane and one right-turn lane on the makai-bound approach, one through lane and one right-turn lane on the northbound approach, and one left-turn lane and one through lane on the southbound approach. Under the alternative future scenario, which assumed that the future street network in the vicinity of the project would be slightly more developed, the intersection would be signalized with a future lane configuration of one left-turn lane, one through lane and one right-turn lane on the northbound approach, one left-turn lane and one shared through/right-turn lane on the southbound approach and one left-turn lane and one shared through/right-turn lane on both the eastbound (mauka-bound) and westbound (makai-bound) approaches.
 - Intersection 8: Kealakaa Street/Pahilihoho Street & Palani Road (SR 190) – Widen Palani Road to provide one left-turn lane, one through lane and one shared through/right-turn lane on the southbound approach and two left-turn lanes and one shared through/right-turn lane on the northbound approach. The southbound departure would be widened to two lanes and merge into a single lane downstream of the intersection.
 - Intersection 10: Uluaoa Street & Palani Road (SR 190) – Install a traffic signal.
 - Intersection 12: Kealakehe Parkway & Ane Keohokalole Highway – Install a traffic signal.

ROADWAY SEGMENTS

- Roadway Segment 2: Palani Road (SR 190) makai (west) of Henry Street – Widen makai-direction to provide two lanes. This location lies between Intersections 3 and 4.
- Roadway Segment 3: Palani Road (SR 190) mauka (east) of Henry Street – Widen makai-direction to provide two lanes. This location lies between Intersections 4 and 5 and the improvements at those intersections described

above would provide an additional makai-bound lane on this segment of Palani Road.

- Roadway Segment 10: Palani Road (SR 190) south of Mamalahoa Highway – Widen southbound direction to provide two lanes between Mamalahoa Highway (State Route 180) and Hao Kuni Street.

Planning-level cost estimates have been prepared for the recommended improvements at each location. Where possible, the cost estimates included in the DEIS (*Appendix G Civil Infrastructure*) were used. Staff at the County of Hawaii Planning and Public Works Departments provided assistance in determining the appropriate parameters of these estimates.

General assumptions for the cost estimates include:

1. No utility conflicts, except for the power line relocation along Palani Road widening
2. Right-of-way costs were not included in the estimates
3. The improvements are constructible
4. Added travel lanes will be 12' wide, carried to the nearest upstream or downstream intersection as applicable
5. Palani Road (SR 190) will have 10' wide shoulders, but no sidewalks or curb & gutter
6. Mobilization is 5% of the roadwork construction costs
7. Traffic control is assumed to be 10% of the roadwork construction cost
8. Removing of existing striping and pavement legends will be by grinding (striping details as referenced are per State DOT Standard Plans)
9. Additional environmental documentation will be required for off-site improvements not covered in the EIS for this project or for the separate Ane Keohokalole Highway project. These costs were calculated as a percentage of the estimated construction costs where applicable
10. Cost estimates from Appendix G of the DEIS were used as a reference, as well as the updated *Civil Infrastructure, Keahuolu Affordable Housing Project*, dated June 2008 by Belt Collins Hawaii Ltd. for Hawaii Housing Finance & Development Corporation
11. Design speed was assumed to be 5 m.p.h. higher than the posted speed limit
12. All costs are in 2007 dollars to correlate with the DEIS

The specific parameters for each location are summarized below and detailed in Attachments A through G. Additional information and excerpts from Appendix G of the DEIS are included in Attachment H. Future lane configurations are shown in Attachment I.

Intersection 3: Kamakaeha Avenue & Palani Road (SR 190)

1. The existing lane configuration will be maintained.
2. Interconnect with the adjacent intersections include trenching & conduit.
3. Fog seal the intersection after signal installation.
4. The intersection will be re-stripped after signal installation.
5. The cost to prepare and file a simple environmental document for the construction was included at 10% of construction costs.
6. See Attachment A for cost summary.

Intersection 4: Henry Street/Ane Keohokalole Highway & Palani Road (SR 190)

1. The widening of the makai-bound direction will extend to Intersection 3 (Kamakaeha Avenue & Palani Road).
2. The costs of fog seal are included in the roadwork lump sum.
3. Additional signal modification and relocation of the loops will be required as additional lanes are added to mitigate the increase in traffic.
4. Remainder of construction of the approach westbound lanes is included.
5. Existing pavement is adequate and an overlay or restructure of existing pavement is not required.
6. The intersection will be re-stripped after the widening and signal modification.
7. The cost estimate of improvements on Ane Keohokalole Highway are a separate cost for a 40' wide road, as shown in Appendix G of the DEIS and the subsequent (June 2008) *Civil Infrastructure, Keahuolu Affordable Housing Project*. The cost of widening the roadway to a 60' cross-section is required.
8. See Attachment B for cost summary.

Intersection 5: Palani Road (SR 190) & Minor Site Access Road

1. The cost estimate for this improvement is drawn from Appendix G of the DEIS. No additional costs have been identified.

Intersection 7: Ane Keohokalole Highway & Major Site Access Road

1. The cost estimate of improvements on Ane Keohokalole Highway are a separate cost, as shown in Appendix G of the DEIS and the updated Belt Collins report. The additional 20' pavement width on Ane Keohokalole Highway for 300' on the north and south legs are included in this cost estimate.
2. The cost estimate for the makai bound approach (east leg of the intersection) is included in the on-site costs portion of the DEIS.
3. Based on the draft EIS analysis, the improvement needed at this location to achieve LOS D would signalize the intersection and result in one through lane and one right-turn lane on the northbound approach, one left-turn lane and one through lane on the southbound approach and separate left-turn and right-turn lanes on the makai-bound approach.
4. The alternative future scenario that was analyzed assumes that Makala Boulevard will be extended to Ane Keohokalole Highway as a baseline condition. The improvement needed at this location to achieve LOS D would signalize the intersection and result in one left-turn lane, one through lane and one right-turn lane on the northbound approach, one left-turn lane and one shared through/right-turn lane on the southbound approach and one left-turn lane and one shared through/right-turn lane on both the eastbound (mauka-bound) and westbound (makai-bound) approaches.
5. See Attachment C for cost summaries of the additional improvements at this location.

Intersection 8: Kealakaa Street/Pahiliholo Street & Palani Road (SR 190)

1. Fog seal the intersection after civil improvements are complete.
2. Existing pavement is adequate and an overlay or restructure of existing pavement is not required.
3. The intersection will be re-striped after the widening is complete.
4. The cost to prepare and file an environmental document for the construction was included at 1% of construction costs.
5. See Attachment D for cost summary.

Intersection 10: Uluaoa Street & Palani Road (SR 190)

1. The existing lane configuration will be maintained.
2. Fog seal the intersection after signal installation.
3. The intersection will be re-striped after signal installation.

4. The cost to prepare and file a simple environmental document for the construction was included at 10% of construction costs.
5. See Attachment E for cost summary.

Intersection 12: Kealakehe Parkway & Ane Keohokalole Highway

1. The existing lane configuration will be maintained.
2. Fog seal the intersection after signal installation.
3. The intersection will be re-striped after signal installation.
4. See Attachment F for cost summary.

Street Segment 10: Palani Road (SR 190) south of Mamalahoa Highway

1. The costs of fog seal are included in the roadwork lump sum.
2. Existing pavement is adequate and an overlay or restructure of existing pavement is not required.
3. The street segment will be re-striped after the widening is complete.
4. Adjust three private driveways.
5. The total cost per linear foot of \$500.00/LF for 22' (12' travel lane, 10' shoulder) was used following discussions with Belt Collins staff.
6. The cost to prepare and file an environmental document for the construction was included at 1% of construction costs.
7. Cost to relocate the power lines was provided by Steve Sakai, Ronald NS Ho & Associates. This cost did not include relocation of fiber optic lines or potential right-of-way costs, if needed.
8. See Attachment G for cost summary.

The planning level cost estimates for the mitigation measures are listed in Table 1.

PROJECT CONTRIBUTION AND FAIR-SHARE COSTS

The project's fair-share contribution to the estimated cost for each of the traffic mitigation measures identified in the traffic impact analysis and discussed above is presented in Tables 2 through 7. Tables 2, 3 and 4 present these calculations based on the traffic impact analysis in the draft EIS while Tables 5, 6 and 7 are calculated on the basis of the traffic impact analysis of the alternative future scenario.

The project's fair-share contribution to the cost of the improvements at each location where the project would contribute to an identified cumulative impact is based on the proportion of project peak hour traffic contributed to each location relative to the estimated total growth in peak hour traffic volumes through the year 2020. Calculations have been made for both the AM and the PM peak hours and the maximum project contribution identified. The project would be responsible for 100% of the cost of improvements at the two locations where project-specific impacts have been identified.

As shown in Tables 2, 3 and 4, the project's fair share of identified intersection and roadway segment improvement costs ranges from \$5,366,461 (under development concept A, with 1,020 dwelling units) to \$6,185,004 (under development concept B, with 1,840 dwelling units) to \$6,295,451 (under development concept C, with 2,330 dwelling units). Under the alternative future scenario, the project's fair-share contribution costs for the identified traffic improvements range from \$6,397,526 (under development concept A) to \$7,217,940 (under development concept B, with 1,840 dwelling units) to \$7,332,387 (under development concept C). It should be noted that these totals include the estimated cost shown in Appendix G to the Draft EIS (\$1,306,000) to construct the minor site access intersection on Palani Road. The primary reason that the estimated share of the improvement costs attributable to the project is higher under the alternative future scenario is that the total estimated traffic growth on Palani Road (SR 190) south of Mamalahoa Highway is lower, due to the assumed extension of Keanalehu Drive between Manawale'a Street and Palani Road, which results in a greater proportion of the estimated traffic growth there that can be attributed to the Keahuolu Affordable Housing Master Plan project.

SUMMARY AND CONCLUSIONS

Fehr & Peers/Kaku Associates prepared detailed planning-level cost estimates for the traffic mitigation measures at the seven intersections and one street segment that were identified in the traffic impact analyses for the proposed Keahuolu Affordable Housing Master Plan project (while the traffic impact analyses identified impacts on three street segments, two of the three impacted street segments lie adjacent to impacted intersections on Palani Road and the intersection-level mitigation measures would also mitigate the segment-level impacts there). Three development concepts for the project were assessed, each including 197,000 square feet of commercial/retail space, 25 acres of neighborhood parks, a seven-acre archeological preserve, a 12-acre site reserved for a school and between 1,020 and 2,330 housing units.

Two future scenarios were evaluated for each development concept: the traffic impact analysis report in the draft EIS assumed that the street network in the surrounding area would be expanded as described in *Keahole to Honaunau Regional Circulation Plan* (County of Hawaii Planning Department, August 2006), while the traffic impact analysis documented in a separate subsequent technical memorandum assumed that certain additional street segments would be in place by the study horizon year of 2020.

The overall estimated cost of the identified traffic improvements necessary to achieve LOS D or better under the draft EIS scenario is \$15,227,000. Based on the total forecast traffic growth at each location and the portion of that growth that can be attributed to traffic related to the proposed project, the project's "fair-share" contribution to these improvements is estimated to vary from \$5,366,461 (under development concept A, with 1,020 dwelling units) to \$6,185,004 (under development concept B, with 1,840 dwelling units) to \$6,295,451 (under development concept C, with 2,330 dwelling units).

Under the alternative future scenario, the total cost of the identified traffic improvements is \$15,416,000. The project's "fair-share" contribution to these improvements is estimated to vary from \$6,397,526 (under development concept A) to \$7,217,940 (under development concept B, with 1,840 dwelling units) to \$7,332,387 (under development concept C).

| TABLE 1 COST ESTIMATES FOR RECOMMENDED MITIGATION MEASURES | | |
|--|--|--|
| Intersection/Road Segment | Proposed Improvement | Cost Estimate for the Mitigation Measures |
| Locations on State Highways | | |
| IS 12: Ane Keohokalole Hwy/ Kealakehe Pkwy | Install traffic signal | \$836,000 |
| Subtotal | | \$836,000 |
| Locations on Hawaii County Roads | | |
| IS 3: Kamakaeha Ave/Palani Rd (SR 190) | Install traffic signal & interconnect | \$831,000 |
| IS 4: Henry St/Ane Keohokalole Hwy/Palani Rd (SR 190) ¹ | Add NB through lane, 2 nd WB left-turn lane, WB through lane, SB thru lane, signal modification | \$4,535,000 |
| IS 5: Palani Rd (SR 190)/Minor Site Access Rd ² | Add makai deceleration lane, makai acceleration lane, raised island, 2 nd makai receiving lane | \$1,306,000 |
| IS 8: Kealakaa St/Pahilihoho St/Palani Rd (SR 190) | Add SB thru lane, add NB left-turn lane | \$1,863,000 |
| IS 10: Uluaoa St/Palani Rd (SR 190) | Install traffic signal | \$763,000 |
| RS 10: Palani Rd (SR 190) s/o Mamalahoa Hwy | Widen SB to 2 lanes to Hao Kuni St. | \$4,403,000 |
| IS 7: Ane Keohokalole Hwy/Major Site Access Road ^{1,3} | Build and install traffic signal | \$690,000 |
| Subtotal | | \$14,391,000 |
| Grand Total | | \$15,227,000^{1,2} |
| Notes: | | |
| <p>¹ Does not include the cost to construct Ane Keohokalole Highway along the project frontage for \$14,083,000.00, as presented in Appendix G, Draft EIS <i>Keahuolu Affordable Housing Project</i>, February 2008.</p> <p>² The cost for this improvement is drawn from Appendix G to the Draft EIS.</p> <p>³ The estimated cost to construct Ane Keohokalole Highway with a 40' roadway along the project frontage is included in Appendix G to the Draft EIS. The costs shown here represent the additional estimated cost to construct the mitigation measures that were identified for each future scenario. Under the Alternative Future Scenario that was analyzed, Makala Boulevard between Ane Keohokalole Highway and its current terminus is assumed to be constructed as a two-lane roadway for the baseline condition. The mitigation required under this scenario would provide separate left-turn lanes on the mauka-bound and northbound approaches to this intersection, increasing the overall cost for the improvements at this intersection to \$ 879,000. The estimated overall cost of the traffic improvements would increase to \$15,416,000 in the alternative future scenario that was analyzed. Further detail is provided in Attachment D.</p> | | |

TABLE 2
2020 PROJECT FAIR SHARE INTERSECTION TRAFFIC CONTRIBUTION
SCENARIO A

| Int # or Seg # | Intersection | AM Peak Hour | | | | | PM Peak Hour | | | | | Maximum Contribution | Cost Estimate for the Mitigation Measures | Keahuolu Fair Share |
|--|---|---------------------|---------------------------------|--------------------|----------------------|--------------------------------|---------------------|---------------------------------|--------------------|----------------------|--------------------------------|-------------------------|--|------------------------|
| | | Existing Traffic | 2020 with Project Traffic | Project Traffic | Total New Traffic | Project % of New Traffic | Existing Traffic | 2020 with Project Traffic | Project Traffic | Total New Traffic | Project % of New Traffic | | | |
| <i>Mitigation on State Highways</i> | | | | | | | | | | | | | | |
| 12 | Ane Keohokahole Hwy & Kealakehe Parkway | 589 | 2,132 | 380 | 1,543 | 24.6% | 372 | 1,972 | 339 | 1,600 | 21.2% | 24.6% | \$836,000 | \$205,885 |
| <i>Subtotal</i> | | | | | | | | | | | | \$836,000 | \$205,885 | |
| <i>Mitigation on County Roads</i> | | | | | | | | | | | | | | |
| 3 | Kamakaeha Av & Palani Rd (SR 190) | 894 | 1,552 | 185 | 658 | 28.1% | 1,323 | 1,983 | 163 | 660 | 24.7% | 28.1% | \$831,000 | \$233,640 |
| 4 | Henry St & Palani Rd (SR 190) | 1,943 | 4,132 | 557 | 2,189 | 25.4% | 2,105 | 4,089 | 496 | 1,984 | 25.0% | 25.4% | \$4,535,000 | \$1,153,949 |
| 5 | Minor Site Access Rd & Palani Rd (SR 190) | 1,784 | 2,647 | 177 | 863 | 20.5% | 1,846 | 2,836 | 156 | 990 | 15.8% | 100.0*** | \$1,306,000 | \$1,306,000 |
| 7 | Ane Keohokahole Hwy & Major Site Access Rd | 0 | 1,977 | 910 | 1,977 | 46.0% | 0 | 1,592 | 809 | 1,592 | 50.8% | 100.0*** | \$690,000 | \$690,000 |
| 8* | Kealakaa St/Palihiolo St & Palani Rd (SR 190) | 1,915 | 3,003 | 150 | 1,088 | 13.8% | 1,930 | 3,288 | 131 | 1,358 | 9.6% | 13.8% | \$1,863,000 | \$256,847 |
| 10 | Palani Rd (SR 190) & Uluaoa St | 1,595 | 2,008 | 118 | 413 | 28.6% | 1,616 | 2,067 | 104 | 451 | 23.1% | 28.6% | \$763,000 | \$218,000 |
| 10 | Palani Rd (SR 190) south of Mamalahoa Highway | 1,479 | 1,878 | 118 | 399 | 29.6% | 1,588 | 2,033 | 104 | 445 | 23.4% | 29.6% | \$4,403,000 | \$1,302,140 |
| <i>Subtotal</i> | | | | | | | | | | | | \$14,391,000 | \$5,160,576 | |
| TOTAL | | | | | | | | | | | | \$15,227,000 | \$5,366,461 | |

Notes:

* Volumes are recalculated to reflect the 4-legged intersections by combining intersection 8 and 9.

** The cumulative impact at this location is also identified as a project specific impact. The cost for the improvement at Intersection 5 is drawn from Appendix G of the draft EIS.

**TABLE 3
2020 PROJECT FAIR SHARE INTERSECTION TRAFFIC CONTRIBUTION
SCENARIO B**

| Int # or Seg # | Intersection | AM Peak Hour | | | | | PM Peak Hour | | | | | Maximum Contribution | Cost Estimate for the Mitigation Measures | Keahuolu Fair Share |
|--|---|---------------------|---------------------------------|--------------------|----------------------|--------------------------------|---------------------|---------------------------------|--------------------|----------------------|--------------------------------|-------------------------|--|------------------------|
| | | Existing Traffic | 2020 with Project Traffic | Project Traffic | Total New Traffic | Project % of New Traffic | Existing Traffic | 2020 with Project Traffic | Project Traffic | Total New Traffic | Project % of New Traffic | | | |
| <i>Mitigation on State Highways</i> | | | | | | | | | | | | | | |
| 12 | Ane Keohokahole Hwy & Kealakehe Parkway | 589 | 2,248 | 496 | 1,659 | 29.9% | 372 | 2,158 | 525 | 1,786 | 29.4% | 29.9% | \$836,000 | \$249,943 |
| <i>Subtotal</i> | | | | | | | | | | | | <i>\$836,000</i> | <i>\$249,943</i> | |
| <i>Mitigation on County Roads</i> | | | | | | | | | | | | | | |
| 3 | Kamakaeha Av & Palani Rd (SR 190) | 894 | 1,597 | 230 | 703 | 32.7% | 1,323 | 2,077 | 257 | 754 | 34.1% | 34.1% | \$831,000 | \$283,245 |
| 4 | Henry St & Palani Rd (SR 190) | 1,943 | 4,298 | 723 | 2,355 | 30.7% | 2,105 | 4,361 | 768 | 2,256 | 34.0% | 34.0% | \$4,535,000 | \$1,543,830 |
| 5 | Minor Site Access Rd & Palani Rd (SR 190) | 1,784 | 2,697 | 227 | 913 | 24.9% | 1,846 | 2,925 | 245 | 1,079 | 22.7% | 100.0*** | \$1,306,000 | \$1,306,000 |
| 7 | Ane Keohokahole Hwy & Major Site Access Rd | 0 | 2,243 | 1,176 | 2,243 | 52.4% | 0 | 2,040 | 1,257 | 2,040 | 61.6% | 100.0*** | \$690,000 | \$690,000 |
| 8* | Kealakaa St/Palihiolo St & Palani Rd (SR 190) | 1,915 | 3,038 | 185 | 1,123 | 16.5% | 1,930 | 3,366 | 209 | 1,436 | 14.6% | 16.5% | \$1,863,000 | \$306,906 |
| 10 | Palani Rd (SR 190) & Uluaoa St | 1,595 | 2,042 | 152 | 447 | 34.0% | 1,616 | 2,126 | 163 | 510 | 32.0% | 34.0% | \$763,000 | \$259,454 |
| 10 | Palani Rd (SR 190) south of Mamalahoa Highway | 1,479 | 1,912 | 152 | 433 | 35.1% | 1,588 | 2,092 | 163 | 504 | 32.3% | 35.1% | \$4,403,000 | \$1,545,626 |
| <i>Subtotal</i> | | | | | | | | | | | | <i>\$14,391,000</i> | <i>\$5,935,061</i> | |
| TOTAL | | | | | | | | | | | | \$15,227,000 | \$6,185,004 | |

Notes:

* Volumes are recalculated to reflect the 4-legged intersections by combining intersection 8 and 9.

** The cumulative impact at this location is also identified as a project specific impact. The cost for the improvement at Intersection 5 is drawn from Appendix G of the draft EIS.

TABLE 4
2020 PROJECT FAIR SHARE INTERSECTION TRAFFIC CONTRIBUTION
SCENARIO C

| Int # or Seg # | Intersection | AM Peak Hour | | | | | PM Peak Hour | | | | | Maximum Contribution | Cost Estimate for the Mitigation Measures | Keahuolu Fair Share |
|--|---|---------------------|---------------------------------|--------------------|----------------------|--------------------------------|---------------------|---------------------------------|--------------------|----------------------|--------------------------------|-------------------------|--|------------------------|
| | | Existing Traffic | 2020 with Project Traffic | Project Traffic | Total New Traffic | Project % of New Traffic | Existing Traffic | 2020 with Project Traffic | Project Traffic | Total New Traffic | Project % of New Traffic | | | |
| <i>Mitigation on State Highways</i> | | | | | | | | | | | | | | |
| 12 | Ane Keohokahole Hwy & Kealakehe Parkway | 589 | 2,273 | 521 | 1,684 | 30.9% | 372 | 2,177 | 544 | 1,805 | 30.1% | 30.9% | \$836,000 | \$258,644 |
| <i>Subtotal</i> | | | | | | | | | | | | <i>\$836,000</i> | <i>\$258,644</i> | |
| <i>Mitigation on County Roads</i> | | | | | | | | | | | | | | |
| 3 | Kamakaeha Av & Palani Rd (SR 190) | 894 | 1,604 | 237 | 710 | 33.4% | 1,323 | 2,089 | 269 | 766 | 35.1% | 35.1% | \$831,000 | \$291,826 |
| 4 | Henry St & Palani Rd (SR 190) | 1,943 | 4,331 | 756 | 2,388 | 31.7% | 2,105 | 4,392 | 799 | 2,287 | 34.9% | 34.9% | \$4,535,000 | \$1,584,375 |
| 5 | Minor Site Access Rd & Palani Rd (SR 190) | 1,784 | 2,707 | 237 | 923 | 25.7% | 1,846 | 2,934 | 254 | 1,088 | 23.3% | 100.0*** | \$1,306,000 | \$1,306,000 |
| 7 | Ane Keohokahole Hwy & Major Site Access Rd | 0 | 2,299 | 1,232 | 2,299 | 53.6% | 0 | 2,091 | 1,308 | 2,091 | 62.6% | 100.0*** | \$690,000 | \$690,000 |
| 8* | Kealakaa St/Palihiolo St & Palani Rd (SR 190) | 1,915 | 3,043 | 190 | 1,128 | 16.8% | 1,930 | 3,375 | 218 | 1,445 | 15.1% | 16.8% | \$1,863,000 | \$313,803 |
| 10 | Palani Rd (SR 190) & Uluaoa St | 1,595 | 2,048 | 158 | 453 | 34.9% | 1,616 | 2,132 | 169 | 516 | 32.8% | 34.9% | \$763,000 | \$266,124 |
| 10 | Palani Rd (SR 190) south of Mamalahoa Highway | 1,479 | 1,918 | 158 | 439 | 36.0% | 1,588 | 2,098 | 169 | 510 | 33.1% | 36.0% | \$4,403,000 | \$1,584,679 |
| <i>Subtotal</i> | | | | | | | | | | | | <i>\$14,391,000</i> | <i>\$6,036,807</i> | |
| TOTAL | | | | | | | | | | | | \$15,227,000 | \$6,295,451 | |

Notes:

* Volumes are recalculated to reflect the 4-legged intersections by combining intersection 8 and 9.

** The cumulative impact at this location is also identified as a project specific impact. The cost for the improvement at Intersection 5 is drawn from Appendix G of the draft EIS.

TABLE 5
2020 PROJECT FAIR SHARE INTERSECTION TRAFFIC CONTRIBUTION
ALTERNATIVE SCENARIO A

| Int # or Seg # | Intersection | AM Peak Hour | | | | | PM Peak Hour | | | | | Maximum Contribution | Cost Estimate for the Mitigation Measures | Keahuolu Fair Share |
|--|---|---------------------|---------------------------------|--------------------|----------------------|--------------------------------|---------------------|---------------------------------|--------------------|----------------------|--------------------------------|-------------------------|--|------------------------|
| | | Existing Traffic | 2020 with Project Traffic | Project Traffic | Total New Traffic | Project % of New Traffic | Existing Traffic | 2020 with Project Traffic | Project Traffic | Total New Traffic | Project % of New Traffic | | | |
| <i>Mitigation on State Highways</i> | | | | | | | | | | | | | | |
| 12 | Ane Keohokahole Hwy & Kealakehe Parkway | 589 | 2,017 | 215 | 1,428 | 15.1% | 372 | 1,864 | 191 | 1,492 | 12.8% | 15.1% | \$836,000 | \$125,868 |
| <i>Subtotal</i> | | | | | | | | | | | | <i>\$836,000</i> | <i>\$125,868</i> | |
| <i>Mitigation on County Roads</i> | | | | | | | | | | | | | | |
| 3 | Kamakaeha Av & Palani Rd (SR 190) | 894 | 1,488 | 173 | 594 | 29.1% | 1,323 | 1,944 | 152 | 621 | 24.5% | 29.1% | \$831,000 | \$242,025 |
| 4 | Henry St & Palani Rd (SR 190) | 1,943 | 3,975 | 474 | 2,032 | 23.3% | 2,105 | 3,981 | 421 | 1,876 | 22.4% | 23.3% | \$4,535,000 | \$1,057,869 |
| 5 | Minor Site Access Rd & Palani Rd (SR 190) | 1,784 | 2,605 | 192 | 821 | 23.4% | 1,846 | 2,844 | 171 | 998 | 17.1% | 100.0*** | \$1,306,000 | \$1,306,000 |
| 7 | Ane Keohokahole Hwy & Major Site Access Rd | 0 | 1,608 | 169 | 1,608 | 10.5% | 0 | 2,223 | 150 | 2,223 | 6.7% | 100.0*** | \$879,000 | \$879,000 |
| 8* | Kealakaa St/Palihiolo St & Palani Rd (SR 190) | 1,915 | 2,888 | 201 | 973 | 20.7% | 1,930 | 3,249 | 177 | 1,319 | 13.4% | 20.7% | \$1,863,000 | \$384,854 |
| 10 | Palani Rd (SR 190) & Uluaoa St | 1,595 | 2,035 | 177 | 440 | 40.2% | 1,616 | 2,073 | 156 | 457 | 34.1% | 40.2% | \$763,000 | \$306,934 |
| 10 | Palani Rd (SR 190) south of Mamalahoa Highway | 1,479 | 1,851 | 177 | 372 | 47.6% | 1,588 | 2,007 | 156 | 419 | 37.2% | 47.6% | \$4,403,000 | \$2,094,976 |
| <i>Subtotal</i> | | | | | | | | | | | | <i>\$14,580,000</i> | <i>\$6,271,658</i> | |
| TOTAL | | | | | | | | | | | | \$15,416,000 | \$6,397,526 | |

Notes:

* Volumes are recalculated to reflect the 4-legged intersections by combining intersection 8 and 9.

** The cumulative impact at this location is also identified as a project specific impact. The cost for the improvement at Intersection 5 is drawn from Appendix G of the draft EIS.

TABLE 6
2020 PROJECT FAIR SHARE INTERSECTION TRAFFIC CONTRIBUTION
ALTERNATIVE SCENARIO B

| Int # or Seg # | Intersection | AM Peak Hour | | | | | PM Peak Hour | | | | | Maximum Contribution | Cost Estimate for the Mitigation Measures | Keahuolu Fair Share | |
|--|---|---------------------|---------------------------------|--------------------|----------------------|--------------------------------|---------------------|---------------------------------|--------------------|----------------------|--------------------------------|-------------------------|--|------------------------|--|
| | | Existing Traffic | 2020 with Project Traffic | Project Traffic | Total New Traffic | Project % of New Traffic | Existing Traffic | 2020 with Project Traffic | Project Traffic | Total New Traffic | Project % of New Traffic | | | | |
| <i>Mitigation on State Highways</i> | | | | | | | | | | | | | | | |
| 12 | Ane Keohokahole Hwy & Kealakehe Parkway | 589 | 2,086 | 284 | 1,497 | 19.0% | 372 | 1,970 | 297 | 1,598 | 18.6% | 19.0% | \$836,000 | \$158,600 | |
| <i>Subtotal</i> | | | | | | | | | | | | \$836,000 | \$158,600 | | |
| <i>Mitigation on County Roads</i> | | | | | | | | | | | | | | | |
| 3 | Kamakaeha Av & Palani Rd (SR 190) | 894 | 1,530 | 215 | 636 | 33.8% | 1,323 | 2,033 | 241 | 710 | 33.9% | 33.9% | \$831,000 | \$282,072 | |
| 4 | Henry St & Palani Rd (SR 190) | 1,943 | 4,118 | 617 | 2,175 | 28.4% | 2,105 | 4,215 | 655 | 2,110 | 31.0% | 31.0% | \$4,535,000 | \$1,407,784 | |
| 5 | Minor Site Access Rd & Palani Rd (SR 190) | 1,784 | 2,665 | 252 | 881 | 28.6% | 1,846 | 2,939 | 266 | 1,093 | 24.3% | 100.0*** | \$1,306,000 | \$1,306,000 | |
| 7 | Ane Keohokahole Hwy & Major Site Access Rd | 0 | 1,663 | 1,190 | 1,663 | 71.6% | 0 | 2,304 | 231 | 2,304 | 10.0% | 100.0*** | \$879,000 | \$879,000 | |
| 8* | Kealakaa St/Palihiolo St & Palani Rd (SR 190) | 1,915 | 2,942 | 255 | 1,027 | 24.8% | 1,930 | 3,352 | 280 | 1,422 | 19.7% | 24.8% | \$1,863,000 | \$462,575 | |
| 10 | Palani Rd (SR 190) & Uluaoa St | 1,595 | 2,085 | 227 | 490 | 46.3% | 1,616 | 2,162 | 245 | 546 | 44.9% | 46.3% | \$763,000 | \$353,471 | |
| 10 | Palani Rd (SR 190) south of Mamalahoa Highway | 1,479 | 1,901 | 227 | 422 | 53.8% | 1,588 | 2,096 | 245 | 508 | 48.2% | 53.8% | \$4,403,000 | \$2,368,438 | |
| <i>Subtotal</i> | | | | | | | | | | | | \$14,580,000 | \$7,059,340 | | |
| TOTAL | | | | | | | | | | | | \$15,416,000 | \$7,217,940 | | |

Notes:

* Volumes are recalculated to reflect the 4-legged intersections by combining intersection 8 and 9.

** The cumulative impact at this location is also identified as a project specific impact. The cost for the improvement at Intersection 5 is drawn from Appendix G of the draft EIS.

**TABLE 7
2020 PROJECT FAIR SHARE INTERSECTION TRAFFIC CONTRIBUTION
ALTERNATIVE SCENARIO C**

| Int # or Seg # | Intersection | AM Peak Hour | | | | | PM Peak Hour | | | | | Maximum Contribution | Cost Estimate for the Mitigation Measures | Keahuolu Fair Share |
|--|---|---------------------|---------------------------------|--------------------|----------------------|--------------------------------|---------------------|---------------------------------|--------------------|----------------------|--------------------------------|-------------------------|--|------------------------|
| | | Existing Traffic | 2020 with Project Traffic | Project Traffic | Total New Traffic | Project % of New Traffic | Existing Traffic | 2020 with Project Traffic | Project Traffic | Total New Traffic | Project % of New Traffic | | | |
| <i>Mitigation on State Highways</i> | | | | | | | | | | | | | | |
| 12 | Ane Keohokahole Hwy & Kealakehe Parkway | 589 | 2,101 | 299 | 1,512 | 19.8% | 372 | 1,980 | 307 | 1,608 | 19.1% | 19.8% | \$836,000 | \$165,320 |
| <i>Subtotal</i> | | | | | | | | | | | | \$836,000 | \$165,320 | |
| <i>Mitigation on County Roads</i> | | | | | | | | | | | | | | |
| 3 | Kamakaeha Av & Palani Rd (SR 190) | 894 | 1,537 | 222 | 643 | 34.5% | 1,323 | 2,044 | 252 | 721 | 35.0% | 35.0% | \$831,000 | \$290,447 |
| 4 | Henry St & Palani Rd (SR 190) | 1,943 | 4,148 | 647 | 2,205 | 29.3% | 2,105 | 4,239 | 679 | 2,134 | 31.8% | 31.8% | \$4,535,000 | \$1,442,955 |
| 5 | Minor Site Access Rd & Palani Rd (SR 190) | 1,784 | 2,677 | 264 | 893 | 29.6% | 1,846 | 2,949 | 276 | 1,103 | 25.0% | 100.0*** | \$1,306,000 | \$1,306,000 |
| 7 | Ane Keohokahole Hwy & Major Site Access Rd | 0 | 1,676 | 237 | 1,676 | 14.1% | 0 | 2,311 | 238 | 2,311 | 10.3% | 100.0*** | \$879,000 | \$879,000 |
| 8* | Kealakaa St/Palihiolo St & Palani Rd (SR 190) | 1,915 | 2,952 | 265 | 1,037 | 25.6% | 1,930 | 3,362 | 290 | 1,432 | 20.3% | 25.6% | \$1,863,000 | \$476,080 |
| 10 | Palani Rd (SR 190) & Uluaoa St | 1,595 | 2,095 | 237 | 500 | 47.4% | 1,616 | 2,171 | 254 | 555 | 45.8% | 47.4% | \$763,000 | \$361,662 |
| 10 | Palani Rd (SR 190) south of Mamalahoa Highway | 1,479 | 1,910 | 236 | 431 | 54.8% | 1,588 | 2,105 | 254 | 517 | 49.1% | 54.8% | \$4,403,000 | \$2,410,923 |
| <i>Subtotal</i> | | | | | | | | | | | | \$14,580,000 | \$7,167,067 | |
| TOTAL | | | | | | | | | | | | \$15,416,000 | \$7,332,387 | |

Notes:

* Volumes are recalculated to reflect the 4-legged intersections by combining intersection 8 and 9.

** The cumulative impact at this location is also identified as a project specific impact. The cost for the improvement at Intersection 5 is drawn from Appendix G of the draft EIS.

ATTACHMENT A

KAMAKAEHA AVENUE & PALANI ROAD (SR 190)



PRELIMINARY COST ESTIMATE

| ITEM NO. | DESCRIPTION | UNIT | QUANTITY | UNIT PRICE | AMOUNT |
|---|--|------|----------|--------------------|---------------------|
| | ROAD CONSTRUCTION COSTS | | | | |
| | Fog Seal Finish (\$1.5/SF) | LS | Lump Sum | \$39,000.00 | \$39,000.00 |
| | Signing & Striping (Install & remove) | LS | Lump Sum | \$12,000.00 | \$12,000.00 |
| | Mobilization (for Road portion) | LS | Lump Sum | \$5,000.00 | \$5,000.00 |
| | Water Pollution & Erosion Control Measures | LS | Lump Sum | \$2,000.00 | \$2,000.00 |
| | 20% Contingencies ¹ | | | \$11,600.00 | \$11,600.00 |
| | | | | SUB-TOTAL : | \$69,600.00 |
| | Traffic Control (10% of Road Constr Costs) | LS | Lump Sum | \$6,960.00 | \$6,960.00 |
| | Design & Constr Services (15% of Road Constr Costs) ¹ | LS | Lump Sum | \$10,440.00 | \$10,440.00 |
| | Environmental Document (10% of Road Constr Costs) | LS | Lump Sum | \$6,960.00 | \$6,960.00 |
| | | | | SUB-TOTAL : | \$24,360.00 |
| | TRAFFIC SIGNAL COSTS | | | | |
| | Signal Installation ² | LS | Lump Sum | \$500,000.00 | \$500,000.00 |
| | Traffic Signal Interconnect (@\$15/LF) | LS | Lump Sum | \$34,000.00 | \$34,000.00 |
| | 20% Contingencies ¹ | | | \$106,800.00 | \$106,800.00 |
| | | | | SUB-TOTAL : | \$640,800.00 |
| | Design & Constr Services (15% of Signal Costs) ¹ | LS | Lump Sum | \$96,120.00 | \$96,120.00 |
| | | | | SUB-TOTAL : | \$96,120.00 |
| Notes : | | | | TOTAL : | \$830,880.00 |
| ¹ Per Appendix G of DEIS; ² Per R.Thiel, Hawaii County Department of Public Works, Traffic Division | | | | | |
| Estimated by : Natalie K. Porter | | | | | |



FEHR & PEERS
TRANSPORTATION CONSULTANTS

BY NKP DATE 7-25-08 CLIENT KEAHUOLU AHMP SHEET NO. 1 OF 12

ATTACHMENT A

CHECKED _____ DATE _____ JOB _____ JOB NO. LA07-2145

I/S 3: KAMAKAHEHA AVE. / PALANI RD. (SR190)

| | |
|--|--------------------------|
| *INSTALL TRAFFIC SIGNAL + INTERCONNECT TO ADJ I/S' | |
| TRAFFIC SIGNAL (PER R. THIEL) | \$ 500,000 ⁰⁰ |
| INTERCONNECT #15/FT x (150+1,500) (TRENCHING & CONDUIT) | 33,750 ⁰⁰ |
| SEAL COAT (#1.5/SF) (FOR I/S ONLY) | 39,000 ⁰⁰ |
| RESTRIPING | 6,000 ⁰⁰ |
| REMOVE STRIPING | 6,000 ⁰⁰ |

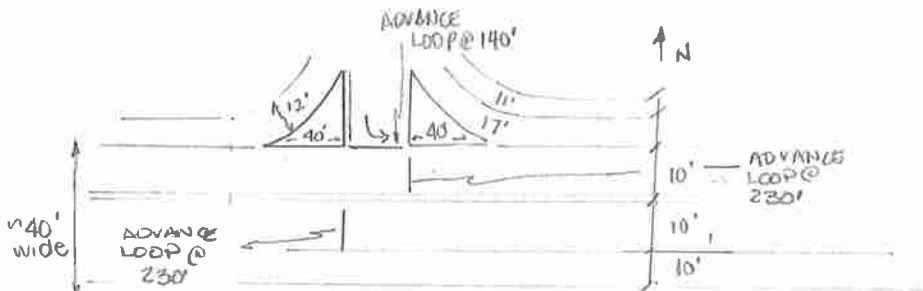
DESIGN SPEED → ASSUME 5 MPH HIGHER THAN POSTED SPEED LIMIT

PALANI RD : DESIGN SPEED = 40 MPH

ADVANCE LOOP AT 230' FROM LIMIT LINE

KAMAKAHEHA AVE : DESIGN SPEED = 30 MPH

ADVANCE LOOP AT 140' FROM LIMIT LINE



$$\begin{aligned}
 \text{SEAL COAT} &= \text{W leg Palani} = 190'(40') + 190'(12')(0.5) + 40'(30') = 9,940 \text{ sq. ft.} \\
 &= \text{E leg Palani} = 190'(30') + 190'(28')(0.5) + 40'(30') = 9,560 \text{ sq. ft.} \\
 &= \text{KAMAKAHEHA} = 140'(45') = 6,300 \text{ sq. ft.} \\
 &= \underline{25,800} \\
 &= \text{SAY } 26,000 \text{ sq. ft.}
 \end{aligned}$$

$$26,000 \times \$1.5/\text{SF} = \$39,000^{00}$$

STRIPING:

$$\begin{aligned}
 2 \text{ ARROWS @ } 42 \text{ SQFT/EA} &= 84 \text{ SQFT.} \\
 \text{DBL YELLOW} &= 500' \text{ ON PALANI} + 140' \text{ ON KAMAKAHEHA} = 640' \times 2 = 1,280' \\
 4" \text{ WHITE EDGE LINE} &= (230' \times 4) + (140' \times 2) = 1,200' \\
 \text{STOP BAR} &= 12'
 \end{aligned}$$

$$\text{TOTAL} = 2,492 \text{ SAY } 2,500'$$

$$2,500 \times \$2/\text{LF} = \$5,000$$

REMOVE STRIPING (ASSUME GRINDING) = COST STRIPING INSTALL

$$\text{LEGEND @ } \$6.00/\text{SQFT} \quad 84 \times 6 = \$504$$

$$\text{STRIPING } \$5,000 + \$504 = \$5,504 \rightarrow \text{SAY } \$6,000^{00}$$

ATTACHMENT B

HENRY STREET/ANE KEOHOKALO LE HIGHWAY & PALANI ROAD (SR 190)



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TRANSPORTATION CONSULTANTS

BY NKP DATE 7-25-08 CLIENT KAHMP SHEET NO. 2 OF 12
ATTACHMENT B
 CHECKED _____ DATE _____ JOB _____ JOB NO. LA07-2145

I/S 4: HENRY ST. / AVE KEDHOKALOLE HWY & PALANI RD. (SR. 190)

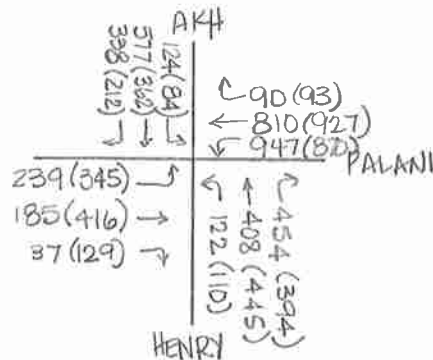
- WIDENING MAKAI BOUND APPROACH
- ADD NB THRU (12')
- ADD 2nd LTL NB (MAKAI)
- ADD THRU NB (MAKAI) LANE
- ADD SB THRU (12')
- SIGNAL MODIFICATION

LEFT TURN POCKETS = ALL STORAGE + DECEL + TAPER (IN POCKET)

TAPER = 26' TO 40' LONGITUDINALLY AASHTO
 3' TRAVERSELY

DESIGN SPEED : PALANI RD (SR 190) = 40 MPH
 DECEL LENGTHS = 275' PER 2004 AASHTO, P. 714 (A. KATO)

CTP VOLUMES
SCENARIO



STORAGE: ASSUME 120 SEC CYCLE

- MAKAI-BOUND LEFT TURN STORAGE
 947 VEHICLES (AM PK HR)
 = 15.8 VEHICLES / MINUTE OR 32 VEHICLES IN 120 S.
 2 LANES = 16 VEHICLES / LANE / CYCLE x 1.5 = 24 VEHICLES / LANE / CYCLE
 ASSUME 25' PER VEHICLE = 600' STORAGE REQ'D

MAKAI - LEFT TURN POCKET LENGTHS

STORAGE PER LANE = 600'
 + DECEL FOR 40 MPH = 275'
 + TAPER FOR DUAL = 150'
 15:1 [L:T] 1,025' LANE 1, 250' TO I/S 5
 APPROX (330' x 12') + (300' of taper) included in Palani est.
 include 395' of 30' + 300' of taper



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TRANSPORTATION CONSULTANTS

BY NKP DATE 7-25-08 CLIENT KAHMP - ATTACH B SHEET NO. 3 OF 12

CHECKED _____ DATE _____ JOB _____ JOB NO. LAD7-2145

I/S 4 (CON'T)

MAUKA LEFT TURN POCKET

STORAGE REQ'D

345 VEHICLES (PM PK HR)
= 5.75 VEH/MIN OR 11.5 VEH IN 120 SEC.
USE 12 VEH/CYCLE X 1.5 = 18 VEH/CYCLE
ASSUME 25' PER VEHICLE = 450' STORAGE REQ'D

STORAGE = 450'
+ DECEL = 275'
+ TAPER 8:1 = 100'
825'

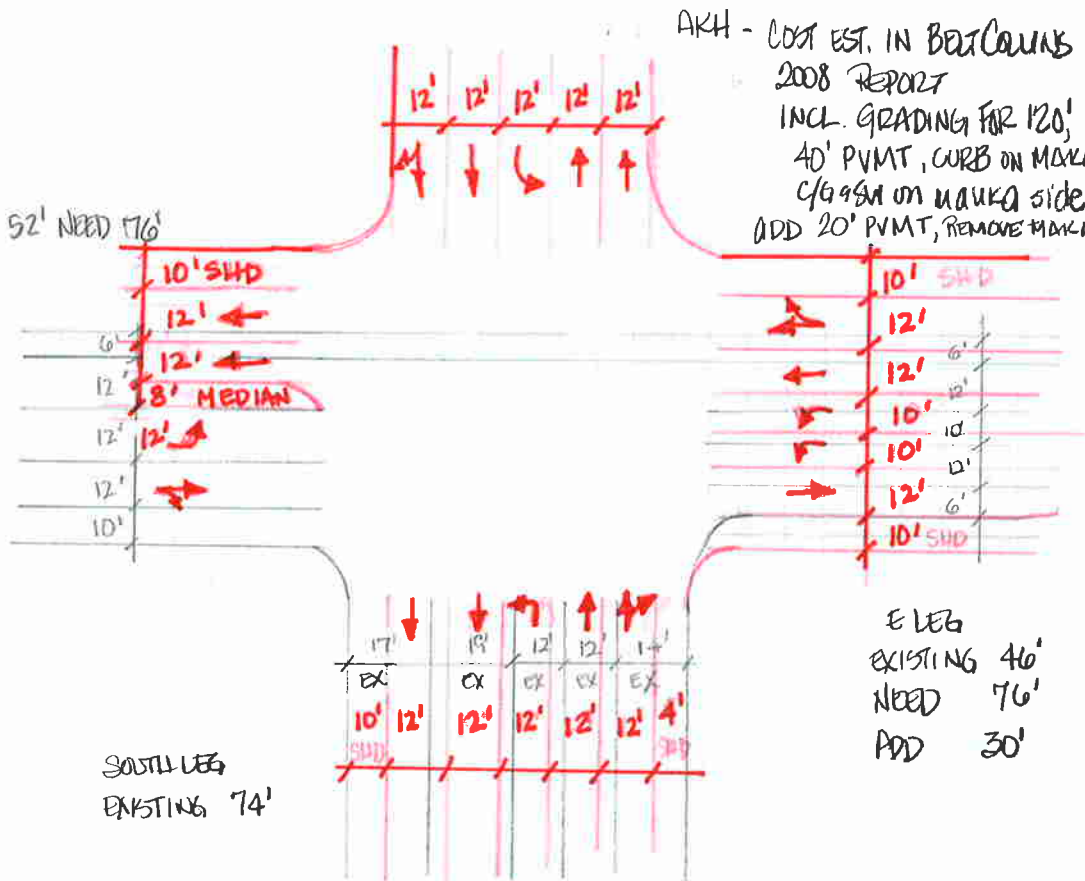
LANE 1,400' TO I/S 3

ON PALANI RD:

W/LEG EXISTING 52' NEED 76'
DED 24'

PALANI

SOUTH LEG
EXISTING 74'



AKH - COST EST. IN BEST COUNTS
2008 REPORT
INCL. GRADING FOR 120',
40' PVMT, CURB ON MAUKA
SIDE
C/G 95M ON MAUKA SIDE
ADD 20' PVMT, REMOVE MEDIAN CURB

E LEG
EXISTING 46'
NEED 76'
ADD 30'



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BY NKP DATE 7-29-08 CLIENT KAHUP ATTACHMENT B SHEET NO. 4 OF 12

CHECKED _____ DATE _____ JOB _____ JOB NO. LA07-2146

I/S 4 (CON'T)

NORTH LEG - AKI Highway

NEED 60' , 40' PVMT INCLUDED IN BELT COLLINS EST

ADD 20' PVMT BTW. I/S 4 AND I/S 7 = 2,750'

PER BELT COLLINS REPT DATED JUNE 2008

ANE KEOHOKALOHE HWY EST ASSUMED 120' GRADING,
40' PVMT, CURB ON MAKA'I, C/G SW ON MAUKA FOR 4,670'
ROAD CONST. COSTS = \$9,878,836⁰⁰ or \$2,115⁰⁰/LF

USING COSTS TO PRORATE FOR 40' GRADING, 40' PVMT
\$5,803,103⁰⁰ or \$1,243⁰⁰/LF

FOR NEW SECTION - NO ADDITIONAL GRADING, OR 40% OF
CONCRETE CURB, ADD REMOVAL OF CONCRETE CURB
ON MAKA'I SIDE (@ \$1/LF)
\$5,621,806⁰⁰ or \$1,204⁰⁰/LF

$$\frac{20}{40} \times 1,204^{00} = \$602^{00}/LF$$

$$2,750' \times \$602/LF = \$1,655,500^{00} \leftarrow$$

WEST LEG

FOR PALANI RD. 7.5 PER BELT COLLINS REPT DATED JUNE 2008
EST ASSUMED FOR 1,410 LF - 12' MED W/AC CURBS

$$\$946,200^{00} \div 1,410 LF = \$671^{00}/LF$$

subtract signing, marking, signs
traffic control
mobilization
water pollution and erosion
control measures
<\$264,500⁰⁰>

10' AC PAVED SHD (FULL DEPTH)
8' AC PAVED SWALE
360' ACCEL LANE
300' TAPER
275' DECEL
00' STORAGE
150' TAPER

$$= \$681,700^{00} \div 1,410 LF$$

$$= \$483.48/LF \text{ USE } \$500/LF$$

$$\frac{24'}{22'} \times \$500/LF \times 825' = \$450,000^{00}$$



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BY NKP DATE 7-29-08 CLIENT KAHMP SHEET NO. 5 OF 12

CHECKED _____ DATE _____ JOB _____ JOB NO. LA07-2145

I/54 (CON'T)

EAST LEG $(\frac{30'}{22} \times \$500^{00}/LF \times 395 LF) + 300 \times (\frac{12 \times 0.5}{22}) \times \$500^{00}/LF$ 40,909
 $= \$310,227$
 SOUTH LEG RESTRIPING ONLY SAY \$311,000⁰⁰

STORAGE REQ' MT = 454 VEH RT IN AM PK HR
 = 7.6 VEH/MIN x 1.5 = 11.4 VEH/MIN
 25' PER VEH = 285' STORAGE
 DECEL FOR 35 MPH = $\frac{222'}{507'}$

SUBTOTAL ROAD COSTS = \$1,655,500⁰⁰ + \$450,000⁰⁰ + \$311,000⁰⁰
 = \$2,416,500⁰⁰
 FOG SEAL - SEE NEXT SHEET \$382,500⁰⁰ } \$2,799,000⁰⁰

STRIPING

MED ISLAND (DBL-DBL YELLOW)

WLEG 825' POCKET INCL DECEL & TAPER (150')
 ELEG 1,025' POCKET " " " (100')
 HENRY 507' POCKET W/DECEL
2,357'

CROSS-WALK HENRY 75' }
 WLEG 80' } 235'
 ELEG 80' }

FOG LINE 4" WHITE 2(1,400) + 2(1,250) + 2(507') = 6,314' }
 LEAD LINES 7(50') = 350' } 6,664'

CHANNELIZING LANE (8") 300' + 2(300') + 200' = 1100'

4" LANE LINES 300' + 1,400' + 1,250' = 2,950'

LEGENDS TYPE III ARROWS 4 LEFT x 42 SQFT = 168 SF
 TYPE II ARROWS 4 ↑ x 45 SQFT = 180 SF
 TYPE I ARROW 2 ↑ x 25 SQFT = 50 SF } 398 SQFT



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BY NKP DATE 7-25-08 CLIENT KANMP - ATTREMB SHEET NO. 6 OF 12

CHECKED _____ DATE _____ JOB _____ JOB NO. LA07-2145

I/d (CONT)

| | | |
|--|---|------------------------|
| 13,071 LF OF PAINT x \$2/LF = \$26,142 ⁰⁰ | } | \$31,740 |
| 633 SQFT OF PAINT LEGENDS x \$6/SF = \$3,798 ⁰⁰ | | |
| SIGNS ⇒ ASSUME 9 @ \$200/SIGN = \$1800 ⁰⁰ | | SAY |
| REMOVE STRIPING BY GRINDING = COST OF INSTALL | | \$32,000 ⁰⁰ |

FOG SEAL

| | | | |
|-------|--------------------------|---|--|
| W Leg | 80' x 1,400 = 112,000 SF | } | 252,560 SF |
| E Leg | 80' x 1,250 = 100,000 SF | | |
| HELDY | 80' x 501 = 40,560 SF | | |
| | | | SAY 255,000 SF @ \$1.50/SF = \$382,500 ⁰⁰ |

ATTACHMENT C

ANE KEOHOKALOLE HIGHWAY & MAJOR SITE ACCESS ROAD



FEHR & PEERS
Transportation Consultants

PRELIMINARY COST ESTIMATE

SHEET 1 OF 1

DATE July 29, 2008

LOCATION IS7:AKHwy/MajAcc

Project No. LA07-2145

| ITEM NO. | DESCRIPTION | UNIT | QUANTITY | UNIT PRICE | AMOUNT |
|--|---|------|----------|--------------------|---------------------|
| | ROAD CONSTRUCTION COSTS | | | | |
| | | | | | |
| | | | | SUB-TOTAL : | |
| | | | | | |
| | | | | SUB-TOTAL : | |
| | | | | | |
| | TRAFFIC SIGNAL COSTS | | | | |
| | Traffic signal installation ¹ | LS | Lump Sum | \$500,000.00 | \$500,000.00 |
| | 20% Contingencies ² | | | \$100,000.00 | \$100,000.00 |
| | | | | SUB-TOTAL : | \$600,000.00 |
| | Design & Constr Services (15% of Signal Costs) ² | LS | Lump Sum | \$90,000.00 | \$90,000.00 |
| | | | | SUB-TOTAL : | \$90,000.00 |
| | | | | | |
| | | | | | |
| | | | | | |
| Notes : | | | | TOTAL : | \$690,000.00 |
| ¹ Per R.Thiel, Hawaii County Department of Public Works, Traffic Division; ² Per Appendix G | | | | | |
| Estimated by : Natalie K. Porter | | | | | |



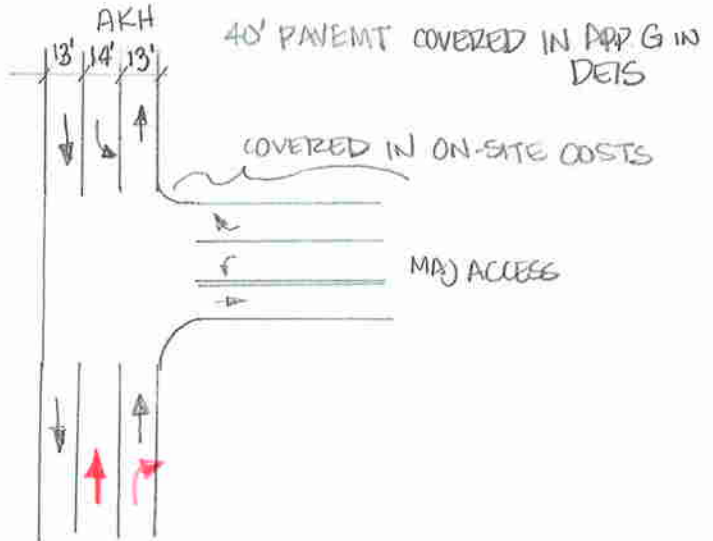
FEHR & PEERS
TRANSPORTATION CONSULTANTS

BY NKP DATE 7-29-08 CLIENT KAHMP ATTACHC SHEET NO. 7 OF 12

CHECKED _____ DATE _____ JOB _____ JOB NO. LA07-2145

I/S 7: ANE KEOHOKALOLE HWY 9 MAJOR SITE ACCESS RD.

SIGNALIZE





FEHR & PEERS
Transportation Consultants

PRELIMINARY COST ESTIMATE

SHEET 1 OF 1

DATE July 29, 2008

LOCATION IS7:AKHwy/MajAcc2

Project No. LA07-2145

| ITEM NO. | DESCRIPTION | UNIT | QUANTITY | UNIT PRICE | AMOUNT |
|---|--|------|----------|--------------------|---------------------|
| | ROAD CONSTRUCTION COSTS | | | | |
| | Mobilization | LS | Lump Sum | \$6,000.00 | \$6,000.00 |
| | Additional left-turn lanes | LS | Lump Sum | \$126,000.00 | \$126,000.00 |
| | Additional signing and striping | LS | Lump Sum | \$4,500.00 | \$4,500.00 |
| | 20% Contingencies ¹ | | | \$27,300.00 | \$27,300.00 |
| | | | | SUB-TOTAL : | \$163,800.00 |
| | Design & Constr Services (15% of Road Constr Costs) ¹ | LS | Lump Sum | \$24,570.00 | \$24,570.00 |
| | | | | SUB-TOTAL : | \$24,570.00 |
| | TRAFFIC SIGNAL COSTS | | | | |
| | Traffic signal installation ² | LS | Lump Sum | \$500,000.00 | \$500,000.00 |
| | 20% Contingencies ¹ | | | \$100,000.00 | \$100,000.00 |
| | | | | SUB-TOTAL : | \$600,000.00 |
| | Design & Constr Services (15% of Signal Costs) ¹ | LS | Lump Sum | \$90,000.00 | \$90,000.00 |
| | | | | SUB-TOTAL : | \$90,000.00 |
| Notes : | | | | TOTAL : | \$878,370.00 |
| ¹ Per Appendix G; ² Per R.Thiel, Hawaii County Department of Public Works, Traffic Division. Alternative Future Scenario | | | | | |
| Estimated by : Natalie K. Porter | | | | | |

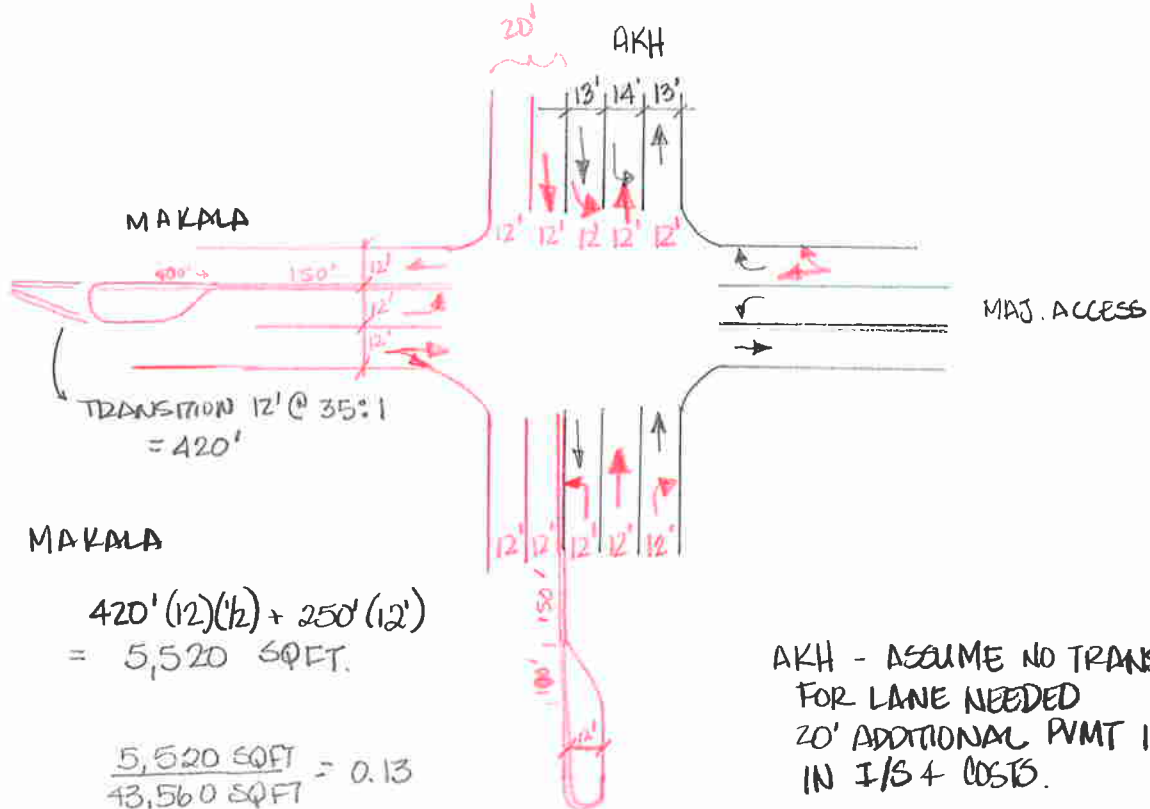


FEHR & PEERS
TRANSPORTATION CONSULTANTS

BY NKP DATE 7-29-08 CLIENT KALIMP ATTACH C SHEET NO. 8 OF 12

CHECKED _____ DATE _____ JOB _____ JOB NO. LAOT 2145

I/S T: ANE KEDHOKALOLE HWY & MAJOR SITE ACCESS / MAKALA BVD
SIGNALIZE +
ADD: 150' LEFT TURN POCKET + 100' CURVE TRANSITION TAPER
ON NB AKH AND MAUKA BOUND MAKALA BVD



MAKALA

$$420' (12) (\frac{1}{2}) + 250' (12') = 5,520 \text{ SQFT.}$$

$$\frac{5,520 \text{ SQFT}}{43,560 \text{ SQFT}} = 0.13$$

AKH - ASSUME NO TRANSITION
FOR LANE NEEDED
20' ADDITIONAL PVMT INCLUDED
IN I/S + COSTS.

$$\frac{12'}{22'} \times \$500^{\text{00}}/\text{LF} \left(\frac{250 + (420 \cdot 0.5)}{460} \right) = \$125,454^{\text{55}} \text{ SAY } \$126,000^{\text{00}}$$

STRIPING DBL YELLOW 250' + 250' + 100' + 100' + 12' + 12' + 420' + 420' = 1,564'

CHANNELIZATION LANE 8" WHITE = 150' + 150' = 300'
1864' @ \$2/LF = \$3,728⁰⁰

2 TYPE III ARROWS @ 42 SQFT = 84 SQFT

@ \$6/SQFT = \$504
\$4,232
SAY \$4,500⁰⁰

ATTACHMENT D

PALANI ROAD (SR 190) & KEALAKAA STREET/PAHILIHOLE STREET



PRELIMINARY COST ESTIMATE

| ITEM NO. | DESCRIPTION | UNIT | QUANTITY | UNIT PRICE | AMOUNT |
|----------|--|------|----------|--------------------|-----------------------|
| | ROAD CONSTRUCTION COSTS | | | | |
| | Roadwork ¹ | LS | Lump Sum | \$1,160,000.00 | \$1,160,000.00 |
| | Signing & Striping (Install & Removal) | LS | Lump Sum | \$9,100.00 | \$9,100.00 |
| | Mobilization (for Road portion) | LS | Lump Sum | \$58,000.00 | \$58,000.00 |
| | Water Pollution & Erosion Control Measures | LS | Lump Sum | \$5,000.00 | \$5,000.00 |
| | 20% Contingencies ² | | | \$246,420.00 | \$246,420.00 |
| | | | | SUB-TOTAL : | \$1,478,520.00 |
| | Traffic Control (10% of Road Constr Costs) | LS | Lump Sum | \$147,852.00 | \$147,852.00 |
| | Design & Constr Services (15% of Road Constr Costs) ² | LS | Lump Sum | \$221,778.00 | \$221,778.00 |
| | Environmental Document (1% of Road Constr Costs) ³ | LS | Lump Sum | \$14,785.20 | \$14,785.20 |
| | | | | SUB-TOTAL : | \$384,415.20 |

Notes : ¹Per Appendix G: pro-rated, ²Per Appendix G of DEIS, ³Per N.Basu/A.Kato

TOTAL : \$1,862,935.20

Estimated by : Natalie K. Porter



FEHR & PEERS
TRANSPORTATION CONSULTANTS

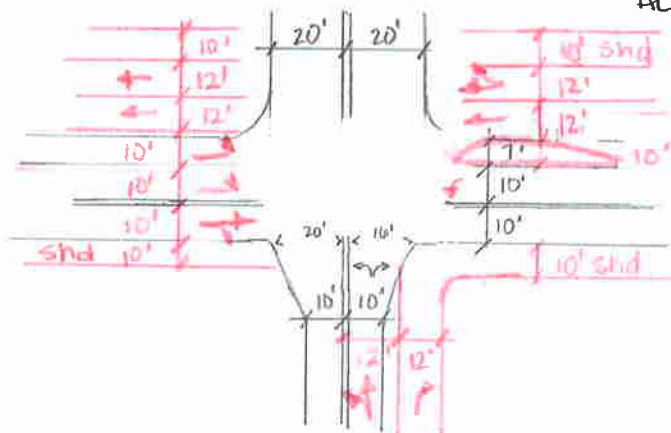
BY NKP DATE 7-25-08 CLIENT KAHMP ATTACH D SHEET NO. 9 OF 12

CHECKED _____ DATE _____ JOB _____ JOB NO. LA07-2145

I/S 8 KEDAIKAA ST. / PAHILIHOLD ST & PALANI RD (SR 190)

WEST LEG EXIST 27' WIDE
ADD 47'

PAHILIHOLD & KEDAIKAA ST
POST SPEED LIMIT 25 MPH
USE 30 MPH DESIGN SPEED
ADVANCE LOOPS @ 140'



EAST LEG
EXIST 27' WIDE
ADD 47'

STRIPING

$$\text{CHANNELIZING (8'')} = \underset{\text{EB}}{200'} + \underset{\text{WB}}{150'} + \underset{\text{NB}}{150'} + \underset{\text{SB}}{150'} = 170'$$

$$\text{LIMIT LINE} = 24' + 30' + 20' + 24' = 98'$$

$$\text{EDGE LINE} = 600 \times 2 = 1200'$$

$$\text{DBL YELLOW } \phi = 150' + 150' + 285' + 600' = 1185'$$

$$\begin{array}{l} \text{ARROWS} \\ \text{TYPE III} \times 5 = 210 \\ \text{TYPE II} \times 4 = 180 \end{array} \left. \vphantom{\begin{array}{l} \text{ARROWS} \\ \text{TYPE III} \times 5 = 210 \\ \text{TYPE II} \times 4 = 180 \end{array}} \right\} 390 + 98 = 488 \text{ SF}$$

$$\begin{array}{l} \text{PAINT} = 2555' \times \$1.50/\text{LF} = \$3,832.50 \\ \text{LEGEND} = 488' \times \$6.0/\text{SF} = \$2,928.00 \end{array} \left. \vphantom{\begin{array}{l} \text{PAINT} = 2555' \times \$1.50/\text{LF} = \$3,832.50 \\ \text{LEGEND} = 488' \times \$6.0/\text{SF} = \$2,928.00 \end{array}} \right\} \$6,760.50$$

SAY \$6,800.00

REMOVAL OF STRIPING VIA GRINDING = COST TO INSTALL STRIPING
↑ INCLUDED IN UNIT COST OF \$671/LF



FEHR & PEERS
TRANSPORTATION CONSULTANTS

BY NKP DATE 7-25-08 CLIENT KAHMP ATTACHED SHEET NO. 10 OF 12

CHECKED _____ DATE _____ JOB _____ JOB NO. LA07-2145

I/S 8 (CONT)

W LEG EXIST = 27' NEED 74' ADD 47'

$$\frac{47}{22} \times \$500^{\circ}/LF \times 585' = \$624,886^{36}$$

STORAGE 500 VEH / PM PK HR
 = 8.4 VEH/MIN = 4.2 VEH/MIN/LANE
 4.2 x 1.5 = 6.3 veh x 25' /veh = 158
 decel for 40 mph = 275
 Taper = 150
 583
 USE 585'

E LEG EXIST 27' WIDE NEED 74' ADD 47'

STORAGE 49 veh / pm pk hr = 0.8 veh/min
 0.8 x 1.5 = 1.2 veh/min x 25' /veh = 30'
 decel = 275'
 taper = 100'
 405'
 USE 410'

$$\frac{47}{22} \times \$500^{\circ}/LF \times 410' = \$437,954^{55}$$

S LEG 20' EXIST NEED 34' ADD 14'

STORAGE 32 veh / PK HR
 = 0.53 veh /min x 1.5 x 25' /veh = 19.9 = 20'
 decel for 30 mph = 170'
 taper = 100'
 290'

$$\frac{14}{22} \times \$500^{\circ} \times 300' = \$95,454^{55}$$

USE 300'

TOTAL ROADWORK = \$1,158,295⁴⁴

SAY \$1,160,000⁰⁰

ATTACHMENT E

ULUAOA STREET & PALANI ROAD (SR 190)



PRELIMINARY COST ESTIMATE

| ITEM NO. | DESCRIPTION | UNIT | QUANTITY | UNIT PRICE | AMOUNT |
|---|--|------|----------|--------------------|---------------------|
| | ROAD CONSTRUCTION COSTS | | | | |
| | Fog Seal Finish (\$1.5/SF) | LS | Lump Sum | \$32,000.00 | \$32,000.00 |
| | Signing & Striping (Install & Removal) | LS | Lump Sum | \$9,000.00 | \$9,000.00 |
| | Mobilization (for Road portion) | LS | Lump Sum | \$2,000.00 | \$2,000.00 |
| | Water Pollution & Erosion Control Measures | LS | Lump Sum | \$2,000.00 | \$2,000.00 |
| | 20% Contingencies ¹ | | | \$9,000.00 | \$9,000.00 |
| | | | | SUB-TOTAL : | \$54,000.00 |
| | Traffic Control (10% of Road Constr Costs) | LS | Lump Sum | \$5,400.00 | \$5,400.00 |
| | Design & Constr Services (15% of Road Constr Costs) ¹ | LS | Lump Sum | \$8,100.00 | \$8,100.00 |
| | Environmental Document (10% of Road Constr Costs) | LS | Lump Sum | \$5,400.00 | \$5,400.00 |
| | | | | SUB-TOTAL : | \$18,900.00 |
| | TRAFFIC SIGNAL COSTS | | | | |
| | Signal Installation ² | LS | Lump Sum | \$500,000.00 | \$500,000.00 |
| | 20% Contingencies ¹ | | | \$100,000.00 | \$100,000.00 |
| | | | | SUB-TOTAL : | \$600,000.00 |
| | Design & Constr Services (15% of Signal Costs) ¹ | LS | Lump Sum | \$90,000.00 | \$90,000.00 |
| | | | | SUB-TOTAL : | \$90,000.00 |
| | | | | TOTAL : | \$762,900.00 |
| <p>Notes : ¹Per Appendix G of DEIS; ²Per R.Thiel, Hawaii County Department of Public Works, Traffic Division</p> | | | | | |
| <p>Estimated by : Natalie K. Porter</p> | | | | | |



FEHR & PEERS
TRANSPORTATION CONSULTANTS

BY NKP DATE 7-25-08 CLIENT KAHMP ATTACH E&F SHEET NO. 11 OF 12

CHECKED _____ DATE _____ JOB _____ JOB NO. LA07-2145

I/S 10: ULUAOA ST @ PALANI RD (SR 190)

SIGNALIZE
RESTRIPE
FOGSEAL

ULUAOA @ 30 MPH DESIGN SPEED = 140' FOR ADV. LOOPS

PALANI @ 40 MPH D.S. = 230' FOR ADV. LOOPS

$$\left. \begin{array}{l} \text{PALANI } (230' + 40' + 230') \times 30' = 15,000 \text{ SQFT.} \\ \text{ULUAOA } (140' + 20') \times 36' = 5,760 \text{ SQFT.} \end{array} \right\} 20,760 \text{ SQFT.}$$

$$20,760 \text{ SQ.FT.} \times \$1.50 / \text{SQFT} = \$31,140^{00} \text{ SAY } \$32,000^{00}$$

STRIPING: DBL YELLOW (230' + 230' + 205') = 665'
LIMIT LINE 18' + 10' + 10' = 38'
EDGE LINE 230' x 4 = 920'

$$\left. \begin{array}{l} 1585' \times \$2 / \text{LF} = \$3,170 \\ 38 \text{ SF} \times \$6 / \text{SQFT} = 228 \\ \text{ASSUME 5 SIGNS @ } \$200 / \text{SIGN} \end{array} \right\} \$4,398 \text{ SAY } \$4,500^{00}$$

REMOVE EXISTING STRIPING BY GRINDING = COST TO INSTALL

I/S 12: ANE KEDHOKALOLE HWY @ KEALAKEHE PKWY

SIGNALIZE, RESTRIPE, FOGSEAL

AKH @ 35 mph D.S = 185' ADV LOOPS

KEALAKEHE @ 40 mph D.S = 230' ADV LOOPS

FOGSEAL AKH (185' + 48' + 185') x 60' = 25,080 SF

KEALAKEHE (230' + 60' + 230') x 48' = 24,960 SF

$$\begin{aligned} &50,040 \text{ SF} \times \$1.50 / \text{SF} \\ &= \$75,060 \text{ SAY } \$76,000^{00} \end{aligned}$$

$$\left. \begin{array}{l} \text{STRIPING: DBL YELLOW } (230 \times 2) + (185 \times 2) = 830' \\ \text{EDGE LINE } (230 \times 4) + (185 \times 4) = 1660' \end{array} \right\} 2490 \times \$2 / \text{LF} = \$4,980^{00}$$

$$\left. \begin{array}{l} \text{LIMIT LINE} = 30 + 30 + 24 + 24 = 108' \\ \text{ARROWS } 4 \times \text{TYPE III} \times 42 = 168 \\ \quad \quad \quad 2 \times \text{TYPE II} \times 45 = 90 \end{array} \right\} 366 \text{ SF} \times \$6 / \text{LF} = \$2,196^{00}$$

$$\begin{aligned} &\$7,176 \\ &\text{SAY } \$7,500 \end{aligned}$$

REMOVE EXISTING STRIPING BY GRINDING = COST TO INSTALL

ATTACHMENT F

ANE KEOHOKALOLE HIGHWAY & KEALAKEHE PARKWAY



PRELIMINARY COST ESTIMATE

| ITEM NO. | DESCRIPTION | UNIT | QUANTITY | UNIT PRICE | AMOUNT |
|---|--|------|----------|--------------------|---------------------|
| | ROAD CONSTRUCTION COSTS | | | | |
| | Fog Seal Finish (\$1.5/SF) | LS | Lump Sum | \$76,000.00 | \$76,000.00 |
| | Signing & Striping | LS | Lump Sum | \$15,000.00 | \$15,000.00 |
| | Mobilization (for Road portion) | LS | Lump Sum | \$4,000.00 | \$4,000.00 |
| | Water Pollution & Erosion Control Measures | LS | Lump Sum | \$2,000.00 | \$2,000.00 |
| | 20% Contingencies ¹ | | | \$19,400.00 | \$19,400.00 |
| | | | | SUB-TOTAL : | \$116,400.00 |
| | Traffic Control (10% of Road Constr Costs) | LS | Lump Sum | \$11,640.00 | \$11,640.00 |
| | Design & Constr Services (15% of Road Constr Costs) ¹ | LS | Lump Sum | \$17,460.00 | \$17,460.00 |
| | | | | SUB-TOTAL : | \$29,100.00 |
| | TRAFFIC SIGNAL COSTS | | | | |
| | Signal Installation ² | LS | Lump Sum | \$500,000.00 | \$500,000.00 |
| | 20% Contingencies ¹ | | | \$100,000.00 | \$100,000.00 |
| | | | | SUB-TOTAL : | \$600,000.00 |
| | Design & Constr Services (15% of Signal Costs) ¹ | LS | Lump Sum | \$90,000.00 | \$90,000.00 |
| | | | | SUB-TOTAL : | \$90,000.00 |
| Notes : | | | | TOTAL : | \$835,500.00 |
| ¹ Per Appendix G of DEIS; ² Per R.Thiel, Hawaii County Department of Public Works, Traffic Division | | | | | |
| Estimated by : Natalie K. Porter | | | | | |



FEHR & PEERS
TRANSPORTATION CONSULTANTS

BY NKP DATE 7-25-08 CLIENT KAHMP ATTACH E&F SHEET NO. 11 OF 12

CHECKED _____ DATE _____ JOB _____ JOB NO. LA07-2145

I/S 10: ULUAOA ST @ PALANI RD (SR 190)
SIGNAUZE
RESTRIPE
FOGSEAL

ULUAOA @ 30 MPH DESIGN SPEED = 140' FOR ADV. LOOPS
PALANI @ 40 MPH D.S. = 230' FOR ADV. LOOPS

$$\left. \begin{array}{l} \text{PALANI } (230' + 40' + 230') \times 30' = 15,000 \text{ SQFT.} \\ \text{ULUAOA } (140' + 20') \times 30' = 5,760 \text{ SQFT.} \end{array} \right\} 20,760 \text{ SQFT.}$$

$$20,760 \text{ SQ.FT.} \times \$1.50/\text{SQFT} = \$31,140^{00} \text{ SAY } \$32,000^{00}$$

STRIPING: DBL YELLOW (230' + 230' + 205') = 665'
LIMIT LINE 18' + 10' + 10' = 38'
EDGE LINE 230' x 4 = 920'

$$\left. \begin{array}{l} 1585' \times \$2/\text{LF} = \$3,170 \\ 38 \text{ SF} \times \$6/\text{SQFT} = 228 \end{array} \right\} \$4,398 \text{ SAY } \$4,500^{00}$$

ASSUME 5 SIGNS @ \$200/SIGN

REMOVE EXISTING STRIPING BY GRINDING = COST TO INSTALL

I/S 12: ANE KEDHOKALOLE HWY @ KEALAKEHE PKWY

SIGNAUZE, RESTRIPE, FOGSEAL

AKH @ 35 mph D.S. = 185' ADV LOOPS
KEALAKEHE @ 40 mph D.S. = 230' ADV LOOPS

$$\left. \begin{array}{l} \text{FOGSEAL AKH } (185' + 48' + 185') \times 60' = 25,080 \text{ SF} \\ \text{KEALAKEHE } (230' + 60' + 230') \times 48' = 24,960 \text{ SF} \end{array} \right\}$$

$$50,040 \text{ SF} \times \$1.50/\text{SF} = \$75,060 \text{ SAY } \$76,000^{00}$$

$$\left. \begin{array}{l} \text{STRIPING: DBL YELLOW } (230 \times 2) + (185 \times 2) = 830' \\ \text{EDGE LINE } (230 \times 4) + (185 \times 4) = 1660' \end{array} \right\} 2,490 \times \$2/\text{LF} = \$4,980^{00}$$

$$\left. \begin{array}{l} \text{LIMIT LINE} = 30 + 30 + 24 + 24 = 108' \\ \text{ARROWS } 4 \times \text{TYPE III} \times 42 = 168 \\ \quad \quad \quad 2 \times \text{TYPE II} \times 45 = 90 \end{array} \right\} 366 \text{ SF} \times \$6/\text{LF} = \$2,196^{00}$$

$$\begin{array}{r} \$7,176 \\ \text{SAY } \$7,500 \end{array}$$

REMOVE EXISTING STRIPING BY GRINDING = COST TO INSTALL

ATTACHMENT G

PALANI ROAD (SR 190) SOUTH OF MAMALAHOA HIGHWAY



PRELIMINARY COST ESTIMATE

| ITEM NO. | DESCRIPTION | UNIT | QUANTITY | UNIT PRICE | AMOUNT |
|--|--|------|----------|--------------------|-----------------------|
| | ROAD CONSTRUCTION COSTS | | | | |
| | Roadwork ¹ | LF | 3000 | \$500.00 | \$1,500,000.00 |
| | Adjust Private Driveways | EA | 3 | \$3,000.00 | \$9,000.00 |
| | Traffic Control | LS | Lump Sum | \$10,000.00 | \$10,000.00 |
| | Mobilization (for Road portion) | LS | Lump Sum | \$500,000.00 | \$500,000.00 |
| | Relocate Power Line ³ | LF | 3000 | \$296.00 | \$888,000.00 |
| | Water Pollution & Erosion Control Measures | LS | Lump Sum | \$5,000.00 | \$5,000.00 |
| | 20% Contingencies ² | | | \$582,400.00 | \$582,400.00 |
| | | | | SUB-TOTAL : | \$3,494,400.00 |
| | Traffic Control (10% of Road Constr Costs) | LS | Lump Sum | \$349,440.00 | \$349,440.00 |
| | Design & Constr Services (15% of Road Constr Costs) ² | LS | Lump Sum | \$524,160.00 | \$524,160.00 |
| | Environmental Document (1% of Road Constr Costs) ⁴ | LS | Lump Sum | \$34,944.00 | \$34,944.00 |
| | | | | SUB-TOTAL : | \$908,544.00 |
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| Notes : | | | | TOTAL : | \$4,402,944.00 |
| ¹ Per Appendix G, pro-rated, ² Per Appendix G of DEIS, ³ Per Steve Sakai (6-12-08), ⁴ Following consultation with Alan Kato (6-16-08) | | | | | |
| Estimated by : Natalie K. Porter | | | | | |



FEHR & PEERS
TRANSPORTATION CONSULTANTS

BY NKP

DATE 6-17-08

CLIENT

SHEET NO. ¹² 9

OF ¹² 9

Rev.

CHECKED

DATE

JOB

JOB NO.

LA 07-2145

PALANI ROAD WIDENING SOUTH OF MAMALAHOLA HWY
~ 3,000' to HAO KUNI ST.

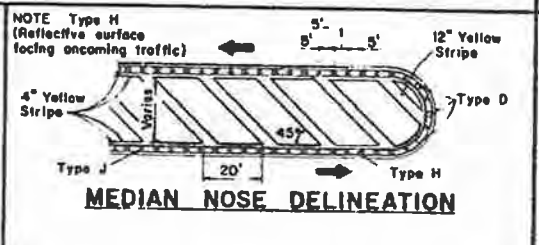
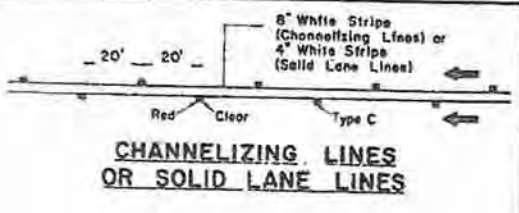
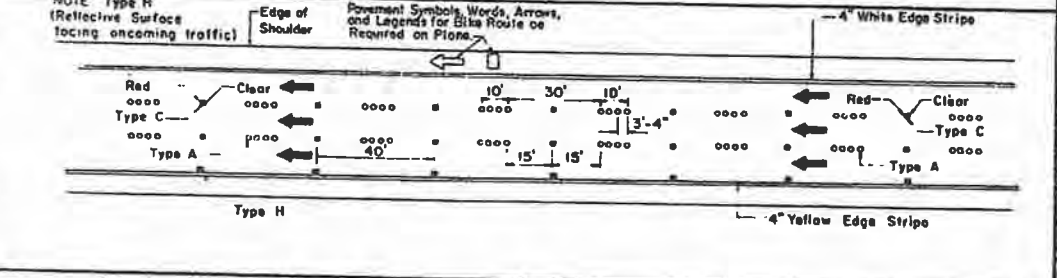
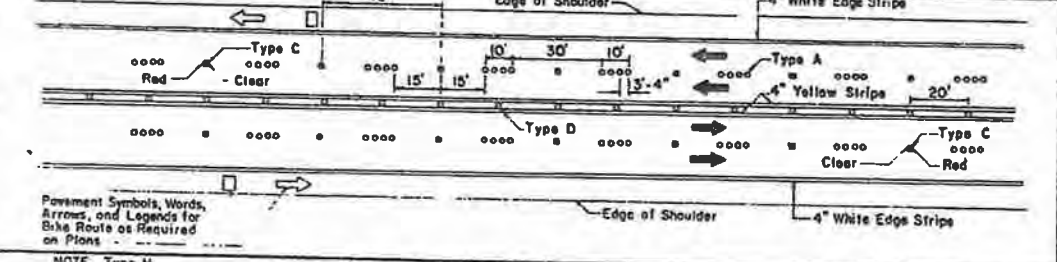
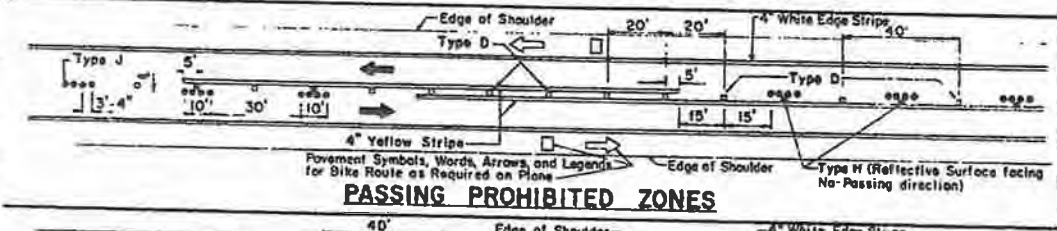
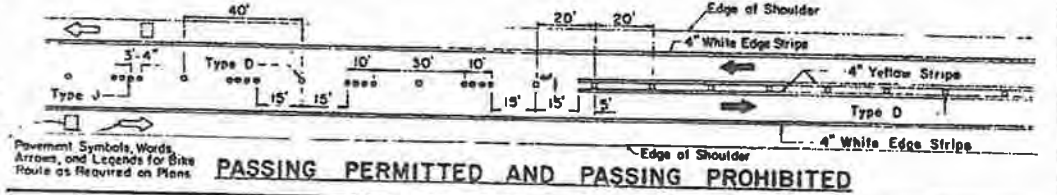
① USE ~~\$1,000~~ /LF FOR WIDENING PALANI ROAD by
500 22' (12' LANE, 10' SHOULDER)
PER ALAN KATO VIA EMAIL (6-13-08)

② ADJUST 3 DWYS @ \$3,000/EA = \$9,000⁰⁰

③ RELOCATE POWERLINE : COST PER STEVE SAKAI via email
(6-12-08)
ESCALATED COST TO 2007 INSTEAD
OF 2009 FOR CONSISTENCY W/A
15% CONTINGENCY
COST DOES NOT INCLUDE FIBER OPTIC CABLES ON THE POLES
OR ROW COSTS.

USE \$296 /LF

ATTACHMENT H
ADDITIONAL INFORMATION &
EXCERPTS FROM APPENDIX G OF
KEAHUOLU AFFORDABLE HOUSING PROJECT, DRAFT EIS
FEBRUARY 2008

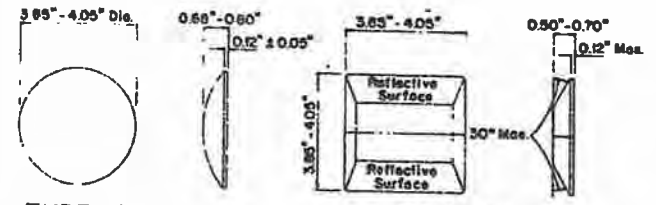


TWO - LANE

MULTI - LANE

DIVIDED HIGHWAY AND FREEWAY

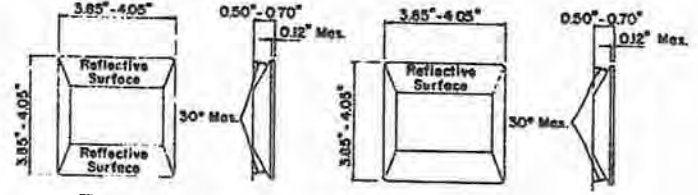
MISCELLANEOUS



TYPE A
NON-REFLECTIVE WHITE MARKER

TYPE C
RED-CLEAR REFLECTIVE MARKER

TYPE J
NON-REFLECTIVE YELLOW MARKER



TYPE D
TWO-WAY YELLOW REFLECTIVE MARKER

TYPE H
ONE-WAY YELLOW REFLECTIVE MARKER

GENERAL NOTES

1. Pavement marking and striping shall conform to the latest "Manual on Uniform Traffic Control Devices for Streets and Highways," and be amended.
2. Layout and installation of pavement marking and striping shall be done by the Contractor. The Contractor shall check the layouts with the Engineer prior to performing work.
3. Edge lines shall not be continued through intersections and shall not be broken for driveways unless otherwise shown or directed.

LEGEND

- Type A
- Type C
- ▣ Type D
- Type H
- Type J

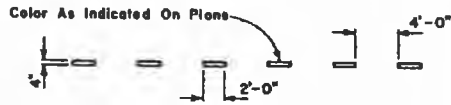
STATE OF MICHIGAN
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

STANDARD PLAN TE-30

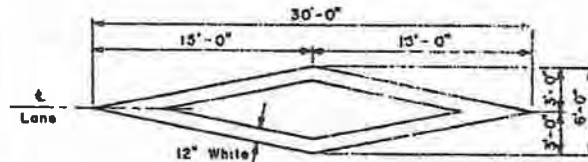
RAISED PAVEMENT MARKERS AND STRIPING

DATE: _____ REVISION: _____ APP'D: _____

E. J. [Signature]
APPROVED DATE: 1/2/88



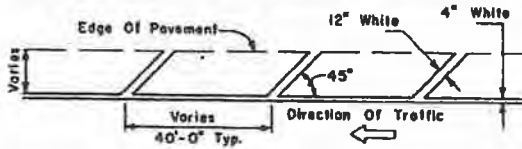
INTERSECTION GUIDE LINE



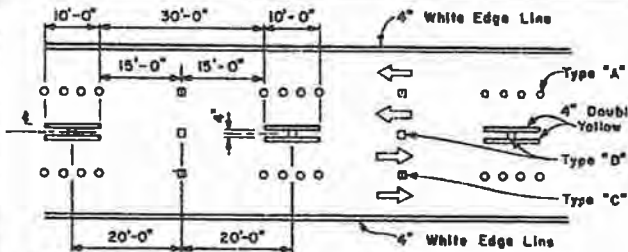
PAVEMENT DIAMOND

GENERAL NOTES:

1. Pavement marking and striping shall conform to the latest edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways," by the FHWA, and as amended.
2. Layout of pavement markings and striping shall be done by the Contractor. The Contractor shall check layout of markings and striping with the Engineer prior to performing work.
3. For additional pavement marking details, see Standard Plan TE-30.

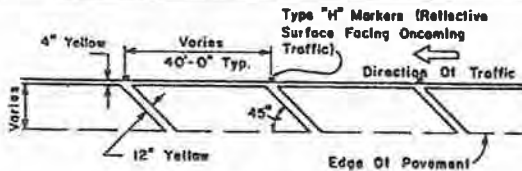


TRANSVERSE RIGHT SHOULDER MARKING

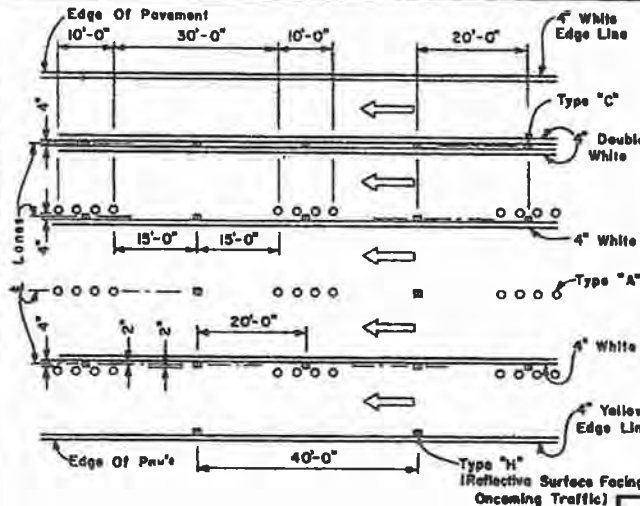


NOTE: Traffic Cone Usage Required.

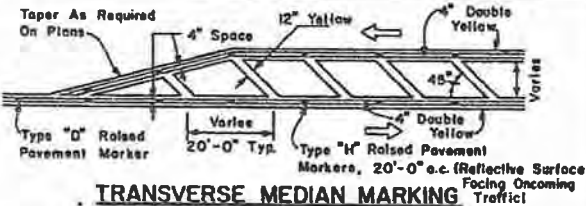
MULTI-LANE REVERSIBLE LANES



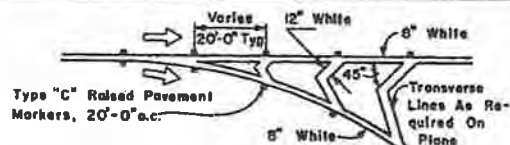
TRANSVERSE LEFT SHOULDER MARKING



MULTI-LANE LANE CHANGE RESTRICTION ZONES



TRANSVERSE MEDIAN MARKING



CHANNELIZING ISLAND

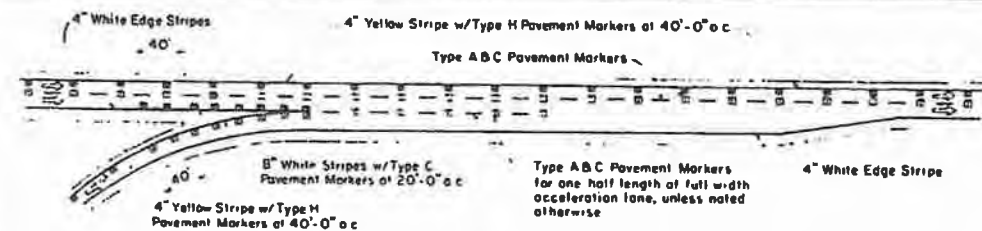
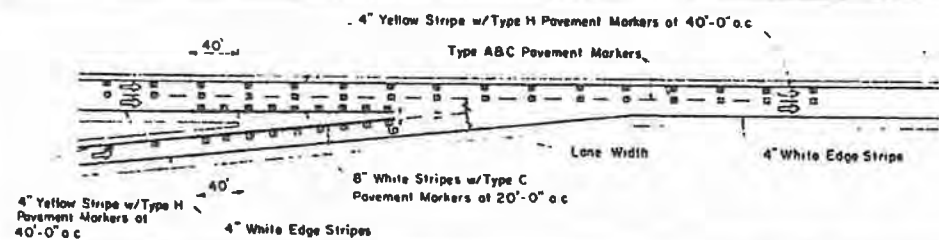
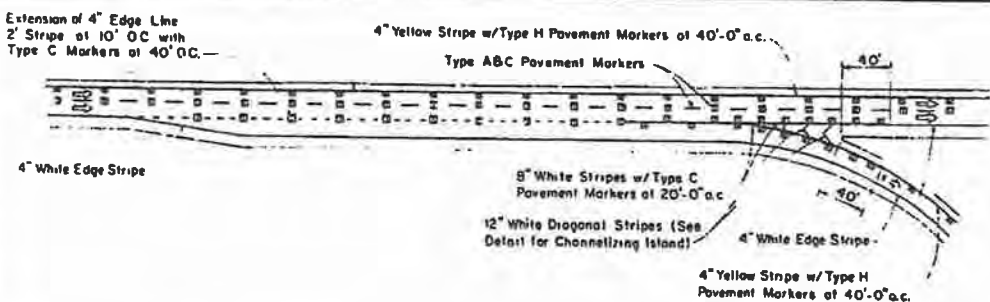
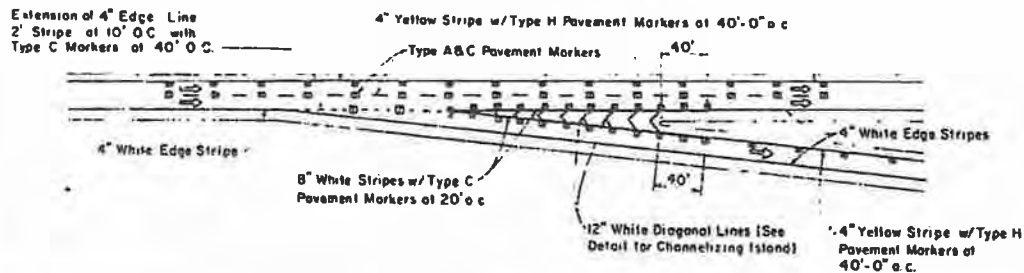
STATE OF MISSOURI
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

STANDARD PLAN TE-31

MISCELLANEOUS
PAVEMENT MARKINGS

Frank J. ...
APPROVED

...
DATE



TAPERED DECELERATION LANE
PARALLEL DECELERATION LANE
TAPERED ACCELERATION LANE
PARALLEL ACCELERATION LANE
TYPICAL ROADWAY EXIT MARKINGS
TYPICAL ROADWAY ENTRANCE MARKINGS

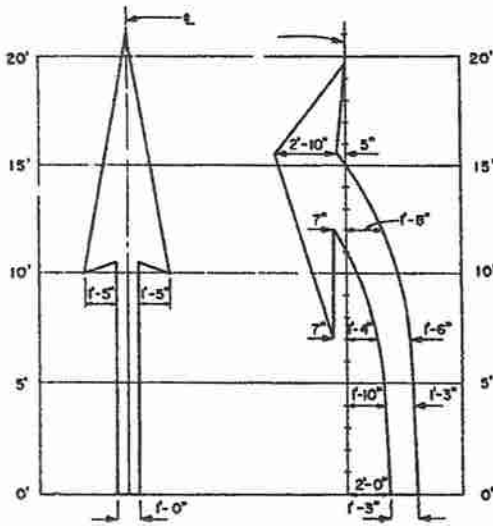
GENERAL NOTES:

1. Pavement Markings and Striping shall conform to the latest edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways," by the FHWA, and as amended.
2. Layout of Pavement Markings and Striping shall be done by the Contractor. The Contractor shall check layout of markings and striping with the Engineer prior to performing work.
3. For additional details, see Standard Plan TE-30.

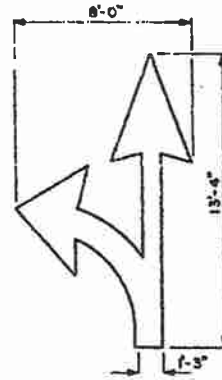
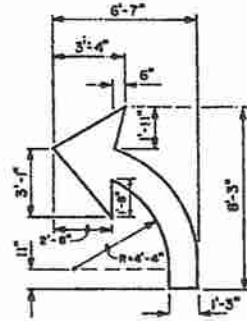
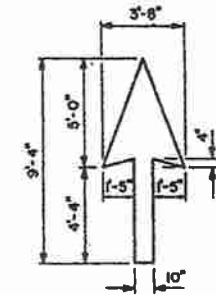
| | | |
|--------|--|-------|
| 7/1/87 | Revised Parallel Deceleration Lane Markings. | AK |
| DATE | REVISION | APP'D |

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
REVISED DESIGN
STANDARD PLAN TE-32
MISCELLANEOUS
PAVEMENT MARKINGS

Earl Jensen *4/1/88*
APPROVED DATE



ELONGATED

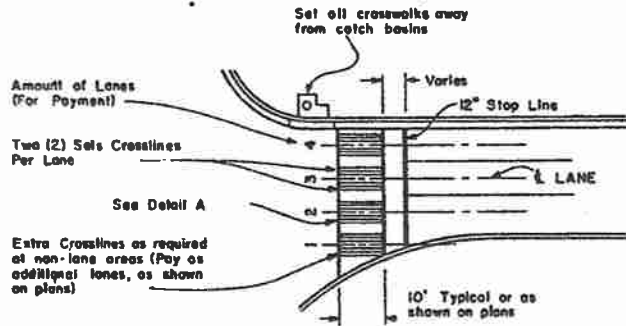


STANDARD

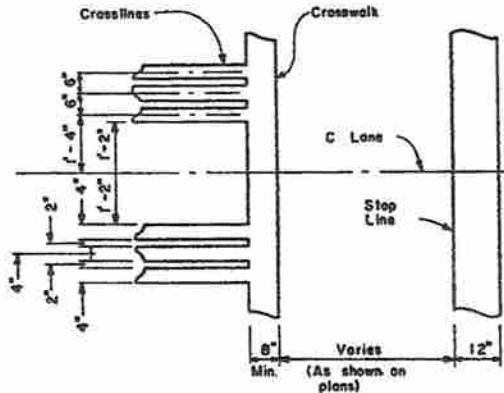
PAVEMENT ARROWS

GENERAL NOTES:

1. Pavement marking and striping shall conform to the latest edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways," by the FHWA, and as amended.
2. Layout of pavement markings and striping shall be done by the Contractor. The Contractor shall check layout of markings and striping with the Engineer prior to performing work.
3. For additional pavement marking details, see Standard Plan TE-30.



PLAN



DETAIL "A"

CROSSWALK & STOP LINE

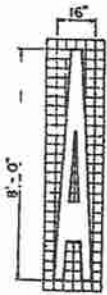
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
ROADWAY DIVISION

STANDARD PLAN TE-33

MISCELLANEOUS
PAVEMENT MARKINGS

Erich J. Tomaka / *Shelton*
APPROVED / DATE

| DATE | REVISION | APP'D. |
|------|----------|--------|
| | | |



B C D E F G H I J K L M

N O P Q R S T U V W X Y Z

2 3 4 5 6 7 8 9 0


GENERAL NOTES

- 1 Pavement Alphabets, Numbers and Symbols shall conform to the latest edition of the FHWA publication, "Manual on Uniform Traffic Control Devices for Streets and Highways" and its amendments.
- 2 The characters are based on a 24x4 (height x width) grid system to facilitate enlarging. Horizontal strokes are 4 units high and vertical strokes are 1 unit wide.
- 3 Unless otherwise noted, the typical height and width of each character shall respectively be 8'-0" and 1'-4". The horizontal strokes shall be 16" high and the vertical strokes shall be 4" wide.
- 4 All pavement messages and symbols shall be laid out by the Contractor and approved by the Engineer prior to installation.

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

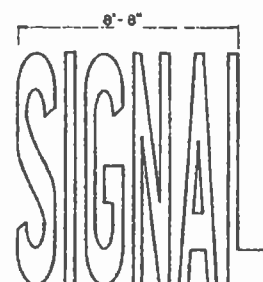
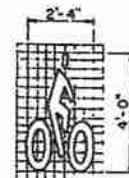
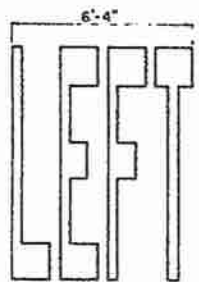
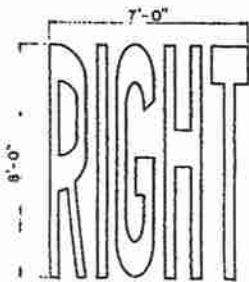
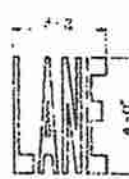
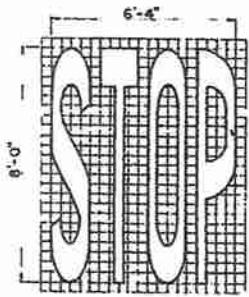
STANDARD PLAN TE-35

**PAVEMENT ALPHABETS
NUMBERS & SYMBOLS**

| | | |
|------|----------|---|
| DATE | REVISION | APP'D. |
| | |  APPROVED |
| | |  DATE |

| | | |
|------|----------|--------|
| DATE | REVISION | APP'D. |
| | | |

STANDARD PLAN TE-35 07/01/86



GENERAL NOTES

- 1 All messages not shown must be approved by the Engineer prior to installation.
- 2 The space between characters in a message shall be 1 grid unit unless otherwise shown or directed.
- 3 All pavement messages shall be white in color.

| DATE | REVISION | APPROVED |
|------|----------|----------|
| | | |

STATE OF MISSISSIPPI
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

STANDARD PLAN TE-36

**PAVEMENT ALPHABETS,
NUMBERS & SYMBOLS**

Richie Tash *11/16/86*
APPROVED DATE

STANDARD PLAN TE-36 07/01/86

CIVIL INFRASTRUCTURE

KEAHUOLU AFFORDABLE HOUSING PROJECT

**KAILUA-KONA, HAWAII
TMK: (3) 7-4-021: 20**

PREPARED FOR:

**Hawaii Housing Finance & Development Corporation
677 Queen Street, Suite 300
Honolulu, Hawaii 96813**

PREPARED BY:



**Belt Collins Hawaii Ltd.
2153 North King Street, Suite 200
Honolulu, Hawaii 96819**

June 2008

3.1 ROADWAYS AND TRAFFIC

The County of Hawaii's proposed Ane Keohokalole Highway is key to full buildout of the Keahuolu project. Without Ane Keohakolole Highway, vehicular access to the site would be limited to access on Keanalehu Drive, and one possible connection to Palani Road. See Figure 3-1: Road System, following the text of this report.

Ane Keohokalole Highway would be a minor arterial with a 120-foot-wide right-of-way and posted speed limit of 35 miles per hour. Two lanes are proposed in each direction. The County plans to designate the highway as a bus transit corridor. A regional bus transit stop at the Ane Keohokalole Highway/Makala Boulevard intersection fronting the Keahuolu project is proposed. Bus stops are also proposed on Ane Keohokalole Highway for local circulators serving the *mauka* and *makai* neighborhoods.

Landowners with frontage to Ane Keohokalole Highway would be expected to share in the cost of constructing the highway. The projected order-of-magnitude cost of the portion fronting the project property, including one lane in each direction plus a middle turn lane with drainage but excluding other utilities, would be \$13,633,000. For planning purposes, the project would be allocated responsibility for half of this off-site road improvement cost, or \$6,816,500. This estimate would be the same for Concepts A, B and C. For details on the road cost, see Appendix A. (Note: All costs presented in this report are in 2007 dollars.)

A right in/right out intersection is proposed along Palani Road. To minimize impacts on traffic along Palani Road, the intersection would include deceleration and acceleration lanes and a raised median to prevent vehicles from attempting to make left turn movements. The order-of-magnitude cost for the Palani Road intersection would be \$1,306,000.

Keahuolu's internal roadways would be pedestrian friendly streets, which accommodate cars, bicycles and pedestrians. The roadways would be designed to County of Hawaii Department of Public Works standards for dedication to the County. The layout of the internal roads would be determined by the developer to coordinate with the development concept. An order-of-magnitude cost for the internal roadways, including water, sewer, drainage, electric, telephone and cable television utilities, based on the concept plan is \$122,725,000.

Existing traffic conditions are assessed in a separate report.

3.2 SITE GRADING AND EROSION CONTROL

The project does not propose major grading of the site. The existing topography would be altered only to the extent necessary for construction of the proposed improvements. It is anticipated that grading would occur on a localized scale and that cut and fill quantities would generally balance as construction progresses. Grading permits, approved by the State Department of Land and Natural Resources Historic Preservation Division, the County Planning Department and the County Department of Public Works would be required for all grading activities.

During all phases of construction, erosion control practices would comply with State, County and Federal regulations. National Pollutant Discharge Elimination System (NPDES) general permit coverage authorizing discharges of storm water associated with construction activities would be required for the project from the State Department of Health, Environmental Management Division,

Appendix A

Roads

**HHFDC Keahuolu Lands
Off-Site Road System Costs**

OFF-SITE ROAD SYSTEM

| Item No. | Estimated Quantity | Description | Unit Price | Total |
|--|--------------------|--|---------------|----------------------|
| Ane Keohokalole Highway | | | | |
| 1- 1 | 1 | Lump Sum, Clearing and Grubbing | \$ 40,000.00 | \$ 40,000 |
| 1- 2 | 1 | Lump Sum, Water Pollution and Erosion Control Measures | \$ 200,000.00 | \$ 200,000 |
| 1- 3 | 83,000 | Cu. Yds., Excavation | \$ 43.00 | \$ 3,569,000 |
| 1- 4 | 83,000 | Cu. Yds., Embankment | \$ 29.00 | \$ 2,407,000 |
| 1- 5 | 17.2 | Acres, Grading | \$ 8,000.00 | \$ 137,600 |
| 1- 6 | 186,800 | Sq. Ft., AC Pavement for Roadways | \$ 8.00 | \$ 1,494,400 |
| 1- 7 | 4,670 | Lin. Ft., Concrete Curb | \$ 30.00 | \$ 140,100 |
| 1- 8 | 4,670 | Lin. Ft., Concrete Curb and Gutter | \$ 60.00 | \$ 280,200 |
| 1- 9 | 44,365 | Sq. Ft., 4" Concrete Sidewalk with Base Course | \$ 12.70 | \$ 563,436 |
| 1- 10 | 6 | Each, Centerline Monuments | \$ 600.00 | \$ 3,600 |
| 1- 11 | 1 | Lump Sum, Striping and Marking | \$ 20,000.00 | \$ 20,000 |
| 1- 11 | 30 | Each, Sign, Post and Footing | \$ 450.00 | \$ 13,500 |
| 1- 11 | 1 | Lump Sum, Traffic Signal Modification | \$ 200,000.00 | \$ 200,000 |
| 1- 11 | 16 | Each, Catch Basin with Dry Well | \$ 20,000.00 | \$ 320,000 |
| 1- 11 | 16 | Each, Dry Well | \$ 12,000.00 | \$ 192,000 |
| 1- 11 | 16 | Each, Drain Inlet and piping | \$ 8,000.00 | \$ 128,000 |
| 1- 11 | 1 | Lump Sum, Traffic Control | \$ 30,000.00 | \$ 30,000 |
| 1- 11 | 1 | Lump Sum, Construction Surveys | \$ 40,000.00 | \$ 40,000 |
| 1- 12 | 1 | Lump Sum, Mobilization/Demobilization | \$ 100,000.00 | \$ 100,000 |
| Subtotal for Ane Keohokalole Highway | | | | \$ 9,878,836 |
| Contingency (20%) | | | | \$ 1,975,767 |
| Subtotal | | | | \$ 11,854,603 |
| Design and Construction Services (15%) | | | | \$ 1,778,190 |
| Total | | | | \$ 13,632,793 |
| SAY | | | | \$ 13,633,000 |

1,189,667
802,333
45,867

Note: 4,670 Linear feet of Ane Keohokalole Highway.

Half Section: 40 feet of pavement = One lane in each direction +
 ^ Mauka middle turn lane. CURB on MAKA side, C&G & sidewalk on MAUKA side
 For water and sewer improvements, see separate costs.

$$\$9,878,836 \div 4,670 \text{ LF} = \$2,115.38/\text{LF}$$

FOR 40' grading & 40' paved rd

$$\text{cost} = 1/3 \text{ excavation \& embankment} \text{ or } \$1,992,000^{\text{oo}}$$

assume other costs are representative

$$\text{subtotal} = \$5,803,103^{\text{oo}} \text{ or } \$1,243^{\text{oo}}/\text{LF}$$

$$\text{subtotal w/o any grading, 4,670 LF of CONCRETE CURB} = \$5,617,136^{\text{oo}} \text{ or } \$1,203^{\text{oo}}/\text{LF}$$

$$\text{ADD CURB REMOVAL-MAKA @ \$1/LF} = \$5,621,800^{\text{oo}} \text{ or } \$1,204^{\text{oo}}/\text{LF}$$

**HHFDC Keahuolu Lands
Off-Site Road System Costs**

OFF-SITE ROAD SYSTEM

| Item No. | Estimated Quantity | Description | Unit Price | Total |
|--|--------------------|--|---------------|---------------------|
| Palani Road Intersection | | | | |
| 1- 1 | 1 | Lump Sum, Clearing and Grubbing | \$ 7,000.00 | \$ 7,000 |
| 1- 2 | 1 | Lump Sum, Water Pollution and Erosion Control Measures | \$ 15,000.00 | \$ 15,000 |
| 1- 3 | 0 | Cu. Yds., Excavation | \$ 43.00 | \$ 0 |
| 1- 4 | 1,700 | Cu. Yds., Embankment | \$ 29.00 | \$ 49,300 |
| 1- 5 | 1.7 | Acres, Grading | \$ 8,000.00 | \$ 13,600 |
| 1- 6 | 59,500 | Sq. Ft., AC Pavement for Roadways | \$ 8.00 | \$ 476,000 |
| 1- 7 | 2,000 | Lin. Ft., AC Curb | \$ 20.00 | \$ 40,000 |
| 1- 8 | 3 | Each, Centerline Monuments | \$ 600.00 | \$ 1,800 |
| 1- 9 | 1 | Lump Sum, Striping and Marking | \$ 15,000.00 | \$ 15,000 |
| 1- 10 | 10 | Each, Sign, Post and Footing | \$ 450.00 | \$ 4,500 |
| 1- 11 | 7 | Each, Dry Well | \$ 12,000.00 | \$ 84,000 |
| 1- 12 | 1 | Lump Sum, Traffic Control | \$ 150,000.00 | \$ 150,000 |
| 1- 13 | 1 | Lump Sum, Construction Surveys | \$ 10,000.00 | \$ 10,000 |
| 1- 14 | 1 | Lump Sum, Mobilization/Demobilization | \$ 80,000.00 | \$ 80,000 |
| Subtotal for Palani Road Intersection | | | | \$ 946,200 |
| Contingency (20%) | | | | \$ 189,240 |
| Subtotal | | | | \$ 1,135,440 |
| Design and Construction Services (15%) | | | | \$ 170,316 |
| Total | | | | \$ 1,305,756 |
| SAY | | | | \$ 1,306,000 |

Notes: 1,410 Linear Feet of new Acceleration and Deceleration Lanes with
 12' Median with AC curbs
 10' AC paved shoulder
 8' AC paved swale
 Taper = 150', Deceleration = 275', Storage = 50'
 Curve Radius = 150'
 Acceleration = 360', Taper = 300'

$$\$ 946,200 \div 1,410 = \$ 671^{00}/LF$$

**HHFDC Keahuolu Lands
On-Site Road System Costs**

ON-SITE ROADS

| Item No. | Estimated Quantity | Description | Unit Price | Total |
|----------------------|--------------------|--|-------------|-----------------------|
| <u>On-Site Roads</u> | | | | |
| 1- 1 | 5,600 | Lin. Ft., 80' Right-of-Way Roads | \$ 2,250.00 | \$ 12,600,000 |
| 1- 2 | 24,200 | Lin. Ft., 60' Right-of-Way Roads | \$ 1,930.00 | \$ 46,706,000 |
| 1- 3 | 16,550 | Lin. Ft., 50' Right-of-Way Roads | \$ 1,790.00 | \$ 29,624,500 |
| | | Subtotal for On-Site Roads | | \$ <u>88,930,500</u> |
| | | Contingency (20%) | | \$ 17,786,100 |
| | | Subtotal | | \$ 106,716,600 |
| | | Design and Construction Services (15%) | | \$ 16,007,490 |
| | | Total | | \$ 122,724,090 |
| | | SAY | | \$ 122,725,000 |

Notes: Lengths of On-Site Roads based on Keahuolu Land Use Plan Concept, dated June 2007.
Cost is 2007 dollars

**HHFDC Keahuolu Lands
On-Site Road System Costs**

| Item No. | Estimated Quantity | Description | Unit Price | Total |
|-------------------------------|--------------------|---|------------|--------------------|
| 80' Right-of-Way Roads | | | | |
| 2- 1 | 1 | Lin. Ft., Clearing and Grubbing | \$ 32.14 | \$ 32.14 |
| 2- 2 | 1 | Lin. Ft., Erosion Control Measures | \$ 48.21 | \$ 48.21 |
| 2- 3 | 1 | Lin. Ft., Roadway Excavation/Embankment | \$ 200.00 | \$ 200.00 |
| 2- 4 | 1 | Lin. Ft., Roadway Pavement | \$ 480.00 | \$ 480.00 |
| 2- 5 | 1 | Lin. Ft., Concrete Curb and Gutter | \$ 60.00 | \$ 60.00 |
| 2- 6 | 1 | Lin. Ft., Concrete Sidewalk | \$ 133.50 | \$ 133.50 |
| 2- 7 | 1 | Lin. Ft., Signing, Striping and Marking | \$ 8.08 | \$ 8.08 |
| 2- 8 | 1 | Lin. Ft., Catch Basin with Sediment Trap | \$ 200.00 | \$ 200.00 |
| 2- 9 | 1 | Lin. Ft., Dry Well | \$ 233.33 | \$ 233.33 |
| 2- 10 | 1 | Lin. Ft., Sewer System | \$ 202.67 | \$ 202.67 |
| 2- 11 | 1 | Lin. Ft., Water System | \$ 201.29 | \$ 201.29 |
| 2- 12 | 1 | Lin. Ft., Construction Surveys, Testing, Field Office | \$ 200.00 | \$ 200.00 |
| 2- 13 | 1 | Lin. Ft., Electrical System | \$ 250.00 | \$ 250.00 |
| | | Subtotal | | \$ 2,249.21 |
| | | SAY | | \$ 2,250.00 |
| 60' Right-of-Way Roads | | | | |
| 3- 1 | 1 | Lin. Ft., Clearing and Grubbing | \$ 25.71 | \$ 25.71 |
| 3- 2 | 1 | Lin. Ft., Erosion Control Measures | \$ 38.57 | \$ 38.57 |
| 3- 3 | 1 | Lin. Ft., Roadway Excavation/Embankment | \$ 128.00 | \$ 128.00 |
| 3- 4 | 1 | Lin. Ft., Roadway Pavement | \$ 336.00 | \$ 336.00 |
| 3- 5 | 1 | Lin. Ft., Concrete Curb and Gutter | \$ 60.00 | \$ 60.00 |
| 3- 6 | 1 | Lin. Ft., Concrete Sidewalk | \$ 115.70 | \$ 115.70 |
| 3- 7 | 1 | Lin. Ft., Signing, Striping and Marking | \$ 8.08 | \$ 8.08 |
| 3- 8 | 1 | Lin. Ft., Catch Basin with Sediment Trap | \$ 166.67 | \$ 166.67 |
| 3- 9 | 1 | Lin. Ft., Dry Well | \$ 194.44 | \$ 194.44 |
| 3- 10 | 1 | Lin. Ft., Sewer System | \$ 202.67 | \$ 202.67 |
| 3- 11 | 1 | Lin. Ft., Water System | \$ 201.29 | \$ 201.29 |
| 3- 12 | 1 | Lin. Ft., Construction Surveys, Testing, Field Office | \$ 200.00 | \$ 200.00 |
| 3- 13 | 1 | Lin. Ft., Electrical System | \$ 250.00 | \$ 250.00 |
| | | Subtotal | | \$ 1,927.12 |
| | | SAY | | \$ 1,930.00 |
| 50' Right-of-Way Roads | | | | |
| 4- 1 | 1 | Lin. Ft., Clearing and Grubbing | \$ 22.50 | \$ 22.50 |
| 4- 2 | 1 | Lin. Ft., Erosion Control Measures | \$ 33.75 | \$ 33.75 |
| 4- 3 | 1 | Lin. Ft., Roadway Excavation/Embankment | \$ 98.00 | \$ 98.00 |
| 4- 4 | 1 | Lin. Ft., Roadway Pavement | \$ 256.00 | \$ 256.00 |
| 4- 5 | 1 | Lin. Ft., Concrete Curb and Gutter | \$ 60.00 | \$ 60.00 |
| 4- 6 | 1 | Lin. Ft., Concrete Sidewalk | \$ 115.70 | \$ 115.70 |
| 4- 7 | 1 | Lin. Ft., Signing, Striping and Marking | \$ 8.08 | \$ 8.08 |
| 4- 8 | 1 | Lin. Ft., Catch Basin with Sediment Trap | \$ 157.89 | \$ 157.89 |
| 4- 9 | 1 | Lin. Ft., Dry Well | \$ 184.21 | \$ 184.21 |
| 4- 10 | 1 | Lin. Ft., Sewer System | \$ 202.67 | \$ 202.67 |
| 4- 11 | 1 | Lin. Ft., Water System | \$ 196.29 | \$ 196.29 |
| 4- 12 | 1 | Lin. Ft., Construction Surveys, Testing, Field Office | \$ 200.00 | \$ 200.00 |
| 4- 13 | 1 | Lin. Ft., Electrical System | \$ 250.00 | \$ 250.00 |
| | | Subtotal | | \$ 1,785.08 |
| | | SAY | | \$ 1,790.00 |

Infrastructure for the proposed project would be built over an approximately 12-year period as the project site is developed. Construction is anticipated to begin in 2008/2009 and provide the required infrastructure for the initial stages of development in 2010. From 2010 until 2020, the infrastructure would be expanded to accommodate the entire project. Construction of the proposed development is anticipated to be completed by 2020.

4.8.1 Roadway System

4.8.1.1 Existing Conditions

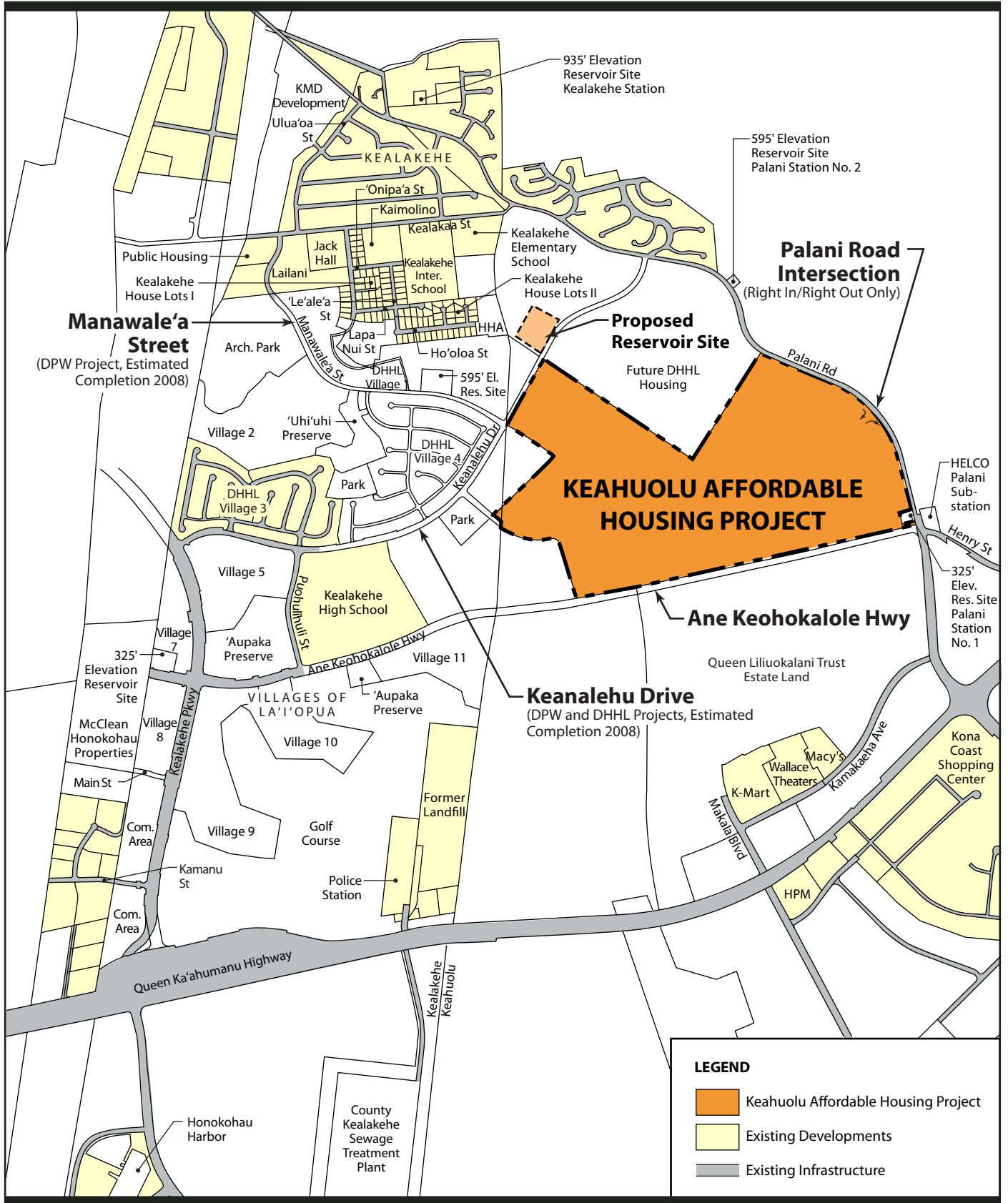
Palani Road is the only existing road bordering the project, along the southern boundary. The proposed Ane Keohokalole Highway would border the project along the makai boundary, and the proposed Keanalehu Drive would border the project along the mauka boundary. Keanalehu Drive and Manawale‘a Street, along the northern-mauka tip of the project, are currently under construction with a projected completion date of late 2008.

4.8.1.2 Proposed Roadway System, Potential Impacts, and Mitigation Measures

Off-Site Roadway System

The County’s proposed Ane Keohokalole Highway is key to full buildout of the Keahuolu project. Without Ane Keohokalole Highway, vehicular access to the site would be limited to Keanalehu Drive and one possible connection to Palani Road. See Figure 4-13.

Ane Keohokalole Highway would be a minor arterial with a 120-foot-wide ROW and posted speed limit of 35 miles per hour. Two lanes are proposed in each direction. The County plans to designate the highway as a bus transit corridor. A regional bus transit stop at the Ane Keohokalole Highway/Makala Boulevard intersection fronting the Keahuolu project is proposed. Bus stops are also proposed on Ane Keohokalole Highway for local circulators serving the mauka and makai neighborhoods.



0 600 1200 1800
SCALE IN FEET

**Figure 4-13
ROAD SYSTEM**

Landowners with frontage to Ane Keohokalole Highway would be expected to share in the cost of constructing the highway. The projected order-of-magnitude cost of the portion fronting the project property, including one lane in each direction plus a middle turn lane with drainage but excluding other utilities, would be \$13,633,000. For planning purposes, the project would be allocated responsibility for half of this off-site road improvement cost, or \$6,816,500. This estimate would be the same for Concepts A, B, and C. For details on the road cost, see the civil infrastructure report in Appendix G.

A right-in/right-out intersection is proposed along Palani Road. To minimize impacts on traffic along Palani Road, the intersection would include deceleration and acceleration lanes and a raised median to prevent vehicles from attempting to make left turn movements. The order-of-magnitude cost for the Palani Road intersection would be \$1,306,000.

Internal Road System

Keahuolu's internal roadways would be pedestrian friendly streets, which accommodate cars, bicycles, and pedestrians. The roadways would be designed to County DPW standards for dedication to the County. The layout of the internal roads would be determined by the developer to coordinate with the development concept. Based on the concept plan, an order-of-magnitude cost for the internal roadways, including water, sewer, drainage, electric, telephone and cable television utilities is \$122,725,000.

Potential Short-Term and Long-Term Impacts and Mitigative Measures

No significant short-term environmental impacts are anticipated from the development of the roadways associated with this project. Construction will be carried out in compliance with applicable regulations to minimize impacts, including best management practices. The long-term impacts of the proposed roads would not be significant. The traffic impacts associated with the Keahuolu Affordable Housing project are assessed in Section 4.4 of this document.