November 30, 2011

Mr. Jake Pinkston
Pinkston Corporation
4656 Fennel Road
P.O. Box 12069
Knoxville, TN 37912

**RE: THE ENCLAVE APARTMENTS, PHASE 2 TIS UPDATE, KNOX CO., TN.**

Dear Mr. Pinkston:

Wilbur smith Associates has completed its review of the current plan for the above referenced development located in the Hardin Valley area of Knox County. The site is located in **Figure 1**. Please find below (Table 1) the trip generation for the submitted traffic impact study dated April of 2006 and the revised trip generation for the current plan for the site, illustrated in **Figure 2**. The 2006 plan included 140 apartment units and 111,290 square feet of commercial retail which was further defined with a 14,700 square-foot pharmacy and a 53,850 square-foot supermarket. The plan currently reflects a total of 236 apartment units and an existing 32,000 square feet of commercial retail. The site currently has 140 apartments and the commercial. The proposed phase will add another 96 apartments. The comparison reduced the previous proposed retail development by 57,450 square feet reflecting the grocery and some ancillary adjacent retail use which is replaced by the additional 96 apartment units in the current plan. The retail commercial development analyzed in this update includes the existing retail and any other retail that may develop as previously proposed, thereby reflecting only the reduction of commercial retail replaced by the additional apartments.

**Table 1 TRIP GENERATION COMPARISON**

| LAND USE | L.U.C | SIZE | DAILY TRAFFIC | AM PEAK ENTER | AM PEAK EXIT | PM PEAK ENTER | PM PEAK EXIT |
|---|---|---|---|---|---|---|---|
| **Traffic Study dated April 2006** | | | | | | | |
| Apartments | Knox Co. | 175 | 1,578 | 20 | 70 | 70 | 57 |
| Commercial Retail | 820 | 111,290 | 7,280 | 100 | 64 | 335 | 349 |
| **TOTAL** | | | **8,858** | **120** | **134** | **405** | **406** |
| **Current Plan Nov. 2011** | | | | | | | |
| Apartments | Knox Co. | 236 | 2,065 | 26 | 92 | 92 | 76 |
| Commercial Retail | 820 | 53,840 | 4,541 | 65 | 42 | 206 | 214 |
| **TOTAL** | | | **6,606** | **91** | **134** | **298** | **290** |
| **TRIP REDUCTION** | | | **2,252** | **29** | **0** | **107** | **116** |

**Note:** Trips generation for the commercial retail utilized trip rates published in **Trip Generation, 8th Edition**, published by the Institute of Transportation Engineers, and apartment trips are based on the Knoxville/Knox Co. MPC adopted rates for multi-family residential units.

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The reduction in the commercial uses reduces the trip generation significantly. With the reduction in trips, the traffic impacts would not require further mitigation than that identified in the 2006 traffic impact assessment. The trip reduction reflects an approximate 25-percent decrease in the daily, 11-percent in the AM peak-hour, and 27-percent in the PM peak hour generated trips.

With the reduced trip generation, an evaluation of Phase 2's impact on Hardin Valley Road was conducted for the Greenland Way intersection. A peak-hour turning movement count (TMC) was conducted and illustrated in **Figure 3**. Trips generated for the next phase, or 96 units, are presented in **Table 2**, reflecting the difference in the total 236 units and the existing 140 units..

**Table 2-TRIP GENERATION**

| Land Use | Land-Use Code | Units | Daily Trips | AM Peak-Hour Trips | | PM Peak-Hour Trips | |
|---|---|---|---|---|---|---|---|
| | | | | Enter | Exit | Enter | Exit |
| Apartment | Knox Co. | 236 | 2,065 | 26 | 92 | 92 | 76 |
| | | 140 | 1,291 | 16 | 57 | 57 | 47 |
| | | 96 | 774 | 10 | 35 | 35 | 29 |

**Reference: Knoxville/Knox County MPC adopted multi-family rates**

Background traffic was developed for 2013 using a 5-percent compounded growth rate applied to the Hardin Valley Road thru traffic movements. **Figure 4** illustrates the projected background traffic. The trip generation for the additional apartments was assigned to the intersection of Greenland Way and Hardin Valley Road. **Figures 5 and 6** illustrate the trip assignment, based on the observed distribution, and the resulting site volumes, respectively. The project related trips added to background traffic is illustrated in **Figure 7** and are analyzed for capacity and level of service (LOS). Table 3 presents the results of the analyses conducted

**Table 3-CAPACITY AND LEVEL OF SERVICE**

| INTERSECTION | TRAFFIC CONTROL | AM PEAK-HOUR TRAFIC | | | PM PEAK-HOUR TRAFFIC | | |
|---|---|---|---|---|---|---|---|
| | | V/C | DELAY | LOS | V/C | DELAY | LOS |
| **Hardin Valley Road Greenland Way** | **STOP NB-LTR/SB-LT** | **0.49 / 0.23** | **38.2 / 82.1** | **E / F** | **0.17 / 0.70** | **15.4 / 53.1** | **C / F** |
| | ***SIGNAL*** | ***0.72*** | ***29.8*** | ***C*** | ***0.63*** | ***12.7*** | ***B*** |

**Note: Average vehicle delay estimated in seconds. STOP control analyses presented by minor approach.**

The STOP controlled Greenland Way approach will operate at levels of service E and C during the AM and PM peak hours, respectively. The opposing Pellissippi State Community College western access left-turn movement, however, is a LOS F during the peak hours. At least 80-percent of the Greenland Way traffic turns right onto Hardin Valley Road towards the Pellissippi Parkway interchange. Much of the Pellissippi State Community College traffic exiting from its access also turns toward the interchange which results in the poor left-turn movement LOS during the peak hours. The recommended signalization of Greenland Way intersection in the 2006 traffic impact assessment would mitigate this left-turn movement LOS, providing a

The Enclave development, however, would not warrant signalization with this additional phase, but signalization may be warranted with the southbound Pellissippi State Community College approach. Signalization of the intersection would require further study to determine if warrants would be fully satisfied.

Phase 2 of the Enclave development is a reduction in the trip generation from the previous 2006 traffic study thereby reducing any anticipated impacts to Hardin Valley Road. The Greenland Way approach should function with a LOS E or better during the peak hours. If you have any questions regarding this updated assessment, please call me.

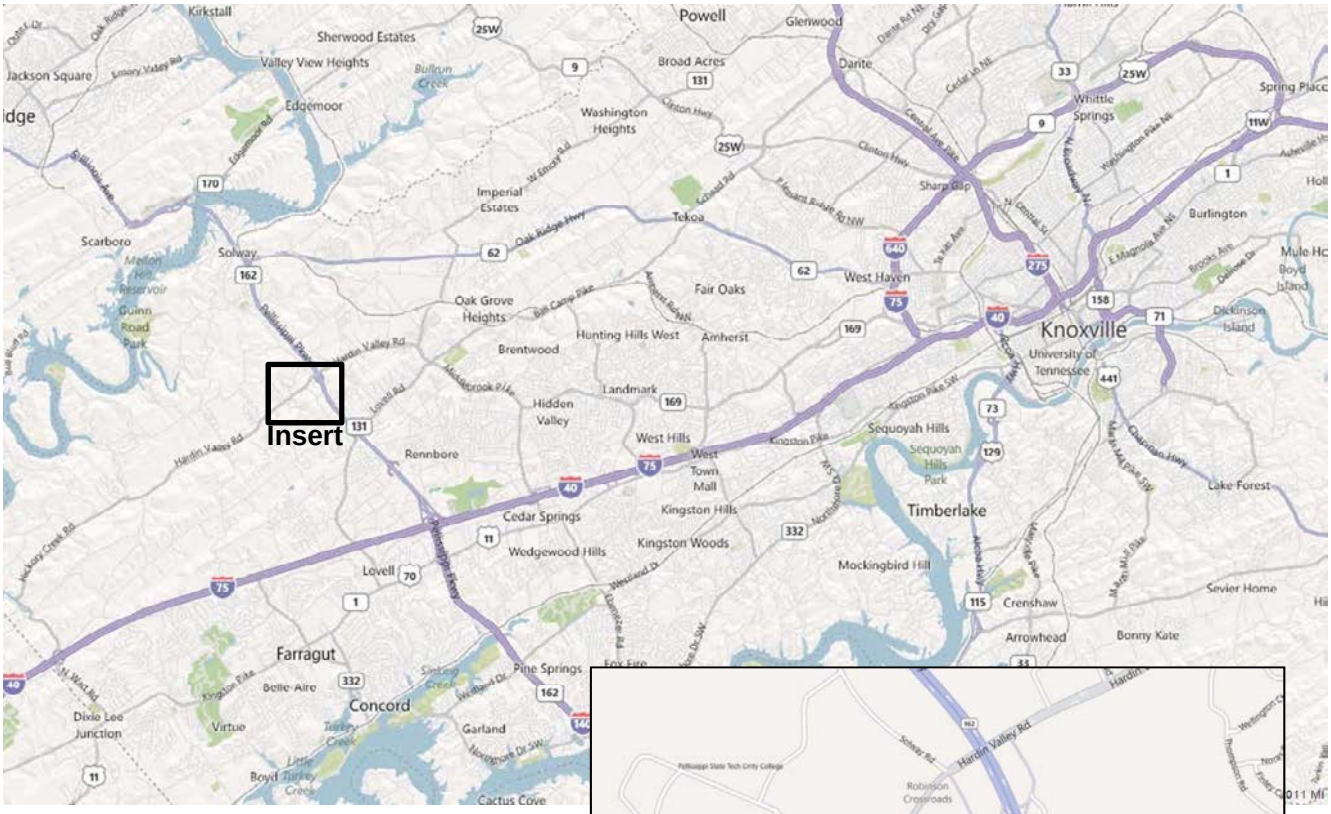
Sincerely,

**WILBUR SMITH ASSOCIATES, INC.**


John F. Gould, P.E.
Senior Transportation Engineer

Enclosures: Figures 1-7
Capacity and LOS Analyses
Peak-Hour Traffic Count

# VICINITY MAP
Enclave Apartments




**SITE**

N

**Figure 1**

# SITE PLAN
Enclave Apartments

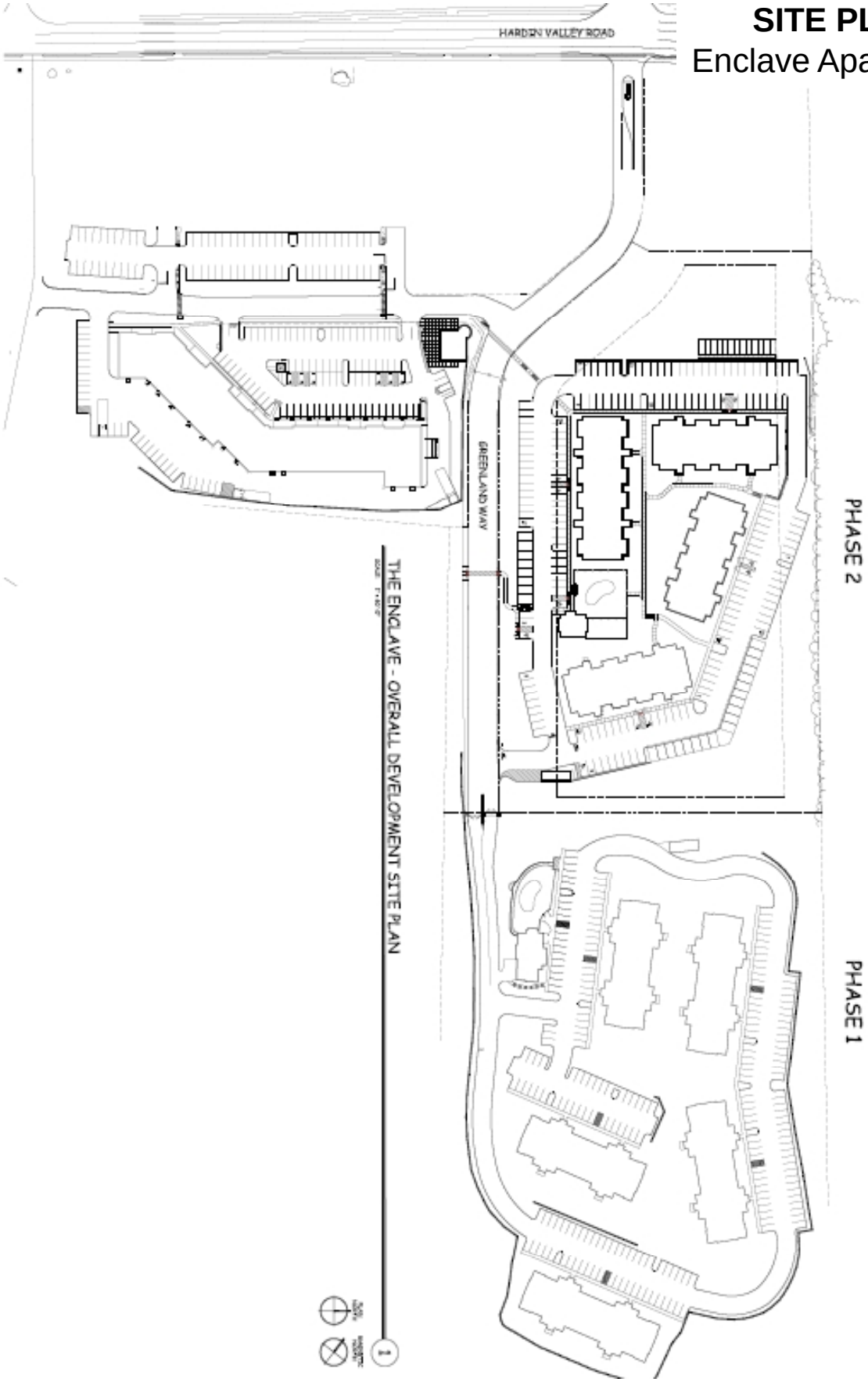
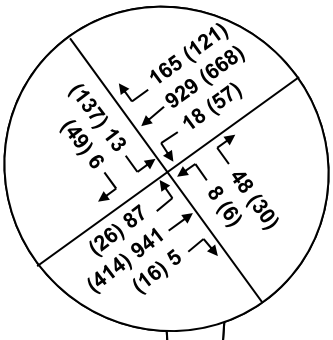



**Figure 1**

# 2011 PEAK-HOUR TRAFFIC VOLUMES

Enclave Apartments





**LEGEND**

**XXX - AM Peak Hour**

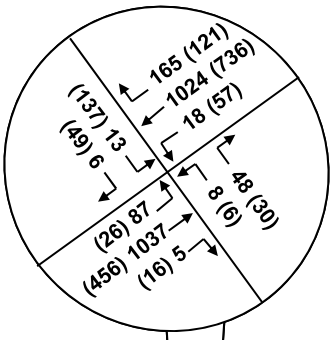
**(XXX) – PM Peak hour**

N

**Figure 2**

# 2013 BACKGROUND PEAK-HOUR TRAFFIC

Enclave Apartments





**LEGEND**

**XXX - AM Peak Hour**

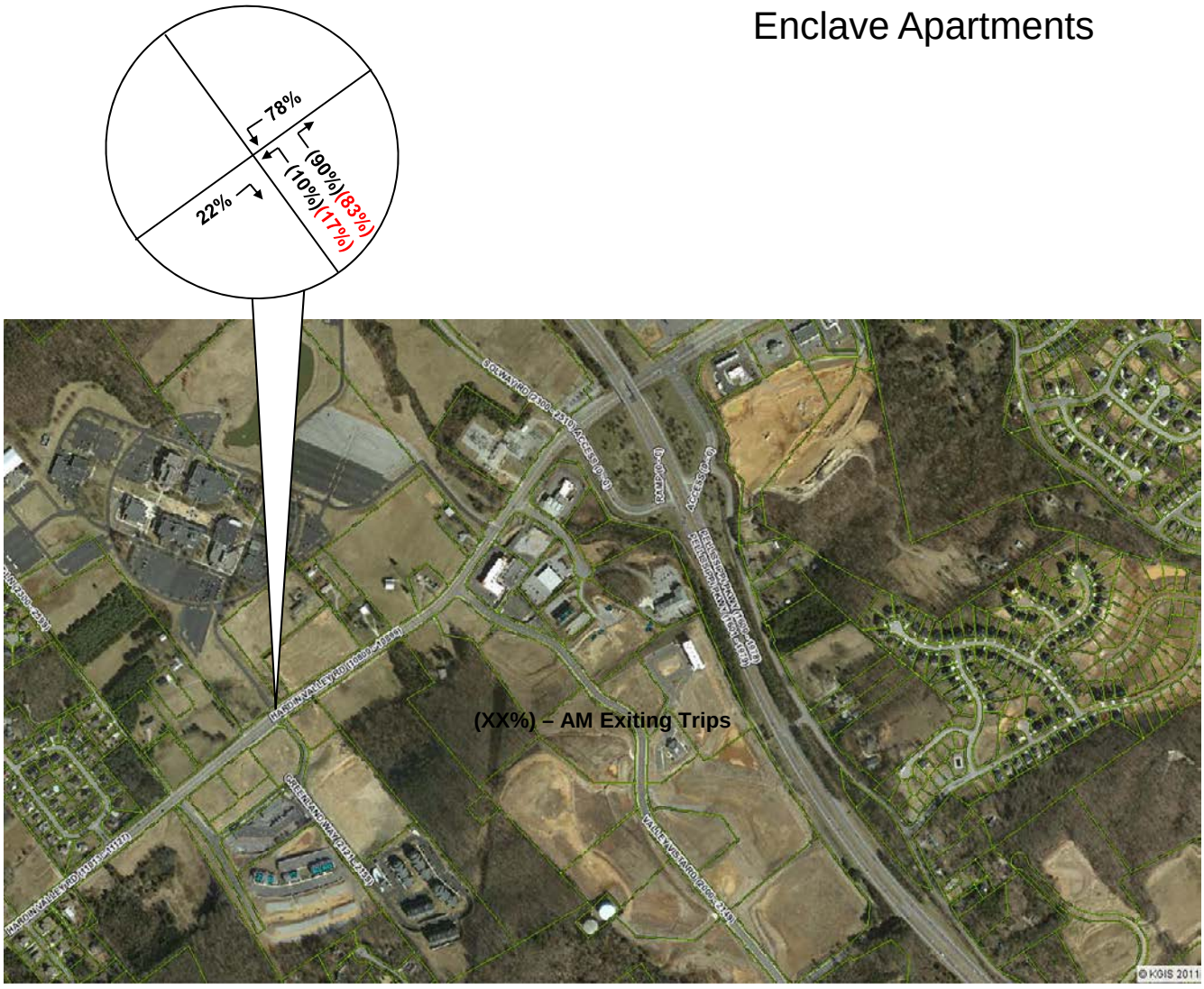
**(XXX) – PM Peak hour**

N

**Figure 3**

# TRIP DISTRIBUTION & ASSIGNMENT

Enclave Apartments




**LEGEND**

**XX% – Entering Trips**

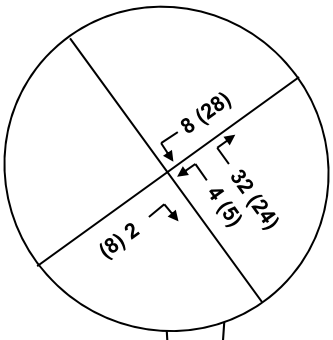
**(XX%) – AM Exiting Trips**

**(XX%) – PM Exiting Trips**

N

**Figure 4**

# SITE TRIPS
Enclave Apartments





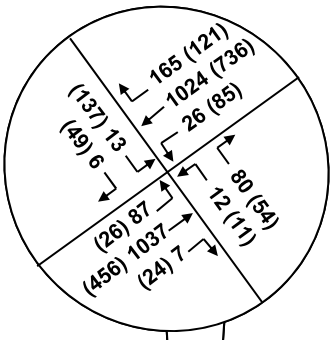
**LEGEND**
**XXX - AM Peak Hour**
**(XXX) – PM Peak hour**

N

**Figure 5**

# 2013 PROJECTED PEAK-HOUR TRAFFIC

Enclave Apartments





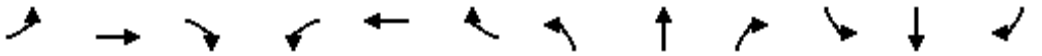
**LEGEND**

**XXX - AM Peak Hour**

**(XXX) – PM Peak hour**

N

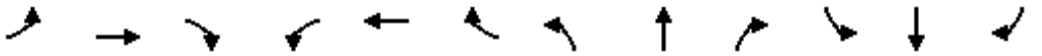
**Figure 6**



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (veh/h) | 87 | 1037 | 7 | 26 | 1024 | 165 | 12 | 0 | 80 | 13 | 0 | 6 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 95 | 1127 | 8 | 28 | 1113 | 179 | 13 | 0 | 87 | 14 | 0 | 7 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | TWLTL | | | TWLTL | | | | | | | |
| Median storage veh) | | 2 | | | 2 | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1292 | | | 1135 | | | 2492 | 2665 | 1127 | 2573 | 2493 | 1113 |
| vC1, stage 1 conf vol | | | | | | | 1316 | 1316 | | 1170 | 1170 | |
| vC2, stage 2 conf vol | | | | | | | 1176 | 1349 | | 1403 | 1324 | |
| vCu, unblocked vol | 1292 | | | 1135 | | | 2492 | 2665 | 1127 | 2573 | 2493 | 1113 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | 6.1 | 5.5 | | 6.1 | 5.5 | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 82 | | | 95 | | | 86 | 100 | 65 | 77 | 100 | 97 |
| cM capacity (veh/h) | 536 | | | 616 | | | 95 | 96 | 249 | 60 | 131 | 254 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | NB 1 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 95 | 1127 | 8 | 28 | 1113 | 179 | 100 | 14 | 7 |
| Volume Left | 95 | 0 | 0 | 28 | 0 | 0 | 13 | 14 | 0 |
| Volume Right | 0 | 0 | 8 | 0 | 0 | 179 | 87 | 0 | 7 |
| cSH | 536 | 1700 | 1700 | 616 | 1700 | 1700 | 205 | 60 | 254 |
| Volume to Capacity | 0.18 | 0.66 | 0.00 | 0.05 | 0.65 | 0.11 | 0.49 | 0.23 | 0.03 |
| Queue Length 95th (ft) | 16 | 0 | 0 | 4 | 0 | 0 | 60 | 20 | 2 |
| Control Delay (s) | 13.1 | 0.0 | 0.0 | 11.1 | 0.0 | 0.0 | 38.2 | 82.1 | 19.6 |
| Lane LOS | B | | | B | | | E | F | C |
| Approach Delay (s) | 1.0 | | | 0.2 | | | 38.2 | 62.4 | |
| Approach LOS | | | | | | | E | F | |

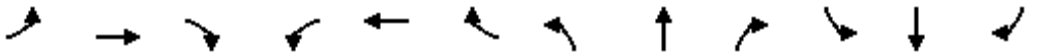
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.5 | | |
| Intersection Capacity Utilization | 81.0% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (veh/h) | 26 | 456 | 24 | 85 | 736 | 121 | 11 | 0 | 54 | 137 | 0 | 49 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 28 | 496 | 26 | 92 | 800 | 132 | 12 | 0 | 59 | 149 | 0 | 53 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | TWLTL | | | TWLTL | | | | | | | |
| Median storage veh) | | 2 | | | 2 | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 932 | | | 522 | | | 1590 | 1668 | 496 | 1596 | 1563 | 800 |
| vC1, stage 1 conf vol | | | | | | | 552 | 552 | | 985 | 985 | |
| vC2, stage 2 conf vol | | | | | | | 1038 | 1116 | | 611 | 578 | |
| vCu, unblocked vol | 932 | | | 522 | | | 1590 | 1668 | 496 | 1596 | 1563 | 800 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | 6.1 | 5.5 | | 6.1 | 5.5 | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 96 | | | 91 | | | 93 | 100 | 90 | 30 | 100 | 86 |
| cM capacity (veh/h) | 735 | | | 1045 | | | 179 | 212 | 574 | 214 | 248 | 385 |

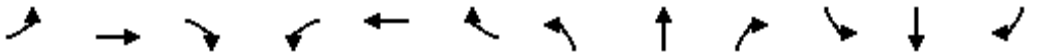
| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | NB 1 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 28 | 496 | 26 | 92 | 800 | 132 | 71 | 149 | 53 |
| Volume Left | 28 | 0 | 0 | 92 | 0 | 0 | 12 | 149 | 0 |
| Volume Right | 0 | 0 | 26 | 0 | 0 | 132 | 59 | 0 | 53 |
| cSH | 735 | 1700 | 1700 | 1045 | 1700 | 1700 | 418 | 214 | 385 |
| Volume to Capacity | 0.04 | 0.29 | 0.02 | 0.09 | 0.47 | 0.08 | 0.17 | 0.70 | 0.14 |
| Queue Length 95th (ft) | 3 | 0 | 0 | 7 | 0 | 0 | 15 | 111 | 12 |
| Control Delay (s) | 10.1 | 0.0 | 0.0 | 8.8 | 0.0 | 0.0 | 15.4 | 53.1 | 15.8 |
| Lane LOS | B | | | A | | | C | F | C |
| Approach Delay (s) | 0.5 | | | 0.8 | | | 15.4 | 43.3 | |
| Approach LOS | | | | | | | C | E | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 5.9 | | |
| Intersection Capacity Utilization | 66.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |



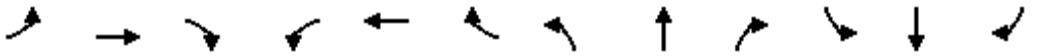
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 87 | 1037 | 7 | 26 | 1024 | 165 | 12 | 0 | 80 | 13 | 0 | 6 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | 4.0 | | | 5.0 | 5.0 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 0.88 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.99 | | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1770 | 1863 | 1583 | 1770 | 1863 | 1583 | | 1633 | | | 1770 | 1583 |
| Flt Permitted | 0.07 | 1.00 | 1.00 | 0.07 | 1.00 | 1.00 | | 0.97 | | | 0.65 | 1.00 |
| Satd. Flow (perm) | 127 | 1863 | 1583 | 130 | 1863 | 1583 | | 1597 | | | 1212 | 1583 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 95 | 1127 | 8 | 28 | 1113 | 179 | 13 | 0 | 87 | 14 | 0 | 7 |
| RTOR Reduction (vph) | 0 | 0 | 3 | 0 | 0 | 67 | 0 | 71 | 0 | 0 | 0 | 6 |
| Lane Group Flow (vph) | 95 | 1127 | 5 | 28 | 1113 | 112 | 0 | 29 | 0 | 0 | 14 | 1 |
| Turn Type | pm+pt | | Perm | pm+pt | | Perm | Perm | | | Perm | | Perm |
| Protected Phases | 1 | 6 | | 5 | 2 | | | 4 | | | 8 | |
| Permitted Phases | 6 | | 6 | 2 | | 2 | 4 | | | 8 | | 8 |
| Actuated Green, G (s) | 61.7 | 58.6 | 58.6 | 58.7 | 57.1 | 57.1 | | 17.0 | | | 16.0 | 16.0 |
| Effective Green, g (s) | 61.7 | 58.6 | 58.6 | 58.7 | 57.1 | 57.1 | | 17.0 | | | 16.0 | 16.0 |
| Actuated g/C Ratio | 0.68 | 0.64 | 0.64 | 0.64 | 0.63 | 0.63 | | 0.19 | | | 0.18 | 0.18 |
| Clearance Time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | 4.0 | | | 5.0 | 5.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 142 | 1197 | 1017 | 112 | 1166 | 991 | | 298 | | | 213 | 278 |
| v/s Ratio Prot | c0.02 | c0.61 | | 0.00 | 0.60 | | | | | | | |
| v/s Ratio Perm | 0.43 | | 0.00 | 0.16 | | 0.07 | | c0.02 | | | 0.01 | 0.00 |
| v/c Ratio | 0.67 | 0.94 | 0.01 | 0.25 | 0.95 | 0.11 | | 0.10 | | | 0.07 | 0.00 |
| Uniform Delay, d1 | 21.1 | 14.7 | 5.8 | 19.0 | 15.8 | 6.9 | | 30.7 | | | 31.4 | 31.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 11.3 | 15.3 | 0.0 | 1.2 | 17.5 | 0.2 | | 0.7 | | | 0.1 | 0.0 |
| Delay (s) | 32.5 | 30.1 | 5.9 | 20.2 | 33.3 | 7.1 | | 31.4 | | | 31.5 | 31.0 |
| Level of Service | C | C | A | C | C | A | | C | | | C | C |
| Approach Delay (s) | | 30.1 | | | 29.5 | | | 31.4 | | | 31.3 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 29.8 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 91.2 | Sum of lost time (s) | 9.0 |
| Intersection Capacity Utilization | 82.7% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 26 | 456 | 24 | 85 | 736 | 121 | 11 | 0 | 54 | 137 | 0 | 49 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 0.89 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.99 | | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1770 | 1863 | 1583 | 1770 | 1863 | 1583 | | 1640 | | | 1770 | 1583 |
| Flt Permitted | 0.26 | 1.00 | 1.00 | 0.41 | 1.00 | 1.00 | | 0.94 | | | 0.73 | 1.00 |
| Satd. Flow (perm) | 493 | 1863 | 1583 | 772 | 1863 | 1583 | | 1558 | | | 1369 | 1583 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 28 | 496 | 26 | 92 | 800 | 132 | 12 | 0 | 59 | 149 | 0 | 53 |
| RTOR Reduction (vph) | 0 | 0 | 8 | 0 | 0 | 41 | 0 | 50 | 0 | 0 | 0 | 45 |
| Lane Group Flow (vph) | 28 | 496 | 18 | 92 | 800 | 91 | 0 | 21 | 0 | 0 | 149 | 8 |
| Turn Type | pm+pt | | Perm | pm+pt | | Perm | Perm | | | Perm | | Perm |
| Protected Phases | 1 | 6 | | 5 | 2 | | | 4 | | | 8 | |
| Permitted Phases | 6 | | 6 | 2 | | 2 | 4 | | | 8 | | 8 |
| Actuated Green, G (s) | 62.3 | 60.7 | 60.7 | 65.5 | 62.3 | 62.3 | | 14.0 | | | 14.0 | 14.0 |
| Effective Green, g (s) | 62.3 | 60.7 | 60.7 | 65.5 | 62.3 | 62.3 | | 14.0 | | | 14.0 | 14.0 |
| Actuated g/C Ratio | 0.69 | 0.68 | 0.68 | 0.73 | 0.69 | 0.69 | | 0.16 | | | 0.16 | 0.16 |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | | | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 364 | 1258 | 1069 | 598 | 1291 | 1097 | | 243 | | | 213 | 247 |
| v/s Ratio Prot | 0.00 | 0.27 | | c0.01 | c0.43 | | | | | | | |
| v/s Ratio Perm | 0.05 | | 0.01 | 0.11 | | 0.06 | | 0.01 | | | c0.11 | 0.01 |
| v/c Ratio | 0.08 | 0.39 | 0.02 | 0.15 | 0.62 | 0.08 | | 0.09 | | | 0.70 | 0.03 |
| Uniform Delay, d1 | 5.9 | 6.5 | 4.8 | 4.0 | 7.4 | 4.5 | | 32.5 | | | 36.0 | 32.2 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.1 | 0.9 | 0.0 | 0.1 | 2.2 | 0.1 | | 0.2 | | | 9.6 | 0.1 |
| Delay (s) | 6.0 | 7.4 | 4.8 | 4.1 | 9.7 | 4.6 | | 32.6 | | | 45.6 | 32.3 |
| Level of Service | A | A | A | A | A | A | | C | | | D | C |
| Approach Delay (s) | | 7.2 | | | 8.5 | | | 32.6 | | | 42.1 | |
| Approach LOS | | A | | | A | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 12.7 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 89.9 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 66.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 26 | 456 | 24 | 85 | 736 | 121 | 11 | 0 | 54 | 137 | 0 | 49 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | 4.0 | | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 0.89 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.99 | | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1770 | 1863 | 1583 | 1770 | 1863 | 1583 | | 1640 | | | 1770 | 1583 |
| Flt Permitted | 0.26 | 1.00 | 1.00 | 0.41 | 1.00 | 1.00 | | 0.94 | | | 0.73 | 1.00 |
| Satd. Flow (perm) | 481 | 1863 | 1583 | 773 | 1863 | 1583 | | 1558 | | | 1366 | 1583 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 28 | 496 | 26 | 92 | 800 | 132 | 12 | 0 | 59 | 149 | 0 | 53 |
| RTOR Reduction (vph) | 0 | 0 | 9 | 0 | 0 | 43 | 0 | 50 | 0 | 0 | 0 | 45 |
| Lane Group Flow (vph) | 28 | 496 | 17 | 92 | 800 | 89 | 0 | 21 | 0 | 0 | 149 | 8 |
| Turn Type | pm+pt | | Perm | pm+pt | | Perm | Perm | | | Perm | | Perm |
| Protected Phases | 1 | 6 | | 5 | 2 | | | 4 | | | 8 | |
| Permitted Phases | 6 | | 6 | 2 | | 2 | 4 | | | 8 | | 8 |
| Actuated Green, G (s) | 60.7 | 59.1 | 59.1 | 63.9 | 60.7 | 60.7 | | 14.0 | | | 14.0 | 14.0 |
| Effective Green, g (s) | 60.7 | 59.1 | 59.1 | 63.9 | 60.7 | 60.7 | | 14.0 | | | 14.0 | 14.0 |
| Actuated g/C Ratio | 0.67 | 0.65 | 0.65 | 0.71 | 0.67 | 0.67 | | 0.16 | | | 0.16 | 0.16 |
| Clearance Time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | 4.0 | | | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 346 | 1219 | 1036 | 582 | 1252 | 1064 | | 242 | | | 212 | 245 |
| v/s Ratio Prot | 0.00 | 0.27 | | c0.01 | c0.43 | | | | | | | |
| v/s Ratio Perm | 0.05 | | 0.01 | 0.11 | | 0.06 | | 0.01 | | | c0.11 | 0.01 |
| v/c Ratio | 0.08 | 0.41 | 0.02 | 0.16 | 0.64 | 0.08 | | 0.09 | | | 0.70 | 0.03 |
| Uniform Delay, d1 | 6.6 | 7.3 | 5.4 | 4.5 | 8.5 | 5.1 | | 32.7 | | | 36.2 | 32.4 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.1 | 1.0 | 0.0 | 0.1 | 2.5 | 0.2 | | 0.2 | | | 10.1 | 0.1 |
| Delay (s) | 6.7 | 8.4 | 5.5 | 4.6 | 11.0 | 5.3 | | 32.8 | | | 46.3 | 32.5 |
| Level of Service | A | A | A | A | B | A | | C | | | D | C |
| Approach Delay (s) | | 8.1 | | | 9.7 | | | 32.8 | | | 42.6 | |
| Approach LOS | | A | | | A | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 13.7 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 90.3 | Sum of lost time (s) | 9.0 |
| Intersection Capacity Utilization | 68.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

# WILBUR SMITH ASSOCIATES

File Name : Hardin Valley & Greenland Way
Site Code : 00001006
Start Date : 11/29/2011
Page No : 1

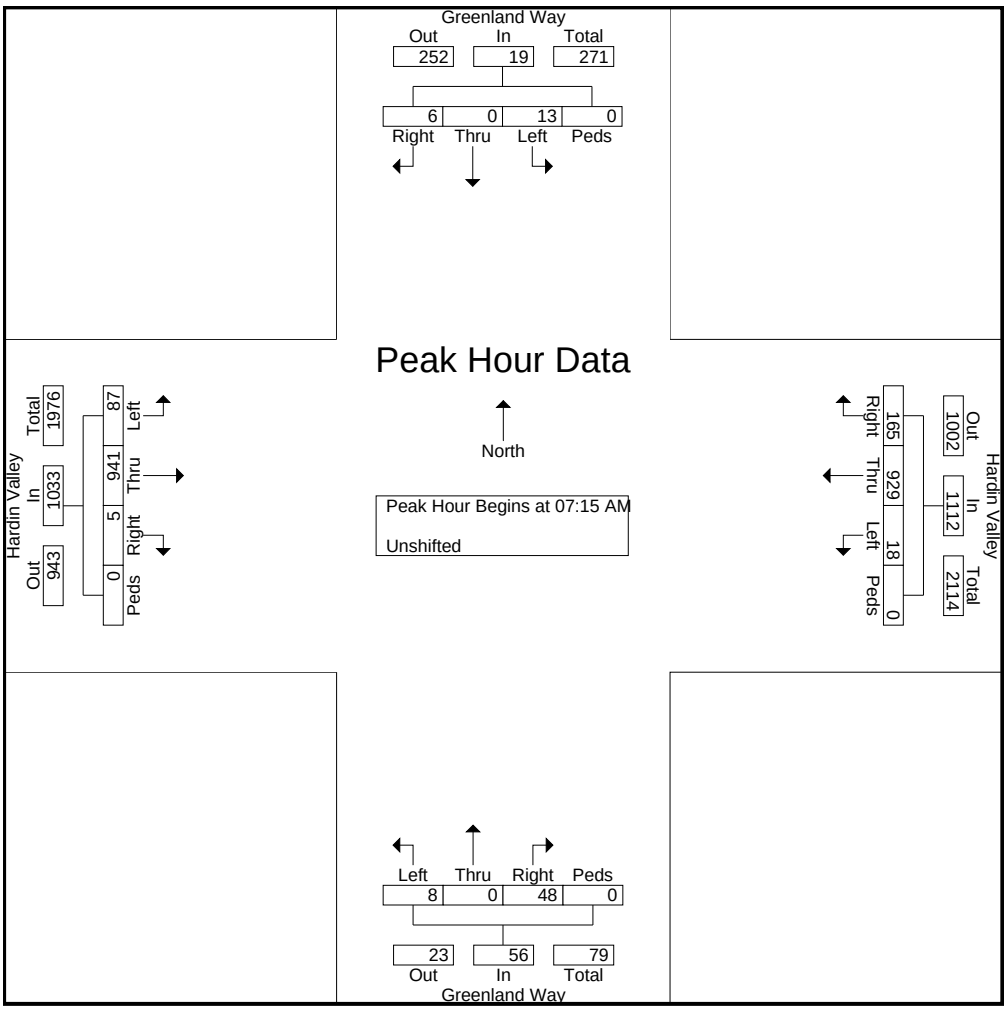
Groups Printed- Unshifted

| | Greenland Way Southbound | | | | | Hardin Valley Westbound | | | | | Greenland Way Northbound | | | | | Hardin Valley Eastbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Int. Total |
| 07:00 AM | 1 | 0 | 0 | 0 | 1 | 1 | 189 | 25 | 0 | 215 | 2 | 0 | 8 | 0 | 10 | 6 | 154 | 0 | 0 | 160 | 386 |
| 07:15 AM | 2 | 0 | 2 | 0 | 4 | 5 | 229 | 55 | 0 | 289 | 4 | 0 | 12 | 0 | 16 | 20 | 217 | 2 | 0 | 239 | 548 |
| 07:30 AM | 1 | 0 | 1 | 0 | 2 | 6 | 212 | 25 | 0 | 243 | 3 | 0 | 13 | 0 | 16 | 22 | 278 | 1 | 0 | 301 | 562 |
| 07:45 AM | 2 | 0 | 3 | 0 | 5 | 6 | 187 | 38 | 0 | 231 | 0 | 0 | 11 | 0 | 11 | 27 | 253 | 2 | 0 | 282 | 529 |
| Total | 6 | 0 | 6 | 0 | 12 | 18 | 817 | 143 | 0 | 978 | 9 | 0 | 44 | 0 | 53 | 75 | 902 | 5 | 0 | 982 | 2025 |
| 08:00 AM | 8 | 0 | 0 | 0 | 8 | 1 | 301 | 47 | 0 | 349 | 1 | 0 | 12 | 0 | 13 | 18 | 193 | 0 | 0 | 211 | 581 |
| 08:15 AM | 2 | 0 | 4 | 0 | 6 | 0 | 161 | 59 | 0 | 220 | 0 | 0 | 7 | 0 | 7 | 44 | 172 | 2 | 0 | 218 | 451 |
| 08:30 AM | 0 | 0 | 2 | 0 | 2 | 2 | 68 | 115 | 0 | 185 | 0 | 1 | 11 | 0 | 12 | 33 | 106 | 3 | 0 | 142 | 341 |
| 08:45 AM | 28 | 0 | 4 | 0 | 32 | 1 | 33 | 135 | 0 | 169 | 1 | 0 | 6 | 0 | 7 | 41 | 66 | 0 | 0 | 107 | 315 |
| Total | 38 | 0 | 10 | 0 | 48 | 4 | 563 | 356 | 0 | 923 | 2 | 1 | 36 | 0 | 39 | 136 | 537 | 5 | 0 | 678 | 1688 |
| *** BREAK *** | | | | | | | | | | | | | | | | | | | | | |
| 03:00 PM | 81 | 0 | 13 | 0 | 94 | 5 | 105 | 16 | 0 | 126 | 7 | 1 | 5 | 0 | 13 | 2 | 99 | 9 | 0 | 110 | 343 |
| 03:15 PM | 66 | 1 | 24 | 0 | 91 | 6 | 111 | 20 | 0 | 137 | 0 | 0 | 1 | 0 | 1 | 11 | 64 | 2 | 0 | 77 | 306 |
| 03:30 PM | 68 | 1 | 17 | 0 | 86 | 6 | 94 | 33 | 1 | 134 | 0 | 0 | 7 | 0 | 7 | 9 | 151 | 2 | 0 | 162 | 389 |
| 03:45 PM | 42 | 2 | 11 | 0 | 55 | 9 | 143 | 26 | 0 | 178 | 0 | 0 | 5 | 0 | 5 | 12 | 204 | 3 | 0 | 219 | 457 |
| Total | 257 | 4 | 65 | 0 | 326 | 26 | 453 | 95 | 1 | 575 | 7 | 1 | 18 | 0 | 26 | 34 | 518 | 16 | 0 | 568 | 1495 |
| 04:00 PM | 37 | 0 | 15 | 0 | 52 | 7 | 111 | 9 | 0 | 127 | 0 | 0 | 3 | 0 | 3 | 4 | 126 | 2 | 0 | 132 | 314 |
| 04:15 PM | 28 | 0 | 7 | 0 | 35 | 5 | 142 | 22 | 2 | 171 | 2 | 0 | 4 | 0 | 6 | 5 | 106 | 4 | 4 | 119 | 331 |
| 04:30 PM | 43 | 0 | 18 | 0 | 61 | 14 | 146 | 13 | 3 | 176 | 1 | 0 | 5 | 0 | 6 | 9 | 95 | 2 | 0 | 106 | 349 |
| 04:45 PM | 44 | 0 | 17 | 0 | 61 | 18 | 159 | 15 | 2 | 194 | 0 | 1 | 4 | 0 | 5 | 3 | 100 | 1 | 1 | 105 | 365 |
| Total | 152 | 0 | 57 | 0 | 209 | 44 | 558 | 59 | 7 | 668 | 3 | 1 | 16 | 0 | 20 | 21 | 427 | 9 | 5 | 462 | 1359 |
| 05:00 PM | 70 | 0 | 23 | 0 | 93 | 17 | 160 | 20 | 0 | 197 | 3 | 0 | 10 | 0 | 13 | 4 | 94 | 4 | 0 | 102 | 405 |
| 05:15 PM | 31 | 0 | 13 | 0 | 44 | 4 | 201 | 22 | 2 | 229 | 1 | 0 | 5 | 0 | 6 | 3 | 106 | 5 | 0 | 114 | 393 |
| 05:30 PM | 18 | 0 | 6 | 0 | 24 | 19 | 134 | 32 | 0 | 185 | 1 | 0 | 8 | 0 | 9 | 7 | 105 | 3 | 2 | 117 | 335 |
| 05:45 PM | 18 | 0 | 7 | 0 | 25 | 17 | 173 | 47 | 0 | 237 | 1 | 0 | 7 | 0 | 8 | 12 | 109 | 4 | 0 | 125 | 395 |
| Total | 137 | 0 | 49 | 0 | 186 | 57 | 668 | 121 | 2 | 848 | 6 | 0 | 30 | 0 | 36 | 26 | 414 | 16 | 2 | 458 | 1528 |
| Grand Total | 590 | 4 | 187 | 0 | 781 | 149 | 3059 | 774 | 10 | 3992 | 27 | 3 | 144 | 0 | 174 | 292 | 2798 | 51 | 7 | 3148 | 8095 |
| Apprch % | 75.5 | 0.5 | 23.9 | 0 | | 3.7 | 76.6 | 19.4 | 0.3 | | 15.5 | 1.7 | 82.8 | 0 | | 9.3 | 88.9 | 1.6 | 0.2 | | |
| Total % | 7.3 | 0 | 2.3 | 0 | 9.6 | 1.8 | 37.8 | 9.6 | 0.1 | 49.3 | 0.3 | 0 | 1.8 | 0 | 2.1 | 3.6 | 34.6 | 0.6 | 0.1 | 38.9 | |

# WILBUR SMITH ASSOCIATES

File Name : Hardin Valley & Greenland Way
Site Code : 00001006
Start Date : 11/29/2011
Page No : 2

| | Greenland Way Southbound | | | | | Hardin Valley Westbound | | | | | Greenland Way Northbound | | | | | Hardin Valley Eastbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Int. Total |
| Peak Hour Analysis From 07:00 AM to 12:30 PM - Peak 1 of 1 | | | | | | | | | | | | | | | | | | | | | |
| Peak Hour for Entire Intersection Begins at 07:15 AM | | | | | | | | | | | | | | | | | | | | | |
| 07:15 AM | 2 | 0 | 2 | 0 | 4 | 5 | 229 | **55** | | | **4** | | | | **16** | 20 | 217 | **2** | | | |
| **07:30 AM** | **1** | **0** | **1** | **0** | **2** | **6** | 212 | 25 | 0 | 243 | 3 | 0 | **13** | 0 | 16 | 22 | **278** | 1 | 0 | **301** | 562 |
| 07:45 AM | 2 | 0 | **3** | | | | | | | | | | | | | **27** | | | | | |
| **08:00 AM** | **8** | **0** | **0** | **0** | **8** | 1 | **301** | **47** | **0** | **349** | 1 | 0 | 12 | 0 | 13 | 18 | 193 | 0 | 0 | 211 | **581** |
| Total Volume | 13 | 0 | 6 | 0 | 19 | 18 | 929 | 165 | 0 | 1112 | 8 | 0 | 48 | 0 | 56 | 87 | 941 | 5 | 0 | 1033 | 2220 |
| % App. Total | 68.4 | 0 | 31.6 | 0 | | 1.6 | 83.5 | 14.8 | 0 | | 14.3 | 0 | 85.7 | 0 | | 8.4 | 91.1 | 0.5 | 0 | | |
| PHF | .406 | .000 | .500 | .000 | .594 | .750 | .772 | .750 | .000 | .797 | .500 | .000 | .923 | .000 | .875 | .806 | .846 | .625 | .000 | .858 | .955 |



# WILBUR SMITH ASSOCIATES

File Name : Hardin Valley & Greenland Way
Site Code : 00001006
Start Date : 11/29/2011
Page No : 3

| | Greenland Way Southbound | | | | | Hardin Valley Westbound | | | | | Greenland Way Northbound | | | | | Hardin Valley Eastbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Int. Total |
| Peak Hour Analysis From 12:45 PM to 05:45 PM - Peak 1 of 1 | | | | | | | | | | | | | | | | | | | | | |
| Peak Hour for Entire Intersection Begins at 05:00 PM | | | | | | | | | | | | | | | | | | | | | |
| 05:00 PM | **70** | | **23** | | **93** | 17 | 160 | 20 | 0 | 197 | **3** | | **10** | 0 | **13** | 4 | 94 | 4 | 0 | 102 | **405** |
| 05:15 PM | 31 | 0 | 13 | 0 | 44 | 4 | **201** | | **2** | 229 | 1 | 0 | 5 | 0 | 6 | 3 | 106 | **5** | | | |
| **05:30 PM** | **18** | **0** | **6** | **0** | **24** | **19** | 134 | 32 | 0 | 185 | 1 | 0 | 8 | 0 | 9 | 7 | 105 | 3 | **2** | **117** | **335** |
| **05:45 PM** | **18** | **0** | **7** | **0** | **25** | **17** | **173** | **47** | **0** | **237** | 1 | 0 | 7 | 0 | 8 | **12** | **109** | 4 | 0 | **125** | 395 |
| Total Volume | 137 | 0 | 49 | 0 | 186 | 57 | 668 | 121 | 2 | 848 | 6 | 0 | 30 | 0 | 36 | 26 | 414 | 16 | 2 | 458 | 1528 |
| % App. Total | 73.7 | 0 | 26.3 | 0 | | 6.7 | 78.8 | 14.3 | 0.2 | | 16.7 | 0 | 83.3 | 0 | | 5.7 | 90.4 | 3.5 | 0.4 | | |
| PHF | .489 | .000 | .533 | .000 | .500 | .750 | .831 | .644 | .250 | .895 | .500 | .000 | .750 | .000 | .692 | .542 | .950 | .800 | .250 | .916 | .943 |