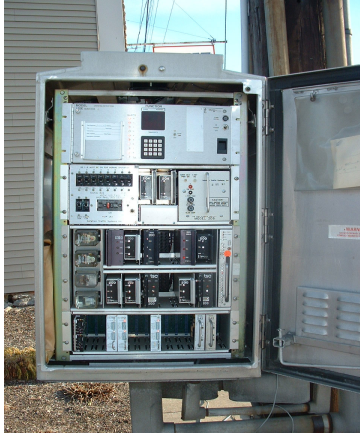


6. SIGNAL INVENTORY

A signal inventory was conducted for all 44 signalized intersections within the project limits. The timing and phasing for all intersections was obtained from the Kentucky Transportation Cabinet. The Translink files containing the signal phasing and timing were provided in the Field Inventory Report (October 25, 2004). The purpose of the signal inventory was to obtain information pertaining to the signal placement, pole locations, controller locations, detector locations, controller types, cabinet types, overall equipment condition and interconnect.



CONTROLLER CABINET
AT COMMONWEALTH

All of the signals along the Dixie Highway Corridor are owned and operated by the Kentucky Transportation Cabinet. The signals are of the 170 type, although the WAPITI software version for each intersection varies significantly. The Dixie Highway Corridor Signals operate on two separate systems. One system includes the signals from Turfway Road to the Expressway Plaza (System 2) and the second system includes the signals from the I-71/75 NB Ramp in Fort Mitchell to the intersection with Arlington Street (System 3). The intersections of Dixie Highway with Montague, the I-71/75 NB Ramp in Covington and the I-71/75 SB Ramp in Covington all operate independently. The last signal to the north, Pike Street & Main Street, is operated as part of the Covington System.

Most of the problems encountered were maintenance issues. Of major concern is the large number of detector failures along Dixie Highway. Once a loop detector fails, it constantly places a call to the side street, even when no car is present. This disrupts the flow of traffic along Dixie Highway and decreases the capacity of the Corridor. “System 2” did not have an operating modem at the time of the signal inventory. This prevents remote access to this system. “System 3” did not have an operating master at the time of the signal inventory. Without a master, the local controller clocks are not being synchronized with one another. If the local clocks are allowed to drift, the programmed progression timings actually work to inhibit traffic flow along Dixie Highway.

The Kentucky Transportation Cabinet was immediately notified of several serious problems. The call log is located in the *Dixie Highway Corridor Study: Public Involvement & Modeling Documentation*. These included:

- February 9, 2004 – Detector Failure in the NB right most left-turn lane at the intersection of Dixie Highway & Buttermilk Pike. In addition, the green bulb was out for the EB center lane signal at the intersection of Buttermilk Pike & Dixie Highway.
- February 9, 2004 – The green bulb was out for the NB signal head at the intersection of Lookout Drive/Whitehouse & Dixie Highway.
- February 10, 2004 – The red bulb was out for the NB left hand signal at the intersection of St. John’s & Dixie Highway.
- February 17, 2004 – The red bulb was out for the WB left hand signal at the intersection of Sleepy Hollow Road & Dixie Highway.

- February 17, 2004 – The conflict monitor was not inserted into the controller at the intersection of St. Joseph’s & Dixie Highway
- February 17, 2004 – Two red bulbs were out at the intersection of Arlington Road & Dixie Highway.

The following list details the problems encountered at each intersection:

- **INTERCONNECT**

Several intersections were not part of the interconnected system. These intersections include:

- Pike & Main Street
- I-75 Northbound Ramp in Covington
- I-75 Southbound Ramp in Covington
- Montague/Western Avenue
- Buttermilk Pike/Huckleberry Lane
- Turfway Road
- Signal System 3
 - Arlington
 - Covington Catholic
 - Sleepy Hollow
 - Ashwood
 - St. John’s
 - I-75 NB Ramp
 - St. Joseph’s
 - St. James
 - Kyles
 - Forside
 - Orchard
 - I-75 SB Ramp

- **MASTER CONTROLLER**

The two signal systems had associated problems with their master controllers.

- System 3 – no master
- System 2 – modem hit by lightning (not operational)

- **PRETIMED INTERSECTIONS**

An intersection was found operating as pretimed. Pretimed intersections allocate a portion of the cycle to the side streets even if a vehicle is not present. This provides considerable and unnecessary delay to Dixie Highway.

- Montague/Western
 - Loop detector amplifiers were found in the controller cabinet

- **“ODD” PHASING**

Several intersections were found with “odd” phasings. Each intersection is controlled by a 170 controller.

- Montague/Western
 - Phase 2 (North-South through) green is followed by Phase 6 (Southbound “Western Avenue”) green which is followed by the Phase 4 (Eastbound Montague) green.
- Dudley/Summit
 - Phase 3 is used as a lagging movement for the NB & SB left turns.
- Kenton Lands Road
 - Lead-Lag N-S Left Turns. Phase 3 SB LT is a lag and Phase 5 NB LT is a lead. OL-A is the NB through movement. OL-A= 5+6+7. OL-B is the SB through movement. OL-B= 3+6+7. Phase 7 is a phantom phase. Phase 7 only “calls” if phase 3 (the lagging NB LT) is skipped. Phase 7 is set for “Coord

Max”. See TransLink Table 8. Phase 6 is the only coordinated phase. See TransLink Table 7. Phase 6 is the only startup phase. See TransLink Table 1. “Exclusive phases” = 3, 4, 7. Phase 2 is the only “Double Entry” phase. See TransLink Table 10.

- Montgomery Drive
 - Lead-Lag N-S Left Turns. Phase 3 SB LT is a lag and Phase 5 NB LT is a lead. OL-A is the NB through movement. OL-A= 5+6+7. OL-B is the SB through movement. OL-B= 3+6+7. Phase 7 is a phantom phase. Phase 7 only “calls” if phase 3 (the lagging NB LT) is skipped. Phase 7 is set for “Coord Max”. See TransLink Table 8. Phase 6 is the only coordinated phase. See TransLink Table 7. Phase 6 is the only startup phase. See TransLink Table 1. “Exclusive phases” = 3, 4, 7. Phase 2 is the only “Double Entry” phase. See TransLink Table 10.
- PEDESTRIAN SIGNALS/PHASING
 - Several intersections were found with pedestrian hardware and phasing issues
 - Montague/Western
 - Only the phase 2 pedestrian movement was on recall.
 - St. James
 - One of the phase 4 pedestrian push buttons was placing a constant call to the controller.
 - Sleepy Hollow
 - Phase 6 was not programmed as a pedestrian phase on TransLink Table 1. Phase 6 has pedestrian signal heads and push buttons.
 - The Pedestrian push button on the Southeast corner did not place a call to the controller.
 - One of the phase 4 pedestrian push buttons was placing a constant call to the controller.
 - Kyles Lane
 - The Pedestrian push button on the Southeast corner did not place a call to the controller.
 - Orchard
 - The Northeast corner “Don’t Walk” lamp was out.
 - I-75 SB Ramp in Fort Mitchell
 - The controller was set for “Max Recall” on phases 2 & 6 but not for “pedestrian recall.”
 - I-75 NB Ramp in Fort Mitchell
 - The controller was set for “Max Recall” on phases 2 & 6 but not for “pedestrian recall.”
 - Winding Way/Crestview Hills
 - The Phase 4 pedestrian push buttons were not operational.
 - Kenton Lands
 - The Phase 2 & 6 pedestrian times were not equal. The crosswalk distance was almost the same.
 - Commonwealth
 - Phase 8 pedestrian push buttons were not operational.

- Bartlett/May
 - Pedestrian signal heads should be installed to prevent pedestrians from being confused by overlap indications.
- **EMERGENCY PREEMPTION SETTINGS**

Several intersections were found with emergency preemption settings in TransLink Table 3, but no emergency preemption hardware.

 - Arlington Road
 - I-75 SB Ramp in Fort Mitchell
 - I-75 NB Ramp in Fort Mitchell
 - Highland
- **FALSE CALLING LOOP DETECTORS**

Several intersections were found where the loop detectors were false calling. This causes the traffic signal to provide green time to the side street when no cars are present.

 - St. Joseph
 - The phase 4 loop detector amplifier indicated a “fault” had occurred on the loop and was placing a constant call to the controller. Upon closer inspection it was found that the “loop lead-in” cables for phases 4 & 8 were not connected to the detector input rack.
 - Kyles Lane
 - One of the phase 1 (SB LT) loop detector amplifiers was stuck on call. The amplifier that was stuck on call was believed to be located in the Westbound Kyles “Right Turn Only” lane. This information could not be confirmed.
 - The Phase 2 and Phase 6 loop detector amplifiers indicate “faults” had occurred on the loops and were placing constant calls to the controller. These amplifiers were only active during “Free” operation.
 - Fortside
 - The phase 4 loop detector amplifier was stuck on call.
 - Orchard
 - The phase 4 west approach loop detector amplifier was stuck on call. The west approach loop wire was broken at the curb line.
 - I-75 SB Ramp in Fort Mitchell
 - Vehicles in the “Northbound through” left lane were being detected by the video detector for phase 5 causing false calls on phase 5.
 - Buttermilk Pike
 - Northbound left turn right lane loop is not detecting vehicles.
 - Arcadia
 - Phase 8 loop detector amplifier was stuck on call. The phase 8 loop was milled out of the pavement on the West approach.
 - Turkeyfoot/Hudson
 - Phase 4 loop detector was stuck on call.
 - Rosemont/Crestview Hills Mall
 - Phase 1 loop detector was stuck on call
 - Garvey/McAlpin
 - Phase 3 loop detector was stuck on call

- **DETECTOR DELAY SETTINGS**

Several intersections were found where a detector delay was set for one or more of the phases. Delays are sometimes used to allow the side street right turning vehicles to turn without having to call the side street green.

- Covington Catholic Entrance
 - This intersection had a 5 second delay set on the Phase 4 detector input.
- Kyles Lane
 - No detector “delay time” (TransLink Table 4 Part 1) was set in the controller for phase 1.
- Carran
 - Phase 4 had a 5 second delay.

- **YELLOW LOCK ISSUES**

Several intersections were found where the yellow lock was set for one or more phases. This setting places a locking call on the phase anytime the phase in question is not green. The reasoning behind the settings for these intersections could not be identified.

- St. James
 - Phase 2 was set for Yellow Lock.
- I-75 SB Ramp in Fort Mitchell
 - The phase 5 (Northbound Left Turn) was programmed for “Yellow Lock” on TransLink Table 1. The Left Turn movement “calls” often when it is not needed.
- Edgewood
 - Phase 4 was set for Yellow Lock.

- **COORDINATION ISSUES**

Several intersections were found where the coordinated phase was not the NB and SB movements on Dixie Highway. The reasoning for these settings could not be determined.

- St. James
 - Phase 2 was the coordinated phase.
- Sleepy Hollow
 - Only phase 2 was programmed to be the “coordinated phase” on TransLink Table 7. Phases 2 & 6 are the North South thru movements.
- Commonwealth
 - Phase 1 & Phase 6 are coordinated phases. Phase 2 has no detectors and was on vehicle and pedestrian recall.

- **LEFT TURN TRAP**

Several intersections were found where a left turn trap is possible. This is an unsafe condition where the left turning traffic believes that the opposing traffic has a red light when they do not.

- Kyles Lane
 - The “LTT” value was set to “0” on TransLink Table 10. Northbound left turn traffic to the private driveways at the intersection will see a Left Turn Trap Yellow if phase 1 is called and phase 4 is skipped. Phase 4 will likely be skipped in the “off peak” periods because when the signal is in “Free” every vehicle that passes over the Southbound Left Turn Loop or the Westbound Right Turn loop will place a call to the controller.

- Bartlett/May
 - A “Left Turn Trap” occurred on every controller cycle. N-S traffic attempting to make a left turn into the private drives located directly across from the side streets will see a yellow clearance when the opposing traffic has a green.
- Turfway/Main/Rose
 - A “Left Turn Trap” was possible on every cycle. If the controller were to go from phases 2 & 6 green (Northbound & Southbound Dixie Highway) to phase 2 & 5 (Northbound Dixie & NB protected left turn) a “Left Turn Trap” would occur for Southbound Dixie Highway Left Turn traffic attempting to enter Rose Drive.
- DETECTOR LOCATIONS

One intersection was found where the detectors were improperly located.

 - I-75 SB Ramp in Fort Mitchell
 - Phase 4 was set for “No Memory”. Vehicles on the phase 4 off ramp are able to stop in front of the loop detectors. This could be a problem in “off peak” periods.
- LAGGING LEFT TURNS

Several intersections were found where the left turn phase lags after the through movement.

 - Expressway Shopping Center
 - Buttermilk Pike – NB & SB Lefts
 - Hallam – SB Left
 - Commonwealth – Lead Lag NB SB Lefts (protected)
- MISCELLANEOUS
 - Buttermilk Pike
 - The timing chart indicates OLA was a phase 4 overlap. Was unable to confirm if OLA was being used at this time.
 - Kenton Lands Road
 - Phase 6 was set for max recall. See TransLink Table 2.
 - The Command Box had values set
 - Phase 1 was set for min recall.
 - Montgomery Drive
 - The Command Box had values set
 - Hallam
 - Phase 4 was set for min recall.
 - Bartlett/May
 - The signal heads for OLA and OLB should be “optically programmable.” The overlap green indications can easily be misunderstood as traffic approaches the Phase 2 red signal heads.
 - Bartlett/May
 - Additional heads and detectors should be installed for the private drives opposite the side streets. Left turn traffic from these private drives must “run the signal red” if opposing traffic does not “call” the signal.

- Garvey/McAlpin
 - Additional heads and detectors should be installed for the private drives opposite the side streets. Left turn traffic from these private drives must “run the signal red” if opposing traffic does not “call” the signal.
- Cave Run
 - Phase 4 and Phase 5 were on min recall. However, the LTT is not set to “On” in TransLink Table 10. Without this setting, removing the phase 4 recall would result in a left turn trap for the SB left turn traffic when Phase 5 is called.
- ALL INTERSECTIONS
 - Consider using a very short background cycle length at night or placing low volume intersections on flash at night. Most intersections do not have a “delay” set on the detectors. When the signal is in “Free” operation at night every vehicle detection (Right Turn on Red) will cycle the controller. Programming the controllers to “Rest in Walk” for the main street would also help prevent this from occurring. “No Coord Ped Recall” on TransLink Table 6 is set to “on.” By setting this “off,” all the pedestrian push buttons on the main street phases could be eliminated (resulting in less maintenance).
 - Update WAPITI software to the latest Revision at all intersections.

In a meeting with the staff of the Kentucky Transportation Cabinet District 6, the problems at each intersection were discussed, and possible solutions were proposed. For the conference memo of this meeting, see the *Dixie Highway Corridor Study: Public Involvement & Modeling Documentation*.