

**Montana US Highway 93 South Wildlife Crossings Research  
MDT # HWY – 308445-RP**

**2011 Third Quarter Progress Report**

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Prepared for the Montana Department of Transportation  
October 31, 2011



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## 1. Study Area and Purpose

The Montana Department of Transportation (MDT) installed 12 large wildlife crossing structures along US Highway 93 South between Florence and Hamilton from 2004 to 2011. Seven additional wildlife crossing structures are currently being installed. Details of the 12 existing wildlife crossing structures and seven future wildlife crossing structure sites are presented in Table 1. A map of the study area showing the locations of existing wildlife crossing structures and future wildlife crossing structure sites is presented in Figure 1.

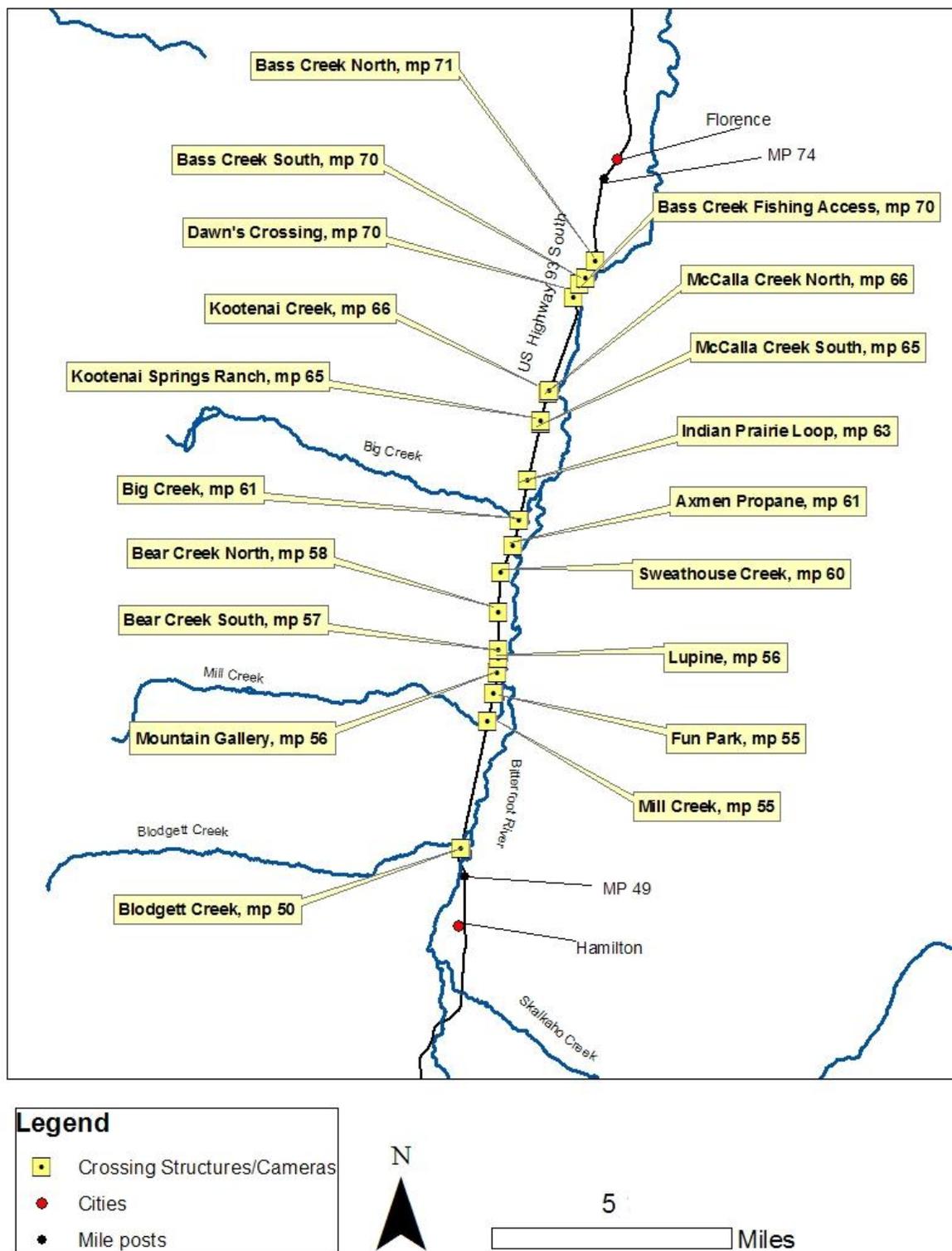
The purpose of this research is to determine:

1. white-tailed deer (*Odocoileus virginianus*) usage rates of existing wildlife crossing structures and future wildlife crossing structures,
2. white-tailed deer usage rates of wildlife crossing structures by type and across types (including height, width, and length),
3. relationships among wildlife crossing structures with landscape variables and crossing rates,
4. changes in animal-vehicle collisions between pre-construction and post-construction of wildlife crossing structures within a twenty-five mile stretch of US Highway 93 South, mile post (mp) 74 to mp 49, and,
5. relationships between animal-vehicle collisions and wildlife crossing structures over time and space.

This research began in 2008 and will be completed in 2015. This research is approximately 43% complete. This report presents preliminary results which preclude discussion and conclusion sections. The project is on time and on budget for all tasks.

**Table 1. Existing Wildlife Crossings Structures and Future Wildlife Crossing Structure Sites, US Highway 93 South, Montana.**

| <b>Existing Structures</b> | <b>Year Completed</b>      | <b>Approximate Mile Post</b> | <b>Structure Type</b>          |
|----------------------------|----------------------------|------------------------------|--------------------------------|
| Bass Creek North           | 2005                       | 71                           | Bridge                         |
| Bass Creek South           | 2005                       | 70                           | Bridge                         |
| Bass Creek Fishing Access  | 2005                       | 70                           | Round Corrugated Steel Culvert |
| Dawn's Crossing            | 2005                       | 70                           | Bridge                         |
| Kootenai Creek             | 2009                       | 66                           | Bridge                         |
| McCalla Creek North        | 2009                       | 66                           | Bridge                         |
| McCalla Creek South        | 2010                       | 65                           | Bridge                         |
| Kootenai Springs Ranch     | 2010                       | 65                           | Concrete Box Culvert           |
| Indian Prairie Loop        | 2010                       | 63                           | Concrete Box Culvert           |
| Big Creek                  | 2011                       | 61                           | Bridge                         |
| Axmen Propane              | 2010                       | 61                           | Round Corrugated Steel Culvert |
| Blodgett Creek             | 2008                       | 50                           | Bridge                         |
| <b>Future Sites</b>        | <b>Expected Completion</b> | <b>Approximate Mile Post</b> | <b>Structure Type</b>          |
| Sweathouse Creek           | 2011                       | 60                           | Bridge                         |
| Bear Creek North           | 2012                       | 58                           | Bridge                         |
| Bear Creek South           | 2012                       | 57                           | Bridge                         |
| Lupine                     | 2012                       | 56                           | Concrete Box Culvert           |
| Mountain Gallery           | 2011                       | 56                           | Concrete Box Culvert           |
| Fun Park                   | 2011                       | 55                           | Concrete Box Culvert           |
| Mill Creek                 | 2011                       | 55                           | Bridge                         |



**Figure 1. Map of US Highway 93 South Study Area and Locations of Existing and Future Wildlife Crossing Structures, Montana.**

## **2. White-tailed Deer Use of Existing Wildlife Crossing Structures and Future Wildlife Crossing Structure Sites**

### **2.1. Methods**

Wildlife usage rates were determined by monitoring existing wildlife crossing structures and future wildlife crossing structure sites with Reconyx Professional Cameras, Model PC85 and Model PC800. Cameras are triggered by motion and take pictures of large and small animals, day and night. All cameras, with two exceptions, were installed inside metal telephone-utility boxes. Each box was secured by a cable, locked to the camera on one end and buried in concrete at the other. All cameras were also secured by electronic code locks. Cameras at Kootenai Creek (mp 66) and Big Creek (southwest camera, mp 61) were locked in a metal Reconyx Bear Boxes mounted on a large fence post and a large tree, and secured with locked cables.

A single camera was installed near one entrance of the following existing wildlife crossing structures: Bass Creek North (mp 71), Bass Creek South (mp 70), Bass Creek Fishing Access (mp 70), Dawn's Crossing (mp 70), Kootenai Creek (mp 66), Indian Prairie Loop (mp 63), Axmen Propane (mp 61), and Blodgett Creek (mp 50). Two cameras were installed, one near each entrance, of the following existing wildlife crossing structures: McCalla Creek North (mp 66), McCalla Creek South (mp 65), and Kootenai Springs Ranch (mp 65). One camera was installed to monitor the jump off ramp at McCalla Creek South (ramp camera, mp 65). Four cameras were installed at Big Creek (mp 61). Cameras were placed near the entrances of existing wildlife crossing structures in order to record the number of white-tailed deer successfully using, moving parallel to, and repelled from the crossing structures. As new wildlife crossing structures are constructed, additional cameras will be installed to monitor post-construction wildlife activity.

Two cameras were installed at each of the future wildlife crossing structure sites. One camera was placed as near as possible to any current structures (existing culverts or bridges) or the location of the future wildlife crossing structure. A second camera was

placed approximately 25 to 75 meters away. Cameras were positioned so that the first camera could capture animal usage of any current structure or other movements nearby, and the second camera could record animal movements as they approached or departed the road way. All pre-construction monitoring was completed in April, 2011.

Two cameras at Bell Crossing (east and west cameras, control) were installed near a bridge over an unnamed spring run on County Road 370, approximately one-quarter mile east of the Bitterroot River. This site was selected as a control to help evaluate changes in the white-tailed deer population over time in a location where road construction is not scheduled to occur. Big Creek (south camera, control, mp 61) was also selected as a long-term control site after construction was completed in April, 2011.

This reporting period, a camera at Big Creek (north camera, control, mp 61) was removed. Four cameras were installed at Big Creek (northeast camera, southeast camera, northwest camera, and southwest camera, mp 61) to monitor post-construction activity. Locations, approximate mile posts, and installation dates of cameras currently monitoring post-construction wildlife activity at existing wildlife crossing structures, and cameras at control sites, are presented in Table 2.

**Table 2. Cameras Currently Installed at Existing Wildlife Crossing Structures on US Highway 93 South, Montana, and at Control Sites.**

| <b>Camera Location</b>               | <b>Approximate Mile Post</b> | <b>Date Installed</b> |
|--------------------------------------|------------------------------|-----------------------|
| Bass Creek North                     | 71                           | Oct. 10, 08           |
| Bass Creek South                     | 70                           | Nov 22, 08            |
| Bass Creek Fishing Access            | 70                           | Nov 22, 08            |
| Dawn's Crossing                      | 70                           | Nov 23, 08            |
| Kootenai Creek                       | 66                           | Apr 21, 09            |
| McCalla Creek North (east camera)    | 66                           | Apr 22, 09            |
| McCalla Creek North (west camera)    | 66                           | Apr 22, 09            |
| McCalla Creek South (west camera)    | 65                           | June 16, 10           |
| McCalla Creek South (ramp camera)    | 65                           | June 16, 10           |
| McCalla Creek South (east camera)    | 65                           | July 30, 10           |
| Kootenai Springs Ranch (east camera) | 65                           | June 10, 10           |
| Kootenai Springs Ranch (west camera) | 65                           | July 29, 10           |
| Indian Prairie Loop                  | 63                           | Sept 27, 10           |
| Big Creek (northeast camera)         | 61                           | July 28, 11           |
| Big Creek (southeast camera)         | 61                           | July 29, 11           |
| Big Creek (northwest camera)         | 61                           | July 28, 11           |
| Big Creek (southwest camera)         | 61                           | Aug 12, 11            |
| Big Creek (south camera, control)    | 61                           | Apr 12, 11            |
| Axmen Propane                        | 61                           | Sept 28, 10           |
| Blodgett Creek                       | 50                           | Mar 15, 10            |
| Bell Crossing (east camera, control) | CR 370                       | May 29, 09            |
| Bell Crossing (west camera, control) | CR 370                       | May 29, 09            |

The following calculations were made for each camera location, where applicable:

- deer per day = the total number of deer observed at a future wildlife crossing structure site divided by the number of days the camera was in operation
- success per day = the total number of deer observed successfully using an existing wildlife crossing structure divided by the number of days the camera was in operation
- success rate = the total number of deer moving through the structure or onto the roadway at future structures, divided by the total number of deer recorded at the structure or site
- rate of repellency = the total number of deer repelled at existing crossing structures or repelled at future crossing sites divided by the total number of deer recorded at the structure or site
- parallel rate = the total number of deer moving parallel to structures or sites divided by the total number of deer recorded at the structure or site.

## **2.2. Results**

Pre-construction monitoring is complete. Twenty-six pre-construction data sets are summarized in Table 3. The order of camera locations is based on the number of deer per day photographed at each camera site.

**Table 3. Summary of Complete Pre-Construction Data Sets.**

| <b>Camera Location</b>               | <b>Mile Post</b> | <b>Camera Days</b> | <b>Deer Per Day</b> | <b>Successful Crossings</b> | <b>Success Rate (%)</b> | <b>Rate of Repellency (%)</b> | <b>Parallel Rate (%)</b> |
|--------------------------------------|------------------|--------------------|---------------------|-----------------------------|-------------------------|-------------------------------|--------------------------|
| McCalla Creek South (south camera)   | 65               | 93                 | 5.0                 | 44                          | 9                       | 3                             | 88                       |
| Indian Prairie Loop (north camera)   | 63               | 78                 | 4.7                 | 0                           | 0                       | 0                             | 100                      |
| Indian Prairie Loop (south camera)   | 63               | 150                | 4.5                 | 0                           | 0                       | 0                             | 100                      |
| Bear Creek South (north camera)      | 57               | 629                | 2.6                 | 1662                        | 98                      | 1                             | 1                        |
| McCalla Creek South (north camera)   | 65               | 115                | 2.2                 | 21                          | 9                       | 7                             | 84                       |
| Big Creek (south camera)             | 61               | 260                | 2.2                 | 0                           | 0                       | 0                             | 100                      |
| Kootenai Springs Ranch (east camera) | 65               | 107                | 2.1                 | 78                          | 32                      | 8                             | 60                       |
| Fun Park (east camera)               | 55               | 490                | 1.5                 | 606                         | 79                      | 11                            | 10                       |
| Axmen Propane (north camera)         | 61               | 212                | 1.5                 | 0                           | 0                       | 0                             | 100                      |
| Lupine (west camera)                 | 56               | 382                | 1.3                 | 0                           | 0                       | 0                             | 100                      |
| Mill Creek (south camera)            | 55               | 566                | 1.2                 | 525                         | 70                      | 15                            | 15                       |
| Sweathouse Creek (north camera)      | 60               | 481                | 1.1                 | 65                          | 12                      | 1                             | 87                       |
| Kootenai Springs Ranch (west camera) | 65               | 55                 | 0.9                 | 26                          | 54                      | 10                            | 36                       |
| Sweathouse Creek (south camera)      | 60               | 503                | 0.8                 | 219                         | 52                      | 4                             | 44                       |
| Big Creek (north camera)             | 61               | 277                | 0.8                 | 33                          | 14                      | 14                            | 72                       |
| Bear Creek North (east camera)       | 58               | 454                | 0.6                 | 29                          | 11                      | 2                             | 87                       |
| Lupine (east camera)                 | 56               | 385                | 0.6                 | 0                           | 0                       | 0                             | 100                      |
| Bear Creek South (south camera)      | 57               | 509                | 0.4                 | 140                         | 68                      | 7                             | 25                       |

| <b>Camera Location</b>          | <b>Mile Post</b> | <b>Camera Days</b> | <b>Deer Per Day</b> | <b>Successful Crossings</b> | <b>Success Rate (%)</b> | <b>Rate of Repellency (%)</b> | <b>Parallel Rate (%)</b> |
|---------------------------------|------------------|--------------------|---------------------|-----------------------------|-------------------------|-------------------------------|--------------------------|
| Axmen Propane (south camera)    | 61               | 176                | 0.4                 | 4                           | 6                       | 3                             | 91                       |
| Mountain Gallery (north camera) | 56               | 440                | 0.3                 | 64                          | 45                      | 4                             | 51                       |
| Fun Park (west camera)          | 55               | 556                | 0.2                 | 57                          | 52                      | 3                             | 45                       |
| Lupine (south camera)           | 56               | 172                | 0.1                 | 16                          | 80                      | 15                            | 5                        |
| Mill Creek (north camera)       | 55               | 568                | 0.07                | 1                           | 3                       | 0                             | 97                       |
| Mountain Gallery (south camera) | 56               | 587                | 0.06                | 24                          | 61                      | 3                             | 36                       |
| Bear Creek North (west camera)  | 58               | 506                | 0.03                | 2                           | 14                      | 14                            | 72                       |
| Lupine (north camera)           | 56               | 204                | 0.005               | 0                           | 0                       | 100                           | 0                        |

Construction monitoring is complete. Eleven construction data sets are summarized in Table 4. The order of camera locations is based on the number of deer per day photographed at each camera site.

**Table 4. Summary of Complete Construction Data Sets.**

| <b>Camera Location</b>                                       | <b>Mile Post</b> | <b>Camera Days</b> | <b>Deer Per Day</b> | <b>Successful Crossings</b> | <b>Success Rate (%)</b> | <b>Rate of Repellency (%)</b> | <b>Parallel Rate (%)</b> |
|--|------------------|--------------------|---------------------|-----------------------------|-------------------------|-------------------------------|--------------------------|
| Big Creek (north camera, construction)                       | 61               | 394                | 1.7                 | 0                           | 0                       | 0                             | 100                      |
| Big Creek (south camera, construction)                       | 61               | 407                | 1.3                 | 0                           | 0                       | 0                             | 100                      |
| McCalla Creek South (ramp camera, construction)              | 65               | 93                 | 0.5                 | 20                          | 44                      | 22                            | 34                       |
| Axmen Propane (north camera, construction)                   | 61               | 52                 | 0.4                 | 0                           | 0                       | 0                             | 100                      |
| Axmen Propane (south camera, construction)                   | 61               | 49                 | 0.4                 | 0                           | 0                       | 0                             | 100                      |
| Kootenai Springs Ranch (west camera, construction)           | 65               | 152                | 0.2                 | 5                           | 18                      | 4                             | 78                       |
| Kootenai Springs Ranch (west structure camera, construction) | 65               | 46                 | 0.2                 | 0                           | 0                       | 0                             | 100                      |
| Kootenai Springs Ranch (east camera, construction)           | 65               | 146                | 0.2                 | 4                           | 17                      | 0                             | 83                       |
| Sweathouse Creek (north camera, construction)                | 60               | 115                | 0.2                 | 0                           | 0                       | 39                            | 61                       |
| McCalla Creek South (west camera, construction)              | 65               | 199                | 0.1                 | 16                          | 67                      | 8                             | 25                       |
| Kootenai Springs Ranch (east structure camera, construction) | 65               | 47                 | 0.06                | 0                           | 0                       | 0                             | 100                      |

White-tailed deer use of existing wildlife crossing structures is compiled in Table 5. Cameras recorded white-tailed deer successfully moving through existing wildlife crossing structures on nearly 8,200 occasions (this number includes data from Bear Creek South, north camera, reported in Table 3). The order of camera locations is based on success per day. Camera data reported were analyzed through September 11, 2011.

**Table 5. White-tailed Deer Use of Existing Wildlife Crossing Structures.**

| <b>Camera Location</b>               | <b>Mile Post</b> | <b>Camera Days</b> | <b>Number of Deer</b> | <b>Success Per Day</b> | <b>Successful Crossings</b> | <b>Success Rate (%)</b> | <b>Rate of Repellency (%)</b> | <b>Parallel Rate (%)</b> |
|--------------------------------------|------------------|--------------------|-----------------------|------------------------|-----------------------------|-------------------------|-------------------------------|--------------------------|
| Kootenai Creek                       | 66               | 797                | 1763                  | 2.1                    | 1682                        | 92                      | 4                             | 4                        |
| Dawn's Crossing                      | 70               | 1023               | 1880                  | 1.8                    | 1865                        | 96                      | 2                             | 2                        |
| Bass Creek Fishing Access            | 70               | 1014               | 1291                  | 1.3                    | 1271                        | 95                      | 4                             | 1                        |
| Big Creek (southwest camera)         | 61               | 31                 | 48                    | 1.3                    | 40                          | 84                      | 8                             | 8                        |
| Big Creek (northeast camera)         | 61               | 45                 | 46                    | 0.9                    | 42                          | 89                      | 8                             | 2                        |
| Blodgett Creek                       | 50               | 509                | 386                   | 0.75                   | 381                         | 96                      | 1                             | 3                        |
| McCalla Creek North (east camera)    | 66               | 748                | 624                   | 0.75                   | 560                         | 86                      | 3                             | 11                       |
| Big Creek (northwest camera)         | 61               | 45                 | 32                    | 0.7                    | 30                          | 94                      | 0                             | 6                        |
| McCalla Creek North (west camera)    | 66               | 699                | 514                   | 0.6                    | 388                         | 74                      | 13                            | 13                       |
| Big Creek (southeast camera)         | 61               | 45                 | 19                    | 0.4                    | 19                          | 100                     | 0                             | 0                        |
| McCalla Creek South (west camera)    | 65               | 432                | 170                   | 0.17                   | 74                          | 43                      | 18                            | 39                       |
| McCalla Creek South (east camera)    | 65               | 393                | 145                   | 0.17                   | 65                          | 45                      | 9                             | 46                       |
| Bass Creek North                     | 71               | 960                | 321                   | 0.16                   | 153                         | 46                      | 7                             | 46                       |
| Kootenai Springs Ranch (west camera) | 65               | 336                | 604                   | 0.1                    | 33                          | 5                       | 12                            | 83                       |
| Kootenai Springs Ranch (east camera) | 65               | 433                | 508                   | 0.09                   | 40                          | 8                       | 7                             | 85                       |
| Indian Prairie Loop                  | 63               | 350                | 510                   | 0.03                   | 12                          | 2                       | 8                             | 90                       |

| <b>Camera Location</b> | <b>Mile Post</b> | <b>Camera Days</b> | <b>Number of Deer</b> | <b>Success Per Day</b> | <b>Successful Crossings</b> | <b>Success Rate (%)</b> | <b>Rate of Repellency (%)</b> | <b>Parallel Rate (%)</b> |
|------------------------|------------------|--------------------|-----------------------|------------------------|-----------------------------|-------------------------|-------------------------------|--------------------------|
| Bass Creek South       | 71               | 953                | 11                    | 0.004                  | 4                           | 33                      | 17                            | 50                       |
| Axmen Propane          | 61               | 341                | 248                   | 0                      | 0                           | 0                       | 13                            | 87                       |

### **2.3. Anticipated Work**

- Install post-construction cameras at Sweathouse Creek, Mountain Gallery, Fun Park, and Mill Creek
- Ongoing monitoring and data analysis.

### **3. White-Tailed Deer Usage Rates of Wildlife Crossing Structures by Type and Across Types**

A detailed statistical analysis of white-tailed deer usage rates of wildlife crossing structures by type and across types will be completed as construction of future wildlife crossing structures is completed and data are compiled, and will include variables such as height, width, and length.

### **4. Relationships among Crossing Structures with Landscape Variables and Crossing Rates**

A methodology to measure and quantify variables such as structure, road, traffic, landscape, vegetation, and deer pellet counts at existing and future wildlife crossing structures was developed. Data was collected in 2010 at existing wildlife crossing structures and future wildlife crossing structure sites, except for the following: Indian Prairie Loop, Big Creek, and Axmen Propane. Construction activities were occurring at these three locations; and landscape variables there were drastically changed by the recent construction activities. Data will be collected at these three locations in 2012. Collected data and usage rates will then be analyzed using multivariate statistics.

## **5. Changes in Animal-Vehicle Collisions between Pre-Construction and Post-Construction of Wildlife Crossing Structures**

Generalized Linear Models (GLMs) will be used to analyze changes in AVC between pre-construction and post-construction of wildlife crossing structures. GLMs will include multiple continuous predictors such as traffic volume and deer density in addition to categorical co-variate pre-construction and post-construction AVC data. GLMs will be completed when future wildlife crossing structures are completed and post-construction AVC data, traffic volume, and deer density data are analyzed. During this quarter data was gathered on pre-construction deer abundance, traffic volume, and deer-vehicle collision carcasses collected along the study area.

## **6. Relationships between AVC Numbers and Wildlife Crossing Structures over Time and Space, Kernel Density Analysis**

Additional kernel density analysis will continue as new wildlife crossing structures are completed and AVC data are collected.

## Major Task Progress

Note: Only the first 15 of the 30 tasks submitted to MDT pre-study are presented at this time.

| <b>Task</b> | <b>Description</b>                    | <b>Estimated Span of calendar years Estimated after kickoff</b> | <b>Cost</b>    | <b>Total billed to date</b> | <b>Percentage complete based on original budget</b> |
|-------------|---------------------------------------|---|----------------|-----------------------------|---|
| 1           | Task 1 Purchase equipment             | Oct 1, 08 - Aug 31, 09  | \$49,650       | 42,843.57                   | 86%   |
| 2           | Task 2 Install equipment              | Oct 9, 08 – Aug 31, 09  | 6,300          | 6,300                       | 100%  |
| 3           | Task 3 Monitor wildlife movement      | Nov 1 08 – May 1, 09, 6 months                                  | 18,105         | 18,105                      | 100%  |
| 4           | Task 4 Obtain & analyze current a-v-c | Fall, 08 - Aug 31, 09   | 8,520          | 7,669.5                     | 90 %  |
| 5           | Task 5 Hold public meeting            | Summer 09   | Not applicable | Not applicable              | Not applicable                                      |
| 6           | Task 6 Create a-v-c prediction models | Spring/ Summer/ Fall 09   | 9,880          | 680                         | 7%  |
| 7           | Task 7 Monitor wildlife movement      | May 1, 09- April 30 '10 = 12 months                             | 41,810         | 41,810                      | 100%  |
| 8           | Task 8 Create Interim Report          | Aug 09  | 3,720          | 3,720                       | 100%  |
| 9           | Task 9 Hold public meeting            | Summer '10  | 2,760          | 2,760                       | 100%  |
| 10          | Task 10 Monitor wildlife movement     | May 1 10 – April 30 '11 = 12 months                             | 40,560         | 40,560                      | 100%  |

|           |  |                               |               |               |             |
|-----------|--|-------------------------------|---------------|---------------|-------------|
| <b>11</b> | <b>Task 11 Create Interim Report</b>         | <b>Jan 1 '10- Dec 31 '10</b>  | <b>3,720</b>  | <b>3,720</b>  | <b>100%</b> |
| <b>12</b> | <b>Task 12 Analyze pre-construction data</b> | <b>July '09 – June '10</b>    | <b>13,360</b> | <b>4,142</b>  | <b>31%</b>  |
| <b>13</b> | <b>Task 13 Reinstall Equipment</b>           | <b>June '10 – July '11</b>    | <b>2,760</b>  | <b>1,380</b>  | <b>50%</b>  |
| <b>14</b> | <b>Task 14 Monitor Wildlife Movement</b>     | <b>May '11 – April '30 12</b> | <b>40,560</b> | <b>16,900</b> | <b>42%</b>  |
| <b>15</b> | <b>Task 15 Create Interim Report</b>         | <b>Jan 1 '11 – Dec 31 '11</b> | <b>3,720</b>  | <b>0</b>      | <b>0%</b>   |