Research Project
Quarterly Progress Report

RESEARCH PROGRAMS

INSTRUCTIONS

Consultant project managers/principal investigators should complete a quarterly progress report for each calendar quarter, or part thereof, during which project is active. All fields must be completed.

Date: 3 February 2014	**Progress Report Number:** Quarterly Report 2013-4	
Project Title: US 93 North Post-Construction Wildlife-Vehicle Collision and Wildlife Crossing Monitoring and Research on the Flathead Indian Reservation between Evaro and Polson, Montana	**Report Period:**	**Due Date**
	☐Quarter 1 (January 1 – March 31)	*April 30*
	☐Quarter 2 (April 1 – June 30)	*July 31*
	☐Quarter 3 (July 1 – September 30)	*October 31*
	■Quarter 4 (October 1 – December 31)	*January 31*
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MDT Project Manager Sue Sillick	**MDT Project Number:** #8208	**Project Start Date:** 1 January 2010
Original Project End Date: 31 July 2015	**Current Project End Date:** 31 July 2015	**Number of Extensions:** 0

Project Schedule Status:

☐ On schedule ☐ On approved revised schedule ☐ Ahead of schedule ■ Behind schedule

Project Expenses Statistics:

Project Expenses This Quarter	Total Project Expenses to Date	Projected Cost to Date
$20,645	$260,986*[1] *[1]Invoices from CSKT received through 31 Dec 2013 but have not been processed yet.	$368,975 (incl. $50K in 2012)

Percent Over/Under	Total Project Budget	Remaining Total Budget
29% under budget (but see note on billing CSKT above)	$550,000 (incl. $50K in 2012)	$289,013

Project Schedule Status (list all tasks with percentage complete, original and revised estimated and actual begin date; original and revised estimated and actual completion date, any outstanding issues, including such items as: schedule, resources, etc.)**:**

Task	Planned Percentage complete	Actual Percentage complete
1. Deer and black bear vehicle collisions	80%	80%[*1]
2. Wildlife use of underpasses	80%	70%[*2]
3. Cost-benefit analyses	80%	70%[*3]

Dates:
This is a long term project with many tasks that reoccur annually.
The starting date for the tasks was 1 January 2010 and the end date for the project is 31 July 2015.

Notes:

*1 Crash and carcass data have been collected and analyzed through 2012. Data through 2013 have been collected by MHP and MDT.

*2
Crossing structures: Data entry for 2013 is ongoing.
Jump-out data through 2012 completed and summarized (see previous quarterly report).
Calibration data tracking beds (inside and outside structures and cameras): data entry and analyses is ongoing.
Deer pellet surveys: completed for 2013.

*3 Basic data have been obtained in 2011 and 2012. Some analyses are possible (with crash and carcass data through 2012) now but have not been conducted yet. This is scheduled for next quarterly report. Note: this was originally planned for the current quarterly report, though it would have to be repeated after all crash and carcass data have been collected at of the project. However, instead the current quarterly report focuses on information for a potential adaptation of the measures for effectiveness.

Progress and Accomplishments this Quarter (includes meetings, work plan status, contract status, signifi progress, etc.)**:**

A meeting was held in Helena/Missoula on 6 January 2014. One of the topics discussed was a potential modification to the measures of effectiveness, particularly with regard to the expected reduction in collisions with large mammals in the fenced road sections along US93N. Below is information that allows the three governments (MDT, CSKT, FHWA) to decide on potential modifications to the measures of effectiveness.

1. Error in one of the MOEs as defined in proposal / work scope for current project.

The actual road length that has wildlife fencing on both sides of the road (between Evaro and Polson) is estimated (based on GPS coordinates from fall 2013) at 8.71 mi (14.01 km). This is lower than the length that was previously reported because of confusion between “fence length” (fence on opposite side of the road counts double, includes zigzags of the fence) and “road length fenced” and the fact that the fence ends on opposite sides of the road are not always exactly opposite of each other.

In the original proposal/work scope (November 2009) it was estimated that approximately 30% (16.6 mi out of 56 mi) of the 56 mi long road section would be fenced and that the mitigation measures in these fenced areas may be 87% effective in reducing collisions with large animals based on research from elsewhere. Therefore the potential reduction in collisions with large animals along the entire road section (mitigated and unmitigated sections combined) was estimated at about 26%.

In reality the total fence length (excluding zigzags) is about 18.4 mi, and the road length that has wildlife fencing on both sides of the road (discarding the road sections that only have fencing on one side of the road) is about 8.7 mi (15.5% of the 56 mi). Assuming an effectiveness of 87% in reducing collisions for the road sections with wildlife fencing on both sides of the road, 0% effectiveness in reducing collisions for the road sections without fencing or with fencing on one side of the road, and assuming no changes in the population size of large wild animals (mostly white-tailed deer), traffic volume, traffic speed and time of travel, and likelihood on animals crossing the road and being hit in unmitigated road sections, one may expect an overall reduction of about 14% in collisions with large mammals (rather than the 26% mentioned in the proposal).

2. Influence of large-mammal-vehicle collisions on the unmitigated road sections.

If the objective (MOE) is to achieve 14% reduction in collisions with large mammals along the entire road section between Evaro and Polson (mitigated and unmitigated road sections combined) (see previous point), then this objective:

1. Is subject to “dilution” through wildlife-vehicle collisions in the unmitigated road sections. The longer the unmitigated road section is that is included in the evaluation, the lower the expected effectiveness in reducing wildlife-vehicle collisions over the entire road corridor, and the lower the probability is that a possible effect in collision reduction as a result of the implementation of the mitigation measures will be detected.
2. Assumes that large mammal-vehicle collision numbers would have remained constant over the years should no mitigation have been implemented. This means: no changes in deer population size, no changes in deer crossing behavior (despite wider footprint road, and likely increase in traffic volume and traffic speed). If this assumption holds then the large mammal-vehicle collisions in the unmitigated road sections should remain constant. However, the wildlife-vehicle collisions in the unmitigated road sections actually vary, and especially reported crashes have increased in the unmitigated road sections after mitigation was implemented on the mitigated road sections. This suggests that the mitigation measures are more effective in reducing wildlife-vehicle collisions than appears based on only a before-after comparison. However, because of the increase in large mammal-vehicle collisions (recorded crashes) in the unmitigated section, the assumption of no change in wildlife-vehicle collisions in the unmitigated sections is likely violated.

Recommendation based on point 1 and 2: The researchers suggest deleting the MOE that evaluates the effectiveness of the mitigation measures based on a reduction in collisions for a mix of mitigated and unmitigated road sections, regardless of the correction from 26% to 14%: Suggestion to delete this from the MOEs:

~~Based on these considerations, **the agencies adopted the following *management MOE* thresholds: if DVCs are reduced by at least 25% across the entire 56 mi long road section (fenced and unfenced road sections combined) using 4 years of post-construction monitoring data, the mitigation measures are considered to have sufficiently improved road safety along the entire corridor with regard to DVCs.**~~

3. Amount of data required for detecting a reduction in mitigated road sections only.

It would be best to base an MOE on the mitigated road sections only, potentially corrected for changes in collisions on the unmitigated sections (Before-After-Control-Impact design). The following (existing) MOE does that:

Additional threshold: if DVCs are reduced by at least 50% in all areas with fencing on both sides of the road (however short these sections might be) using 4 years of post-construction monitoring data, the mitigation measures are considered to have sufficiently improved road safety along the mitigated road sections with regard to DVCs.

This basically recognized that very short road section of fencing with gaps for access roads may not be as effective in reducing collisions as longer sections. However, insufficient data were available at the time the proposal/work scope was written to quantify this; and the 50% objective was based on a guess, not actual data.

A third existing MOE relates to the three road sections with relatively long fencing only: Evaro, Ravalli Curves and Ravalli Hill. While the fence is relatively long in these three road sections, there are also numerous gaps in the fence for access roads and at steep slopes. The longer sections of fencing (about 1-3 miles road length) were thought to be more effective than the shorter sections (e.g. less than 1 mile road length). That is why the objective was set at 70% rather than 50%. On the other hand, it was suspected that the sections in Evaro, Ravalli Hill and Ravalli Curves were perhaps still not long enough to achieve 87% reduction (see point 1), partly because of the gaps in the fence.

Third MOE: Additional threshold: if DVCs are reduced by at least 70% in the three areas with relatively long sections with more or less contiguous fencing (Evaro, Ravalli Curves and Ravalli Hill) using 4 years of post-construction monitoring data, the mitigation measures are considered to have sufficiently improved road safety along these three road sections with regard to DVCs.

The problem with reducing the road length that is evaluated (all mitigated sections or the three longest mitigated section), is that the absolute numbers of reported crashes are lower and more variable than that for longer sections. This makes it harder to detect an effect should there indeed be an effect of the mitigation measures in reducing collisions. Based on power analyses (conducted fall 2013) of the existing crash and carcass data in the three sections (Evaro, Ravalli Curves and Ravalli Hill combined) we would need about 10-12 years with before data and 10-12 years with after data to be reasonably certain that an effect, should it indeed exist, will be detected. This is much longer than we have before data for and it is much longer than the post-construction research project will run for. That is why the first MOE in the original proposal/work scope related to a reduction over the entire road section; it was estimated that only 5 yrs of after data were needed to be able to detect an effect should there indeed be an effect.

Recommendations based on point 3:

1. Base the MOEs on either all fenced section or only the longest three fenced sections, or both, but do not expect the current project to generate sufficient data to be able to detect a reduction in collisions based on a statistical test. The MOE will have to be based on descriptive statistics only (at least for the current duration of the project (4-5 yrs).
2. Continue to collect crash and carcass data and reanalyze the data (with a statistical test) 10-12 yrs (and potentially also around 15-20 yrs) after the mitigation was completed. The before data will still be less than10-12 yrs, but there is a reasonable change an effect will be detected after a longer time with more after data (>10-12 years after data). Such later analyses can be a limited project that can be initiated at that time.

4. Expected effect of short fenced road sections in collision reduction

The following table shows the preliminary wildlife-vehicle collision reduction data for 4 fenced road sections along US93N. These preliminary data are based on a before-after comparison. For the "overall effectiveness" the average of the crash and carcass data was calculated. If the reduction was negative (i.e. an increase in collisions), the overall effectiveness was capped at 0%. The preliminary data indeed suggest a lower effectiveness in collision reduction; lower than the 80-100% reduction found for longer road sections.

Hwy section	Road length fenced (mi)	% reduction crashes large mammals (before-after)	% reduction carcasses large mammals (before-after)	Overall (average crash and carcass)	years before	years after	Source
Evaro	1.7	31.8	36.3	34.1	7	2	This project/report
Ravalli Curves	3.7	60.0	42.0	51.0	4	5	This project/report
Ravalli Hill	1.1	-33.0	-140.0	0.0	4	5	This project/report
Jocko River	0.4	0.0	0.0	0.0	3	6	This project/report

The following table shows data for 1 longer fenced road section I94), one relatively short fenced road section in Montana (I15), and several other short fenced road sections elsewhere. For 1-3 mi long road sections 62.3% reduction (I15/I70) seems an indication that the relatively low effectiveness of the wildlife mitigation measures along US93N in reducing collisions with large mammals (see above) is consistent with what is found elsewhere (see below) for short fenced road sections. Road sections 3-4 mi long may have effectiveness (89.1%; US Hwy 97/US Hwy 1) consistent with longer fenced road sections (87%, see point 1).

Hwy Section	Road length fenced (mi)	% reduction crashes large mammals (before-after)	% reduction crashes large mammals (before-after-control-impact)	% reduction carcasses large mammals (before-after)	% reduction carcasses large mammals (before-after-control-impact)	Overall (average crash and carcass if available, based on BACI if available)	years before	years after	Source
I94 Miles city, Montana	17.7	93.90	93.39	80.83	88.65	91.0	5.8	5.8	Jonathan Floyd & Pat Basting, MDT
I-15 Dearborn, Montana	2.4	59.30	39.69	26.42	73.92	56.8	7.0	7.0	Jonathan Floyd & Pat Basting, MDT
US Hwy 97 Oregon	3.8					84.20	?	?	Simon Wray, ODOT
US Hwy 1, FL	3.5					94	5	2	Braden et al., 2008
I-70/CO Hwy 82	1.5					67.8	?	?	Reed et al., 1982

Recommendations based on point 4:

1. Based on reference data it is indeed justified to modify the MOEs with regard to the effectiveness of relatively short fenced road sections on the reduction of wildlife-vehicle collisions.
2. The current expectation of 50% reduction for all fenced road sections may or may not be too high of an expectation as reference data for very short fenced road sections (e.g. up to a few hundred yards) are currently lacking.
3. The current expectation of 70% reduction for the three fenced sections (Evaro, Ravalli Curves, Ravalli Hill) with 1-4 mi of fencing each, may be more or less correct based on reference data from elsewhere.
4. Because of the limited data that will be available at the end of the project (4-5 yrs of post construction data whereas 10-12 yrs may be required for a statistical test), it may be wise to modify the MOEs to a range of values for collision reduction rather than one value (e.g. instead of ≥50% for all fenced sections consider 30-50% or instead of ≥70% for the three relatively long fenced sections consider 50-70%).
5. Alternatively, it may be that fence end effects (fence end runs, road and landscape elements that may or may not encourage large mammals to approach the road at fence ends, spatial precision of crash and carcass data) start having more influence on the effectiveness of wildlife fencing in reducing wildlife-vehicle collisions as the fenced road section becomes shorter. By definition, the “data noise” at fence ends forms an increasing proportion of the effectiveness data of the fenced road section as the fenced road section becomes shorter. Increase in data noise

may make the effectiveness of shorter road sections less predictable than that of longer fenced road sections. Short fenced road sections are likely to be less effective than longer fenced road sections in reducing collisions with large mammals, but the effectiveness of the fencing at a particular location can vary wildly depending on the local situation. In addition, shorter fenced sections are likely to have fewer crashes or carcasses (before data) and therefore the estimate of the effectiveness of the mitigation in reducing collisions may be less stable compared to longer fenced road sections; basically 1 more carcass or 1 less crash in short fenced sections can result in relatively large changes in the %% effectiveness. This means that seemingly large ranges for effectiveness (e.g. 30-50% or 50-70%) are perhaps not as large as they seem; it may be relatively easy to obtain results that still fall outside this range. This suggests adopting very large ranges, because the effectiveness of short fenced road sections in reducing wildlife-vehicle collisions may vary wildly.

6. The type of MOEs selected thus far.

The implementation of the mitigation measures, including the length of the fenced road sections, was based on the status of knowledge and desires of the stakeholders (including e.g. the desire of land owners and users to limit fencing) in the early 2000's. The MOEs that have been defined so far were based on what the state of knowledge was in 2007-2010. At the same time it was recognized that the mitigation measures along US93N were different from the mitigation measures that had produced most of the knowledge by that time. In fact, the multi-functional nature of the landscape and the shorter road sections with mitigation were one of the main reasons the current study was initiated to begin with. It is not surprising that knowledge has increased since the mitigation measures were designed and since the MOEs were formulated. It is also not surprising that the current study appears to add to the knowledge base, especially with regard to the pros and cons of relatively short sections of wildlife fencing in multi-functional landscapes.

So far the MOEs were based on knowledge about the effectiveness of the mitigation measures from elsewhere, particularly from road sections with relatively long fencing in natural areas. This means that the null hypothesis was that the effectiveness of the mitigation measures for short road sections in multi-functional landscapes would be at least somewhat similar to that of mitigation measures implemented along longer road sections in more or less natural areas. It may be that the null hypothesis will have to be rejected.

Another type of MOE (currently not existing) could relate to whether the implementation of mitigation measures along short road sections in multi-functional landscapes is contributing to the knowledge base and if the new knowledge can is likely to lead to changes in practices or changes in the expectations for future mitigation projects. Such an MOE would basically relate to how useful the knowledge is that this research project generates. Naturally the knowledge could not have been generated without having implemented the mitigation measures.

Circumstances Affecting Project, Scope, or Budget (please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems)**:**

As discussed previously there are substantial financial shortfalls for the project.

Substantial savings have been made through CSKT (had access to supplementary funding) and through involving students. It is uncertain though if these savings are sufficient to allow for the completion of the current work scope and how long student labor is available (current student labor it ran out in January 2014).

WTI-MSU and CSKT provided MDT with a budget and work scope for the 5th year of monitoring in the Evaro area and at the isolated structures.

Results/Risk/Anything Learned:

See section on MOEs

Anticipated Work Next Quarter:

Field:

Crossing structures
Monitoring crossing structures Evaro and isolated structures continues.

Wildlife guards (4) and people access point (1)
Monitoring continues.

Jump-outs Evaro
Monitoring tracking beds jump-outs Evaro will start again early May 2014.

Desk:

Crossing structures
Continued data entry for 2013.

Wildlife guards and people access point:
Enter data.

Jump-outs Evaro
Enter data 2013.

Economic analyses:
Conduct preliminary analyses.

Separate from MDT project:

1. Excursions

On 5 December an excursion was organized for two visitors from France, Maxime Clasquin and Corinne Perrin, who travel the world visiting mitigation projects and report about it: http://descrayonsdesidees.com/en/rencontres/initiatives-en-chemin

2. Interpretive signs US 93 N

Interpretive signs for the mitigation measures along US93 N were installed at the pull out at Polson Hill on or just before 2 October 2013.

Potential Implementation, including the party(ies) responsible for implementation, any identified barriers to implementation and a discussion of how these barriers can be eliminated or at least reduced, and the products required for implementation:

The outreach program (separate from MDT project) aims to make the lessons learned accessible to the transportation and natural resource management community. It is up to agencies to evaluate or update their own policy with regard to highway wildlife mitigation though.