TurtleCrossings_5items

Question 1

Passage 1

Tortoise Underpasses

from the U.S. Department of Transportation Federal Highway Administration website

Imagine several hundred desert tortoises wearing name tags.

That was the scene a few years ago on Mojave Desert land along State Highway 58 in San Bernardino County, California. Locating and tagging the tortoises was the first step in a multi-agency project to monitor the tortoises use of new storm-drain culverts[1] spanning the width of the highway. Eight federal and state partners were involved—the California Department of Transportation, the Bureau of Land Management, the California Energy Commission, the U.S. Fish and Wildlife Service, the Federal Highway Administration, the Nevada Department of Transportation, the California Department of Fish and Game, and the U.S. Geological Survey.

Since desert tortoises move rather slowly and within a limited home range, finding them and attaching IDs to their shells was relatively easy. Developing a reliable system for tracking their passage into and out of culverts proved more difficult.

"We needed an automated system that could be left unattended from March through October, when the tortoises were not hibernating," says William Boarman, USGS biologist and project manager. "We also wanted it to be secure from vandalism and environmental damage."

The research team's solution: Passive Integrated Transponder (PIT) tags and a computerized reading system. The PIT-tag system, used primarily to census fish, was adapted by AVID, Inc. and Beigel Technology Corporation to meet the criteria of the desert tortoise project. Easy maintenance was achieved by using a renewable energy source—solar panels and a solar-rechargeable battery. Protection from theft and environmental damage (for example, high summer temperatures) was accomplished by burying the system's receiver and antennae underground and camouflaging them with desert soil. (Protecting the solar panels, which could not be hidden and which were frequently stolen, required more complicated measures).

Here's how the PIT-tag system worked: When a tortoise entered or left a culvert, it passed through an electromagnetic field emitted from a "reader" tuned to a specific radio frequency. The reader detected and decoded the tortoise's ID (programmed into the memory of the system's microchip), and a datalogger inside the reader recorded it along with the date and time of passage.

Throughout the research project, team members paid attention to the smallest details. They attached the PIT tags to the tortoises' shells with an Epoxy glue that would not hurt the shells. They programmed the reading system to turn itself off at night (desert tortoises are active only during the day). They consulted a world-class surfboard designer to come up with a well-insulated "house" for the reader coil. They buried each reader in locked "nesting boxes." They designed the reading coil to cover an 8-foot (2.4 m) area, overcoming the short-distance limitations of PIT-tag technology.

The system recorded five tortoises using the culverts on 75 occasions in 1995 and 1996. Since the small vertebrates have no identifiable "corridor" and move at a leisurely pace (it took one tortoise seven hours—stopping and starting—to get through a culvert), these numbers are likely to increase as the tortoises gradually discover the culverts.

The solar-powered PIT-tag system used on the Highway 58 project can be used on almost any narrow wildlife crossing, according to Michael Beigel of Beigel Technology. Says Beigel: "If you need more power, you can make simple adaptations—bigger batteries, additional solar panels, or moving solar panels."

The system is also easily adaptable to other species. "It can be used for virtually every animal you can catch," says Boarman.

"Tortoise Underpasses," from the U.S. Department of Transportation Federal Highway Administration Web site. In the public domain.

Passage 2

"If you build it they will come" fails for turtle crossings

by Sarah Zielinski

It's really too bad that turtles can't read.

If they did, it would make saving them so much easier. When people create an ecopassage so the reptiles can safely cross a road by going underneath or over it, they could let the animals know with little signs saying "Don't become roadkill! Safe crossing, left 20 meters."

Instead, we have to rely on fencing to keep the turtles and snakes off roads, which is a good idea because 98 percent or more of turtles are killed in their first attempt at a road crossing. But the reliance on fences may be a problem, a new study shows. When there aren't effective fences to keep the reptiles out, they don't use the ecopassages, James Baxter-Gilbert of Laurentian University in Sudbury, Ontario, and colleagues report March 25 in *PLOS ONE*.

The study looked at the effectiveness of a series of ecopassages built along a 13-kilometer stretch of Highway 69/40 near Burwash, Ontario, near Lake Huron, a region with high reptile biodiversity. The passages ran beneath the highway and were paired with fencing along the road. The researchers looked at reptile activity along the roadway before and after the project was constructed, and also used another stretch of highway, near the Magnetawan First Nation, as a comparison.

They surveyed the roadside and put up cameras in the ecopassages to see what kind of animals used the crossings. They captured Blanding's turtles and snapping turtles, and tracked their movements with radio transmitters. And they took painted turtles and placed them on the other side of the highway from their wetlands to see if they could make their way home through the tunnels.

Animals used the ecopassages, the study revealed, but the most common patrons of the underground passageways were ducks and geese. Few reptiles traveled through them. And, worse, turtles and snakes didn't stay off the roads. The number of reptiles on the roadway near the ecopassages actually increased after they were put in place, resulting in lots of dead snakes and turtles.

A small part of the problem may be that many turtles, at least, don't really want to use the ecopassages. The researchers tested the turtles' willingness to enter the passages, and most turtles either took so long that the scientists gave up (69 percent) or the turtles refused to go in (22 percent).

But the bigger failure was in the fencing. Along three kilometers of road, rips, holes and washouts had caused 115 gaps. During the spring melt, up to 30 percent of the fence was submerged. And other areas had been left completely unfenced. In total, the researchers calculate, about two-thirds of the road was lined with permeable fence.

The solution: Build better fences. "Roads are meant to be long-lasting structures," the researchers note, "and mitigation measures [to protect wildlife] should be equally long-lasting."

"'If you build it they will come' fails for turtle crossings," by Sarah Zielinski, from *Science News*. March 25, 2015.

Write an informational essay comparing the studies discussed in the two articles, explaining how the studies are similar and different in their approach and conclusions.

Manage your time carefully so that you can

- Plan your essay and do some prewriting using your scratch paper or on the prewriting pages provided in your answer document
- Write your essay on the lined pages of your answer document or in the response box in Nextera

Be sure to

- Use evidence from both passages
- Avoid over-relying on one passage

Your written response should be in the form of a multi-paragraph informational essay.

Write your answer on the lined pages in your answer document or in the response box in Nextera. Anything you write that is <u>not</u> on the lined pages or in the response box in Nextera will NOT be scored.

Question 2

Passage 1

Tortoise Underpasses

from the U.S. Department of Transportation Federal Highway Administration website

Imagine several hundred desert tortoises wearing name tags.

That was the scene a few years ago on Mojave Desert land along State Highway 58 in San Bernardino County, California. Locating and tagging the tortoises was the first step in a multi-agency project to monitor the tortoises use of new storm-drain culverts[1] spanning the width of the highway. Eight federal and state partners were involved—the California Department of Transportation, the Bureau of Land Management, the California Energy Commission, the U.S. Fish and Wildlife Service, the Federal Highway Administration, the Nevada Department of Transportation, the California Department of Fish and Game, and the U.S. Geological Survey.

Since desert tortoises move rather slowly and within a limited home range, finding them and attaching IDs to their shells was relatively easy. Developing a reliable system for tracking their passage into and out of culverts proved more difficult.

"We needed an automated system that could be left unattended from March through October, when the tortoises were not hibernating," says William Boarman, USGS biologist and project manager. "We also wanted it to be secure from vandalism and environmental damage."

The research team's solution: Passive Integrated Transponder (PIT) tags and a computerized reading system. The PIT-tag system, used primarily to census fish, was adapted by AVID, Inc. and Beigel Technology Corporation to meet the criteria of the desert tortoise project. Easy maintenance was achieved by using a renewable energy source—solar panels and a solar-rechargeable battery. Protection from theft and environmental damage (for example, high summer temperatures) was accomplished by burying the system's receiver and antennae underground and camouflaging them with desert soil. (Protecting the solar panels, which could not be hidden and which were frequently stolen, required more complicated measures).

Here's how the PIT-tag system worked: When a tortoise entered or left a culvert, it passed through an electromagnetic field emitted from a "reader" tuned to a specific radio frequency. The reader detected and decoded the tortoise's ID (programmed into the memory of the system's microchip), and a datalogger inside the reader recorded it along with the date and time of passage.

Throughout the research project, team members paid attention to the smallest details. They attached the PIT tags to the tortoises' shells with an Epoxy glue that would not hurt the shells. They programmed the reading system to turn itself off at night (desert tortoises are active only during the day). They consulted a world-class surfboard designer to come up with a well-insulated "house" for the reader coil. They buried each reader in locked "nesting boxes." They designed the reading coil to cover an 8-foot (2.4 m) area, overcoming the short-distance limitations of PIT-tag technology.

The system recorded five tortoises using the culverts on 75 occasions in 1995 and 1996. Since the small vertebrates have no identifiable "corridor" and move at a leisurely pace (it took one tortoise seven hours—stopping and starting—to get through a culvert), these numbers are likely to increase as the tortoises gradually discover the culverts.

The solar-powered PIT-tag system used on the Highway 58 project can be used on almost any narrow wildlife crossing, according to Michael Beigel of Beigel Technology. Says Beigel: "If you need more power, you can make simple adaptations—bigger batteries, additional solar panels, or moving solar panels."

The system is also easily adaptable to other species. "It can be used for virtually every animal you can catch," says Boarman.

"Tortoise Underpasses," from the U.S. Department of Transportation Federal Highway Administration Web site. In the public domain.

Passage 2

"If you build it they will come" fails for turtle crossings

by Sarah Zielinski

It's really too bad that turtles can't read.

If they did, it would make saving them so much easier. When people create an ecopassage so the reptiles can safely cross a road by going underneath or over it, they could let the animals know with little signs saying "Don't become roadkill! Safe crossing, left 20 meters."

Instead, we have to rely on fencing to keep the turtles and snakes off roads, which is a good idea because 98 percent or more of turtles are killed in their first attempt at a road crossing. But the reliance on fences may be a problem, a new study shows. When there aren't effective fences to keep the reptiles out, they don't use the ecopassages, James Baxter-Gilbert of Laurentian University in Sudbury, Ontario, and colleagues report March 25 in *PLOS ONE*.

The study looked at the effectiveness of a series of ecopassages built along a 13-kilometer stretch of Highway 69/40 near Burwash, Ontario, near Lake Huron, a region with high reptile biodiversity. The passages ran beneath the highway and were paired with fencing along the road. The researchers looked at reptile activity along the roadway before and after the project was constructed, and also used another stretch of highway, near the Magnetawan First Nation, as a comparison.

They surveyed the roadside and put up cameras in the ecopassages to see what kind of animals used the crossings. They captured Blanding's turtles and snapping turtles, and tracked their movements with radio transmitters. And they took painted turtles and placed them on the other side of the highway from their wetlands to see if they could make their way home through the tunnels.

Animals used the ecopassages, the study revealed, but the most common patrons of the underground passageways were ducks and geese. Few reptiles traveled through them. And, worse, turtles and snakes didn't stay off the roads. The number of reptiles on the roadway near the ecopassages actually increased after they were put in place, resulting in lots of dead snakes and turtles.

A small part of the problem may be that many turtles, at least, don't really want to use the ecopassages. The researchers tested the turtles' willingness to enter the passages, and most turtles either took so long that the scientists gave up (69 percent) or the turtles refused to go in (22 percent).

But the bigger failure was in the fencing. Along three kilometers of road, rips, holes and washouts had caused 115 gaps. During the spring melt, up to 30 percent of the fence was submerged. And other areas had been left completely unfenced. In total, the researchers calculate, about two-thirds of the road was lined with permeable fence.

The solution: Build better fences. "Roads are meant to be long-lasting structures," the researchers note, "and mitigation measures [to protect wildlife] should be equally long-lasting."

"'If you build it they will come' fails for turtle crossings," by Sarah Zielinski, from *Science News*. March 25, 2015.

What does the word consulted mean as it is used in paragraph 7?

got advice from

debated with

addressed

watched

Question 3

Passage 1

Tortoise Underpasses

from the U.S. Department of Transportation Federal Highway Administration website

Imagine several hundred desert tortoises wearing name tags.

That was the scene a few years ago on Mojave Desert land along State Highway 58 in San Bernardino County, California. Locating and tagging the tortoises was the first step in a multi-agency project to monitor the tortoises use of new storm-drain culverts[1] spanning the width of the highway. Eight federal and state partners were involved—the California Department of Transportation, the Bureau of Land Management, the California Energy Commission, the U.S. Fish and Wildlife Service, the Federal Highway Administration, the Nevada Department of Transportation, the California Department of Fish and Game, and the U.S. Geological Survey.

Since desert tortoises move rather slowly and within a limited home range, finding them and attaching IDs to their shells was relatively easy. Developing a reliable system for tracking their passage into and out of culverts proved more difficult.

"We needed an automated system that could be left unattended from March through October, when the tortoises were not hibernating," says William Boarman, USGS biologist and project manager. "We also wanted it to be secure from vandalism and environmental damage."

The research team's solution: Passive Integrated Transponder (PIT) tags and a computerized reading system. The PIT-tag system, used primarily to census fish, was adapted by AVID, Inc. and Beigel Technology Corporation to meet the criteria of the desert tortoise project. Easy maintenance was achieved by using a renewable energy source—solar panels and a solar-rechargeable battery. Protection from theft and environmental damage (for example, high summer temperatures) was accomplished by burying the system's receiver and antennae underground and camouflaging them with desert soil. (Protecting the solar panels, which could not be hidden and which were frequently stolen, required more complicated measures).

Here's how the PIT-tag system worked: When a tortoise entered or left a culvert, it passed through an electromagnetic field emitted from a "reader" tuned to a specific radio frequency. The reader detected and decoded the tortoise's ID (programmed into the memory of the system's microchip), and a datalogger inside the reader recorded it along with the date and time of passage.

Throughout the research project, team members paid attention to the smallest details. They attached the PIT tags to the tortoises' shells with an Epoxy glue that would not hurt the shells. They programmed the reading system to turn itself off at night (desert tortoises are active only during the day). They consulted a world-class surfboard designer to come up with a well-insulated "house" for the reader coil. They buried each reader in locked "nesting boxes." They designed the reading coil to cover an 8-foot (2.4 m) area, overcoming the short-distance limitations of PIT-tag technology.

The system recorded five tortoises using the culverts on 75 occasions in 1995 and 1996. Since the small vertebrates have no identifiable "corridor" and move at a leisurely pace (it took one tortoise seven hours—stopping and starting—to get through a culvert), these numbers are likely to increase as the tortoises gradually discover the culverts.

The solar-powered PIT-tag system used on the Highway 58 project can be used on almost any narrow wildlife crossing, according to Michael Beigel of Beigel Technology. Says Beigel: "If you need more power, you can make simple adaptations—bigger batteries, additional solar panels, or moving solar panels."

The system is also easily adaptable to other species. "It can be used for virtually every animal you can catch," says Boarman.

"Tortoise Underpasses," from the U.S. Department of Transportation Federal Highway Administration Web site. In the public domain.

Passage 2

"If you build it they will come" fails for turtle crossings

by Sarah Zielinski

It's really too bad that turtles can't read.

If they did, it would make saving them so much easier. When people create an ecopassage so the reptiles can safely cross a road by going underneath or over it, they could let the animals know with little signs saying "Don't become roadkill! Safe crossing, left 20 meters."

Instead, we have to rely on fencing to keep the turtles and snakes off roads, which is a good idea because 98 percent or more of turtles are killed in their first attempt at a road crossing. But the reliance on fences may be a problem, a new study shows. When there aren't effective fences to keep the reptiles out, they don't use the ecopassages, James Baxter-Gilbert of Laurentian University in Sudbury, Ontario, and colleagues report March 25 in *PLOS ONE*.

The study looked at the effectiveness of a series of ecopassages built along a 13-kilometer stretch of Highway 69/40 near Burwash, Ontario, near Lake Huron, a region with high reptile biodiversity. The passages ran beneath the highway and were paired with fencing along the road. The researchers looked at reptile activity along the roadway before and after the project was constructed, and also used another stretch of highway, near the Magnetawan First Nation, as a comparison.

They surveyed the roadside and put up cameras in the ecopassages to see what kind of animals used the crossings. They captured Blanding's turtles and snapping turtles, and tracked their movements with radio transmitters. And they took painted turtles and placed them on the other side of the highway from their wetlands to see if they could make their way home through the tunnels.

Animals used the ecopassages, the study revealed, but the most common patrons of the underground passageways were ducks and geese. Few reptiles traveled through them. And, worse, turtles and snakes didn't stay off the roads. The number of reptiles on the roadway near the ecopassages actually increased after they were put in place, resulting in lots of dead snakes and turtles.

A small part of the problem may be that many turtles, at least, don't really want to use the ecopassages. The researchers tested the turtles' willingness to enter the passages, and most turtles either took so long that the scientists gave up (69 percent) or the turtles refused to go in (22 percent).

But the bigger failure was in the fencing. Along three kilometers of road, rips, holes and washouts had caused 115 gaps. During the spring melt, up to 30 percent of the fence was submerged. And other areas had been left completely unfenced. In total, the researchers calculate, about two-thirds of the road was lined with permeable fence.

The solution: Build better fences. "Roads are meant to be long-lasting structures," the researchers note, "and mitigation measures [to protect wildlife] should be equally long-lasting."

"'If you build it they will come' fails for turtle crossings," by Sarah Zielinski, from *Science News*. March 25, 2015.

What is the author's main purpose in passage 1?

to describe the results of a study of the movement of tortoises

to describe a system used to track the movement of tortoises

to describe the effectiveness of culverts in protecting tortoises

to describe a way to protect more tortoises in the future

Question 4

Passage 1

Tortoise Underpasses

from the U.S. Department of Transportation Federal Highway Administration website

Imagine several hundred desert tortoises wearing name tags.

That was the scene a few years ago on Mojave Desert land along State Highway 58 in San Bernardino County, California. Locating and tagging the tortoises was the first step in a multi-agency project to monitor the tortoises use of new storm-drain culverts[1] spanning the width of the highway. Eight federal and state partners were involved—the California Department of Transportation, the Bureau of Land Management, the California Energy Commission, the U.S. Fish and Wildlife Service, the Federal Highway Administration, the Nevada Department of Transportation, the California Department of Fish and Game, and the U.S. Geological Survey.

Since desert tortoises move rather slowly and within a limited home range, finding them and attaching IDs to their shells was relatively easy. Developing a reliable system for tracking their passage into and out of culverts proved more difficult.

"We needed an automated system that could be left unattended from March through October, when the tortoises were not hibernating," says William Boarman, USGS biologist and project manager. "We also wanted it to be secure from vandalism and environmental damage."

The research team's solution: Passive Integrated Transponder (PIT) tags and a computerized reading system. The PIT-tag system, used primarily to census fish, was adapted by AVID, Inc. and Beigel Technology Corporation to meet the criteria of the desert tortoise project. Easy maintenance was achieved by using a renewable energy source—solar panels and a solar-rechargeable battery. Protection from theft and environmental damage (for example, high summer temperatures) was accomplished by burying the system's receiver and antennae underground and camouflaging them with desert soil. (Protecting the solar panels, which could not be hidden and which were frequently stolen, required more complicated measures).

Here's how the PIT-tag system worked: When a tortoise entered or left a culvert, it passed through an electromagnetic field emitted from a "reader" tuned to a specific radio frequency. The reader detected and decoded the tortoise's ID (programmed into the memory of the system's microchip), and a datalogger inside the reader recorded it along with the date and time of passage.

Throughout the research project, team members paid attention to the smallest details. They attached the PIT tags to the tortoises' shells with an Epoxy glue that would not hurt the shells. They programmed the reading system to turn itself off at night (desert tortoises are active only during the day). They consulted a world-class surfboard designer to come up with a well-insulated "house" for the reader coil. They buried each reader in locked "nesting boxes." They designed the reading coil to cover an 8-foot (2.4 m) area, overcoming the short-distance limitations of PIT-tag technology.

The system recorded five tortoises using the culverts on 75 occasions in 1995 and 1996. Since the small vertebrates have no identifiable "corridor" and move at a leisurely pace (it took one tortoise seven hours—stopping and starting—to get through a culvert), these numbers are likely to increase as the tortoises gradually discover the culverts.

The solar-powered PIT-tag system used on the Highway 58 project can be used on almost any narrow wildlife crossing, according to Michael Beigel of Beigel Technology. Says Beigel: "If you need more power, you can make simple adaptations—bigger batteries, additional solar panels, or moving solar panels."

The system is also easily adaptable to other species. "It can be used for virtually every animal you can catch," says Boarman.

"Tortoise Underpasses," from the U.S. Department of Transportation Federal Highway Administration Web site. In the public domain.

Passage 2

"If you build it they will come" fails for turtle crossings

by Sarah Zielinski

It's really too bad that turtles can't read.

If they did, it would make saving them so much easier. When people create an ecopassage so the reptiles can safely cross a road by going underneath or over it, they could let the animals know with little signs saying "Don't become roadkill! Safe crossing, left 20 meters."

Instead, we have to rely on fencing to keep the turtles and snakes off roads, which is a good idea because 98 percent or more of turtles are killed in their first attempt at a road crossing. But the reliance on fences may be a problem, a new study shows. When there aren't effective fences to keep the reptiles out, they don't use the ecopassages, James Baxter-Gilbert of Laurentian University in Sudbury, Ontario, and colleagues report March 25 in *PLOS ONE*.

The study looked at the effectiveness of a series of ecopassages built along a 13-kilometer stretch of Highway 69/40 near Burwash, Ontario, near Lake Huron, a region with high reptile biodiversity. The passages ran beneath the highway and were paired with fencing along the road. The researchers looked at reptile activity along the roadway before and after the project was constructed, and also used another stretch of highway, near the Magnetawan First Nation, as a comparison.

They surveyed the roadside and put up cameras in the ecopassages to see what kind of animals used the crossings. They captured Blanding's turtles and snapping turtles, and tracked their movements with radio transmitters. And they took painted turtles and placed them on the other side of the highway from their wetlands to see if they could make their way home through the tunnels.

Animals used the ecopassages, the study revealed, but the most common patrons of the underground passageways were ducks and geese. Few reptiles traveled through them. And, worse, turtles and snakes didn't stay off the roads. The number of reptiles on the roadway near the ecopassages actually increased after they were put in place, resulting in lots of dead snakes and turtles.

A small part of the problem may be that many turtles, at least, don't really want to use the ecopassages. The researchers tested the turtles' willingness to enter the passages, and most turtles either took so long that the scientists gave up (69 percent) or the turtles refused to go in (22 percent).

But the bigger failure was in the fencing. Along three kilometers of road, rips, holes and washouts had caused 115 gaps. During the spring melt, up to 30 percent of the fence was submerged. And other areas had been left completely unfenced. In total, the researchers calculate, about two-thirds of the road was lined with permeable fence.

The solution: Build better fences. "Roads are meant to be long-lasting structures," the researchers note, "and mitigation measures [to protect wildlife] should be equally long-lasting."

"'If you build it they will come' fails for turtle crossings," by Sarah Zielinski, from *Science News*. March 25, 2015.

What is the central idea of passage 2?

A study has shown that reptiles and other animals do not like to use ecopassages to cross roads.

A study has shown that ecopassages can cause more animal deaths than people predicted.

A study has shown that reptiles and other animals prefer crossing roads and need to be trained better.

A study has shown that ecopassages are not working well and that effective fencing is important.

Question 5

Passage 1

Tortoise Underpasses

from the U.S. Department of Transportation Federal Highway Administration website

Imagine several hundred desert tortoises wearing name tags.

That was the scene a few years ago on Mojave Desert land along State Highway 58 in San Bernardino County, California. Locating and tagging the tortoises was the first step in a multi-agency project to monitor the tortoises use of new storm-drain culverts[1] spanning the width of the highway. Eight federal and state partners were involved—the California Department of Transportation, the Bureau of Land Management, the California Energy Commission, the U.S. Fish and Wildlife Service, the Federal Highway Administration, the Nevada Department of Transportation, the California Department of Fish and Game, and the U.S. Geological Survey.

Since desert tortoises move rather slowly and within a limited home range, finding them and attaching IDs to their shells was relatively easy. Developing a reliable system for tracking their passage into and out of culverts proved more difficult.

"We needed an automated system that could be left unattended from March through October, when the tortoises were not hibernating," says William Boarman, USGS biologist and project manager. "We also wanted it to be secure from vandalism and environmental damage."

The research team's solution: Passive Integrated Transponder (PIT) tags and a computerized reading system. The PIT-tag system, used primarily to census fish, was adapted by AVID, Inc. and Beigel Technology Corporation to meet the criteria of the desert tortoise project. Easy maintenance was achieved by using a renewable energy source—solar panels and a solar-rechargeable battery. Protection from theft and environmental damage (for example, high summer temperatures) was accomplished by burying the system's receiver and antennae underground and camouflaging them with desert soil. (Protecting the solar panels, which could not be hidden and which were frequently stolen, required more complicated measures).

Here's how the PIT-tag system worked: When a tortoise entered or left a culvert, it passed through an electromagnetic field emitted from a "reader" tuned to a specific radio frequency. The reader detected and decoded the tortoise's ID (programmed into the memory of the system's microchip), and a datalogger inside the reader recorded it along with the date and time of passage.

Throughout the research project, team members paid attention to the smallest details. They attached the PIT tags to the tortoises' shells with an Epoxy glue that would not hurt the shells. They programmed the reading system to turn itself off at night (desert tortoises are active only during the day). They consulted a world-class surfboard designer to come up with a well-insulated "house" for the reader coil. They buried each reader in locked "nesting boxes." They designed the reading coil to cover an 8-foot (2.4 m) area, overcoming the short-distance limitations of PIT-tag technology.

The system recorded five tortoises using the culverts on 75 occasions in 1995 and 1996. Since the small vertebrates have no identifiable "corridor" and move at a leisurely pace (it took one tortoise seven hours—stopping and starting—to get through a culvert), these numbers are likely to increase as the tortoises gradually discover the culverts.

The solar-powered PIT-tag system used on the Highway 58 project can be used on almost any narrow wildlife crossing, according to Michael Beigel of Beigel Technology. Says Beigel: "If you need more power, you can make simple adaptations—bigger batteries, additional solar panels, or moving solar panels."

The system is also easily adaptable to other species. "It can be used for virtually every animal you can catch," says Boarman.

"Tortoise Underpasses," from the U.S. Department of Transportation Federal Highway Administration Web site. In the public domain.

Passage 2

"If you build it they will come" fails for turtle crossings

by Sarah Zielinski

It's really too bad that turtles can't read.

If they did, it would make saving them so much easier. When people create an ecopassage so the reptiles can safely cross a road by going underneath or over it, they could let the animals know with little signs saying "Don't become roadkill! Safe crossing, left 20 meters."

Instead, we have to rely on fencing to keep the turtles and snakes off roads, which is a good idea because 98 percent or more of turtles are killed in their first attempt at a road crossing. But the reliance on fences may be a problem, a new study shows. When there aren't effective fences to keep the reptiles out, they don't use the ecopassages, James Baxter-Gilbert of Laurentian University in Sudbury, Ontario, and colleagues report March 25 in *PLOS ONE.*

The study looked at the effectiveness of a series of ecopassages built along a 13-kilometer stretch of Highway 69/40 near Burwash, Ontario, near Lake Huron, a region with high reptile biodiversity. The passages ran beneath the highway and were paired with fencing along the road. The researchers looked at reptile activity along the roadway before and after the project was constructed, and also used another stretch of highway, near the Magnetawan First Nation, as a comparison.

They surveyed the roadside and put up cameras in the ecopassages to see what kind of animals used the crossings. They captured Blanding's turtles and snapping turtles, and tracked their movements with radio transmitters. And they took painted turtles and placed them on the other side of the highway from their wetlands to see if they could make their way home through the tunnels.

Animals used the ecopassages, the study revealed, but the most common patrons of the underground passageways were ducks and geese. Few reptiles traveled through them. And, worse, turtles and snakes didn't stay off the roads. The number of reptiles on the roadway near the ecopassages actually increased after they were put in place, resulting in lots of dead snakes and turtles.

A small part of the problem may be that many turtles, at least, don't really want to use the ecopassages. The researchers tested the turtles' willingness to enter the passages, and most turtles either took so long that the scientists gave up (69 percent) or the turtles refused to go in (22 percent).

But the bigger failure was in the fencing. Along three kilometers of road, rips, holes and washouts had caused 115 gaps. During the spring melt, up to 30 percent of the fence was submerged. And other areas had been left completely unfenced. In total, the researchers calculate, about two-thirds of the road was lined with permeable fence.

The solution: Build better fences. "Roads are meant to be long-lasting structures," the researchers note, "and mitigation measures [to protect wildlife] should be equally long-lasting."

"'If you build it they will come' fails for turtle crossings," by Sarah Zielinski, from *Science News*. March 25, 2015.

What does the phrase "permeable fence" mean as it is used in paragraph 18?

fence that animals can pass through

fence that is under water

fence that extends for a long distance

fence that is not strong enough