- **Title**: SnowSafe – Helping people drive safer on icy and snowy roads
- **Each Team Member's Name and Role(s)**
    - Kaitlyn Dempsey - 25% helped design sketches, written scenarios and feedback appendix
    - Kristina Tschomakoff - 25% helped with written scenarios and updated storyboard and appendix.
    - Shaun Raftery - 25% helped design sketches, grammar checking, formatting, appendix
    - Stephanie Lato - 25% helped with problem and solution overview, design research goals, design research results, and task analysis questions paragraph answers, appendix

- **Problem and Solution Overview** *(1 paragraph)*: A concise statement of the problem you are tackling and a brief synopsis of your proposed solution.

    Poor weather conditions result in approximately 22% of the accidents that occur each year. Nearly 2,000 people die and over 135,000 people are injured each year due to car accidents on icy and snowy roads. We were inspired to tackle this problem because of the many accidents that occurred in Fort Worth, Texas this year due to the icy road conditions. Our hope is to find a way to make the roads safer to drive on and decrease the number of fatalities and injuries. To accomplish this, we have decided to make an app with features such as including directions to the user's destination that avoid the most dangerous, snowy roads. The app would also be a way for local city government to provide updated information about which roads have been plowed as well as an estimate of when roads will be plowed.

- **Design Research Goals, Stakeholders, and Participants** *(1 page)*: Describe your design research, including the participants, their background, and their environment. Describe why you chose the particular methods and participants in your design research.

    We conducted four interviews with 3 college students and 1 recent graduate. Molly is 20 years old and has had her license for 4 years. She is a sophomore at SIUe and commutes to and from school daily. She lives in Illinois, about 45 minutes northeast from campus in a small town. So, Molly has experience driving in the snow on country roads as well as highways. We interviewed Shannon, who is 26 years old and has had her license for 10 years. She is a full-time nurse at Barnes hospital and commutes to work. She is from the greater St. Louis city area and is most familiar with Saint Louis city streets and highways. We interviewed Abigail, who is 19 years old and has had her license for 3 years. She is a full-time student at SIUE, studying pre-vet. She is from Troy, Illinois, and regularly drives on highways and backroads. We interviewed Charlie, who is 24 years old and currently lives in Chicago. He has had his license for 8 years and grew up living and driving in Edwardsville.

    Our interview questions included: Describe your experience driving in good vs bad weather conditions. Do you have any specific stories about scary or bad experiences while driving in bad conditions? Have you experienced a difference in the conditions of different types of roads (highway, city, country)? Do any get more treatments than others? Do you feel safer on a specific type? Do you feel safe riding with or driving others in snowy conditions? Do you feel you would benefit personally from something to make driving in snow safer and easier, and do you have any ideas on how driving in

bad conditions could be better? We also decided to use a poll as well. Poll questions included questions that required less detailed answers such as: How many years have you been driving? How much experience do you have driving on snowy roads on a scale of 1-10? Does it take you longer to arrive at your destination when the roads are snowy? On a scale of 1-10, how safe do you feel when driving on icy roads? Would you feel more comfortable driving in non-ideal conditions if you had a newer car? Have you ever been in an accident that resulted because the roads were too slick? Have you ever had to pull over to the side of the road because it was too icy to drive on?

The interviews gave us more detailed descriptions of users' experiences and needs. We also had the ability to ask follow up questions or for more clarification from the people we interviewed. However, even though the poll questions were more general and were mainly yes/no questions, they allowed us to reach more people to see if drivers would benefit from a way to make their drives in snowy conditions safer.

- **Design Research Results and Themes** *(1 page)*: Discuss common themes, problems, and practices that emerged in your design research. Include any updated themes that emerged when considering your design research in your design process.

Participants have experience driving in unsafe conditions and have driven on a variety of different road types. From the interviews, the participants have told us they believe that highways were cleared the fastest, followed by city roads, and finally country roads. However, the participants had different experiences on how quickly the roads had been cleared.

All participants appreciate the systems we currently have in place to help clear the snow during bad weather (such as snowplows), but they also would all like to see other methods being implemented to help make conditions safer to drive on. In addition, all four participants would be willing to implement additional technology and products into their vehicles and/or phones in order to help make driving and conditions safer.

Molly and Abigail both have some experience driving in older cars, and based on our interviews, we noticed that driving in an older car can be more dangerous in snowy conditions. Our poll also reflected this conclusion.

Each participant agreed that it is hard to find out which roads are safe to drive on and which roads to avoid just based on methods currently available. In their experiences, information from the news or radio wasn't completely updated or accurate. One participant commented that they wished they could know when certain roads would be cleared, and wanted to have a better idea of the process government snowplows use to organize their road clearing.

Our major takeaway from the interviews was these findings indicate a need for better information on snowy roads and faster road clearance.

- **Answers to Task Analysis Questions** *(2 pages)*: Provide brief answers to the task analysis questions. These should be updated according to your evolved understanding of the problem and your design.

1. Who is going to use the design?

Drivers of all ages would use this design. We want to make our app user friendly, so everyone would be able to benefit from using the app. We want everyone to be as safe as possible so we don't want to intentionally limit the people who could use our app.

2. What tasks do they now perform?

Users rely on the news and radio stations to update them on which roads are dangerous to drive on and maybe about snowplow schedules. However, there is not a place where users can quickly go to for consistent, updated information about the conditions they have to drive on in order to reach their destination. Users can find directions to destinations through other apps, but again there is no apps that will alert them of dangerous road conditions or show them the safest way to arrive at their destination.

Our app will perform tasks such as giving directions to the user's specified destination while avoiding the most snowy and dangerous roads. The app will have software to read directions aloud to users so that users do not have to look at their phone while driving. The app will also be a way for local city management to update information about the road conditions to users. The local city management would be able to provide a plow schedule so users know about when specific roads will be plowed. In addition to the plow schedule, local city management would be able to specify any specific roads that they believe are still dangerous to drive on and roads that they believe users should try to avoid in order to stay safe.

3. What tasks are desired?

Drivers want to be able to determine when the roads will be plowed and what roads are still snowy. They would like updated information from a reliable source about which roads are safe to drive on and which to avoid. Drivers would like directions to their destinations based upon updated information about road conditions. They want to avoid the most snow-covered roads in order to drive as safely as possible to their destination. Drivers would like another way for roads to be cleared more quickly. This would help in case snowplows are unable to clear all the roads right away.

4. How are the tasks learned?

Tasks are learned through users interacting with the product. Our design will incorporate elements from other navigation applications that will be familiar to our users. There will also be clear color codes and indicators to help drivers distinguish between safe and unsafe roads. We want our app to be as user friendly as possible, which is why we decided to go with a simpler final design. Tasks will also be learned through experience. The more experience people have driving on snowy roads with our app, the safer and more comfortable they will feel. Once they understand how to navigate through our app to find the specific information they are looking for (perhaps about the conditions of specific roads or information about when plows are scheduled) or how to specify their destination and follow those directions, our app will help them drive safer every time they need to drive in bad conditions.

5. Where are the tasks performed?

Most of the tasks are performed before the driver has started their car. They will look on their phone for information about roads, estimated plow times, and which routes to take. They can also plan and view how to get to their destination. Some tasks, like following directions, will be performed as the driver is driving, when they can hear the information. Local city management will be able to update information about plow times and dangerous roads from their offices or headquarters before they make that information public to users.

6. What is the relationship between the person and data?

Some of the data, such as dangerous roads, and snowplow times will be common data that can be accessed by anyone. Other data will be personal data, like where the user wants to go and their current location. The data provided by the app will allow the person to adjust their plans (for example, help them decide when to leave based on plow schedules) for them to feel as safe and as prepared as they can so they can reach their destination.

7. What other tools does the person have?

Users have the option to press a button that would send an automatic request to local city management that they would like a certain road to be plowed. If enough users request the same road, local city management could decide if they want to update their plow times.

8. How do people communicate with each other?

People will not be able to communicate with other drivers. However, they will be able to communicate indirectly with their city to learn more about when which roads will be plowed and which roads they should avoid. Also, users can communicate with local city management to send a request to plow a certain road.

9. How often are the tasks performed?

These tasks will be performed every time a user accesses the application to get directions, learn about the roads, or contact the city. The app will update automatically with the newest information available provided by the local city management. Tasks will also be performed before and during when the driver is going to their destination. Drivers will put in the address of the destination before driving and then will receive verbal directions from the app throughout the drive. As far as when plowing the roads will state, ideally it would start to be cleared as soon as possible after the storm. The quicker the roads become safer to drive on, the fewer accidents there will be.

10. What are the time constraints on the tasks?

People will usually be ready to leave by the time they access the app, so it is important to make getting directions as well as displaying unsafe roads the fastest. The snowplow times will also be important and will be updated automatically as well. The city contact information could wait longer, as people won't need to access them as quickly. There could also be time constraints on updates based on how quickly city management can update the plow schedule and row conditions. However, they will probably make this a priority in order to keep people as safe as possible.

11. What happens when things go wrong?

If things go wrong and the information is not kept up to date by city management, people will have to rely on things like the internet, radio, or the news weather report to determine how safe the roads may be. This will take them much longer though, and some people may be in a hurry when they are trying to get directions. If our app does not work 100% all the time, there can still be accidents because of the dangerous driving conditions. However, even if we cannot stop all the accidents, reducing the number of accidents will still save many lives and prevent injuries.

- **Proposed Design Sketches** *(1 page)*: Present scanned images of your three initial designs in the context of their four tasks. Include one paragraph for each design, discussing how it supports your tasks. Include one paragraph discussing your choice of design and tasks to further pursue.
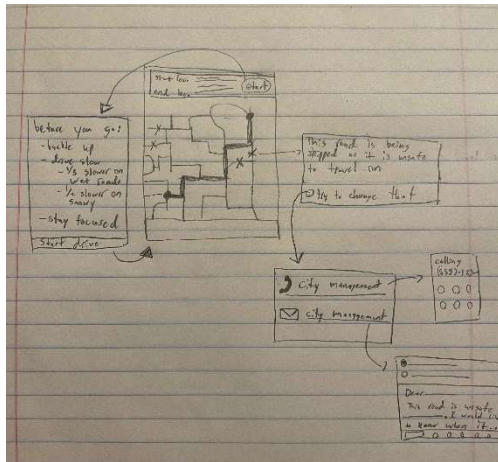
This design asks the user to input two locations, a start, and an end, and shows them the safest and quickest way to get there. By clicking on the X's, the user can see that those roads are unsafe and then be directed to a page with contact details. These details are made specific to the locations that the user has already entered. Clicking on the phone icon or email icon will send the user to their phone or email app. When the user tries to get the directions between the two places, they are automatically directed to a page that will give them information on how to drive safer.
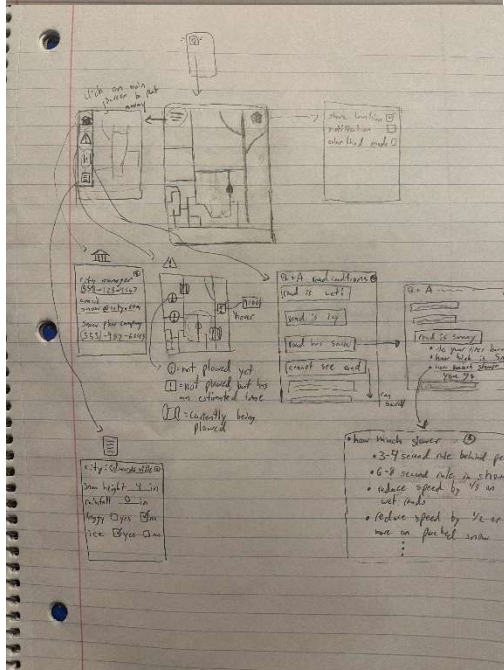
This design centers around using the user's location to see around them and the conditions of the roads. If the user clicks on the top left menu button, they will be given more options by clicking on the small icons. By clicking on the building icon, the user is directed to a screen that shows contact information for who Is in charge of plowing roads. If the user clicks on the hazard button, they are directed to a similar street view but with small icons. Each icon represents the condition of the road and will show what it means when it is hovered over. If the user clicks on the road icon, they will get sent to a screen that will show them useful information on how to drive safely in whatever condition they might be in. Lastly, if the user clicks on the written page icon, they get sent to a screen that shows them the current information on the weather conditions in their area.

This design is intended for those with a daily commute that requires forward knowledge of road conditions in order to make sure the user arrives on time. From any menu screen, through access to the drop-down navigation menu, the user can navigate to the Daily Paths list, which displays all active and inactive paths. It also has an info button, which pops up a text box explaining the purpose of the daily paths, and how to use them. The "Create New Path" button will take the user to the Path Edit screen, where a new path can be made. This process includes editing of arrival time, dates, destination, and early warning time. The early warning time will send out a notification at a specified time (ex. 1 hour) before the app has calculated the user should need to leave to arrive at the arrival time.

The design our group chose to work on ended up being a mix of a few designs, but it was mostly focused on our first design. While we liked each one and thought they would be good choices if incorporated together, the first design is keystone of the solution to the problem we presented. This is due to how the first design addresses the tasks we deemed as most important the best, and the other designs wouldn't likely be possible without the first one existing anyways. This design worked best because it had a simple interface that our users could learn, but it also included all the information that we thought was necessary. Our interviewees told us that other than the news, there is not an easy way for them to find updated information about road conditions, including which roads have been plowed already. With this in mind, we wanted to make sure that the people who need more safety on the roads would have easy access to the most important information that would help them. We wanted to implement a task to give directions and mark dangerous routes in order to help people arrive at their destinations safely. Based on feedback from the people we interviewed, we realized drivers would benefit if they knew which roads were safe to drive on and which to avoid. We felt that this task is more compelling than others we considered because there is not another app that gives directions based on which roads are in the best condition to drive safely. We also wanted a task that gave information about when snowplows would go out and on which roads. This way the app can recommend roads that have been plowed recently so the user can drive on those roads instead. This task was more compelling than others because knowing when roads were going to be plowed seemed to be a problem that everyone consistently had. If people know if the roads are still snowy when they plan on leaving, then they can try to leave later to drive when it's freshly plowed, or earlier to make sure they can drive slower to get to their destination on time.

- **Written Scenarios** *(1 page)*: Convert your two tasks into written scenarios for your design. Scenarios include the steps a person will go through to accomplish the task, including references to your design. Scenarios do not need to detail every little step, but should be realistic, should be dependent upon the design you have chosen, should appropriately reference elements of your design, and should communicate how a person will accomplish the task using your design.

Give directions and mark dangerous routes

Ashley is a new 26-year-old part time food delivery driver and full time student in the city of St. Louis. She is a go getter and often does long shifts of her choosing (up to 12 hours a day). Because of this, Ashley is often out driving during the winter in snowy/icy conditions and needs to know which roads are safe or not to drive on to route her deliveries. When a delivery pops up on her screen, Ashley can enter the address of the restaurant/customer in the SnowSafe app. SnowSafe will then route her current location to the desired destination with the fastest and safest route. It would also show multiple alternative routes and include with which roads are not safe for driving marked with red X's. In addition, if there is only one route available to a destination and it has the red X, she can click the X to learn more information on the current status of this road. This simple addition will allow Ashley to be as safe as possible while making her deliveries.

Give information when plows go out, along with monitors inside of plows / Give advice on how to drive

Michael is a 47-year-old chef who lives out in the countryside but works in the city. There are two ways to get to his house, the backroads way, and a highway. The highway takes a detour through another small town which will usually take him longer to get to his work. The backroads way is the way he normally takes, but it is more dangerous when it is snowy or icy. The back roads do not get plowed by the city and he spends long amounts of time trying to drive slowly through these unsafe roads. With our design SnowSafe, he is able to get the information he needs to leave at the appropriate time, and he also knows when he should stay home from work. When he first wakes up in the morning, he gets on SnowSafe and sets his route into the app to see if it is safe enough to take the back roads. If it is then he will continue his morning routine as normal and drive the way he always does. If it is too dangerous then he will look on the app to see when the main roads get plowed. If the roads are plowed early and he knows it is going to continue to snow, then he will leave earlier before the roads have time to collect more snow. Once he has the information, he can continue getting ready, knowing what time he will have to leave in order to get to work on time.

- **Storyboards of the Selected Design**: Include updated storyboards of your design. Reference these appropriately in your scenarios.
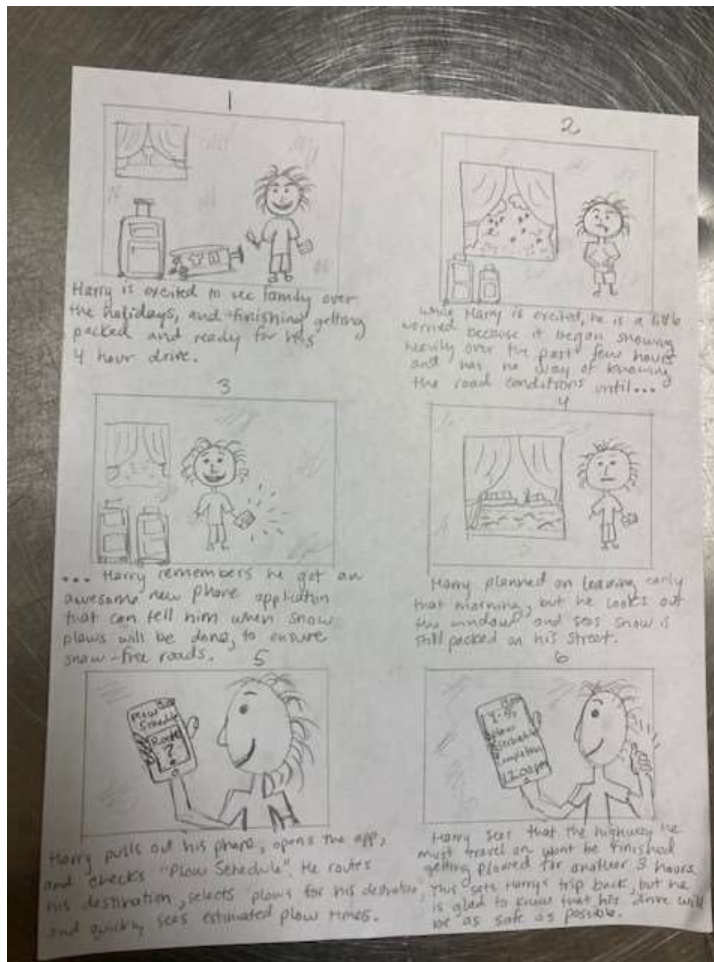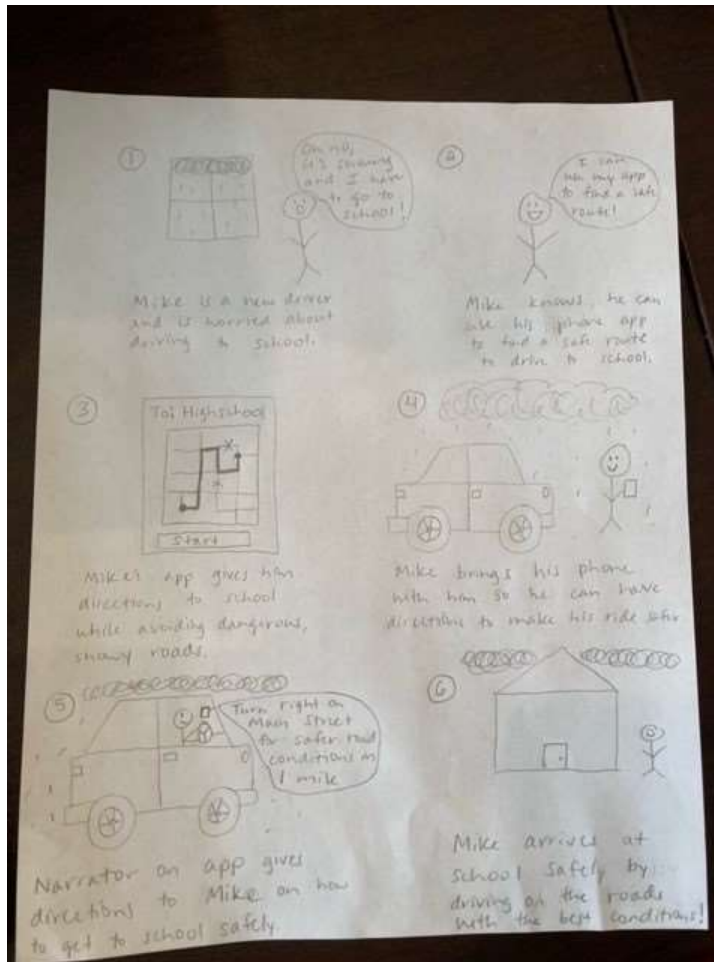
- **Appendix of Feedback Sessions and User Research:** Compile your activities from the Feedback Sessions for User Design Research, Task Analysis, and Initial Designs and attach them to the end of your report. Also include your User Design Research interviews or any other material that you used to obtain feedback from participants.

Feedback Sessions:

- User design research – If we decide to create a machine that melts the ice off the roads, we should make sure we can incorporate a smart device element. We also need to make sure the device is affordable.
- Task Analysis – Feedback we received suggested that our tasks pertaining to lighting and heating systems for the roads were impractical and not financially feasible. We also decided the scope of our tasks should be geared towards what is accomplishable by the SnowSafe application.
- Initial designs – Other groups suggested that we go with the first design since it was simple to create and use. We were also told that the alarm system would be a good thing to implement.

Participant interview recording:

- o [Shannon Interview](#)
- o [Molly Interview](#)
- o [Abigail Interview](#)

Poll results:

How many years have you been driving?

28.6% 1-2 years ; 57.1% 3-5 years ; 14.3% 5+ years

How much experience do you have driving on snowy roads on a scale of 1-10?

1 (lowest) = 28.6% ; 4 = 14.3% ; 5 = 14.3% ; 6 = 14.3% ; 7 = 14.3% ; 10 (most) = 14.3%

2, 3, 8, 9 = 0%

Do you change the way you drive when weather conditions are snowy or rainy?

100% yes ; 0% no

Does it take you longer to arrive at your destination when the roads are snowy?

71.4% Yes ; 28.6% No

On a scale of 1-10, how safe do you feel when driving on icy roads?

1 (least safe) = 42.9% ; 3 = 14.3% ; 4 = 14.3% ; 5 = 14.3% ; 7 = 14.3%

2, 6, 8, 9, 10 = 0%

Would you feel more comfortable driving in nonideal conditions if you had a newer car?

57.1% yes ; 14.3% no ; 28.6% unsure

Have you ever had to pull over to the side of the road because it was too icy to drive on?

14.3% yes ; 85.7% no

Have you ever been in an accident that resulted because the roads were too slick?

14.3% yes ; 85.7% no

Do you feel the current processes in place (like snow plows) to clear roads are sufficient/timely?

14.3% yes ; 57.1% no

28.6% depends

Do you feel like there should be a better and quicker way to make the roads safer to drive on?

85.7% yes ; 0% no ; 14.3% unsure