[00:00:00.00] Colleen: Okay so can we, um, conclude anything?

[00:00:04.27] Colleen: Do you all feel like we can conclude anything?

[00:00:07.00] Multiple: Yes

[00:00:09.20] Colleen: Ellie?

[00:00:10.16] Ellie: Surface friction affects the cart more than air friction.

[00:00:14.06] Colleen: Okay. And what evidence makes you say that?

[00:00:17.01] Ellie: Because our ratios, we were the one with air resistance, and our ratios were pretty similar, whereas like,

[00:00:22.09] your, you guys tested, increased the friction and it was very different.

[00:00:27.19] Kapp: Okay but I, I think like, like you can't equate a piece of cardboard to tape on the wheels, (a few people laugh) like, there's no like,

[00:00:34.11] we're not quantifying the amount of friction that's provided.

[00:00:36.22] So like, think about if you had a massive parachute, and like a little piece of tape. (laughter)

[00:00:40.17] Then like the air friction would be more.

[00:00:43.15] Ellie: Yeah

[00:00:45.29] Colleen: Mmm

[00:00:46.14] (cross-talk) (unclear student): ...attached to a parachute. (unclear) dumb. (laughter)

[00:00:50.26] Emilia: I though it was like, (unclear) force, like (it creates?) force,

[00:00:54.01] we're just trying to (quantify?) why it (unclear). So that, I think maybe we can conclude that both air friction and surface friction, yeah?

[00:01:01.01] (nodding head) it's all friction.

[00:01:03.02] (lots of laughter)

[00:01:05.07] Sarah: like, they (inaudible)

[00:01:07.25] Marka: Like in more general terms I think you can say like, that an increase in friction leads to a greater difference between the two sections of the graph.

[00:01:16.13] Like if something is low resistance, low friction, like, um, what their group did, it was less of a difference versus something is more friction has a greater difference.

[00:01:25.16] So like that makes, that would explain, like the anomaly graph (unclear).

[00:01:29.17] Colleen: Do you all agree with that?

[00:01:30.25] Max, others: Yeah

[00:01:32.03] Colleen: What about-

[00:01:33.05] David P: Did you guys spray the axles?

[00:01:34.25] Alex: Yeah

[00:01:35.30] David P: and like it got much, much better?

[00:01:37.00] Alex: Yeah

[00:01:38.00] David P: So then, perhaps it's like just the friction

[00:01:40.04] Colleen: Well did it get much much better from what it had been?

[00:01:43.24] David R: No, it's- (overlapping)

[00:01:44.24] Erica: It was already, yeah--

[00:01:45.24] Alex: It was pretty good

[00:01:46.24] Colleen: Theirs was already really close

[00:01:47.24] Alex: Like even though we didn't change anything besides wiping down the ramp (laughter),

[00:01:52.10] um, like even then it was within like eight thousandths

[00:01:55.24] Audrey: So then just by wiping down the ramp, like it

[00:01:59.05] David R: But we don't know what it was before. Cause we didn't do it before

[00:02:02.16] David P: (quiet) I didn't want to (laughter)

[00:02:04.02] David R: We didn't think wiping down the ramp would make a difference

[00:02:05.21] Erica: Yeah

[00:02:06.10] David R: So our control was we wiped down the ramp and did it and then we greased the axles and then we did it again.

[00:02:11.04] But they were all almost straight.

[00:02:12.18] Emilia: Well then I think we should do one where it (Colleen laughs) just like go down and then wipe down the ramp and

[00:02:18.05] Erica: We've done that, we've already done that. Right we already tested that.

[00:02:20.10] Emilia: But this is using a different car

[00:02:21.10] David R: It's just like variable between cars

[00:02:23.19] Multiple: Yeah

[00:02:24.05] Marka: Also like--

[00:02:25.16] Erica: But I feel like the fact that we've done so many tests with so many cars and ramps without wiping it down and it's all been pretty different, like, is already pretty telling.

[00:02:32.27] Max: I seriously doubt that wiping down the ramp would make that big of a difference. (overlapping talk)

[00:02:37.22] David P: yeah but isn't the dust going to like affect (laughing)

[00:02:40.28] Erica: I don't know

[00:02:42.23] David R: Well, we did it with one of the um, whiteboard wipe things. (Student: Oh) So something on that could have

[00:02:50.17] David P: Oh, maybe it /-

[00:02:51.18]Erica: /I thought you used a paper towel-

[00:02:52.17] David P: Oh isn’t that stuff oily though?

[00:02:53.27] David R: No, I used that (pointing in the direction of the whiteboards) (laughter)

[00:02:55.17] (overlapping talk) (student): Isn't that wet?

[00:03:00.00] David P: Isn't it like covered in like oils from the

[00:03:02.10] David R: Yeah.

[00:03:03.00] David P: from the markers so in essense you guys

[00:03:06.02] Erica: /So frictionless!

[00:03:07.04] David P: / just greased the (laughter)

[00:03:10.06] David R: Yes. We really messed it up. (laughter)

[00:03:15.06] David R: There was no real control. We just greased it and then (unclear). (laughter)

[00:03:21.02] Colleen: So how does the weight thing, the weight group fit into it?

[00:03:25.00] David P: They don't. (laughter)

[00:03:27.04] David R: They only did one trial

[00:03:28.02] Marka: The thing with the weight group, like you guys had had a trend, it's just the only one that ruined it was like the first one with no weight

[00:03:33.20] and so that makes me think that it could be like something there that was like maybe human error or some other factor that.

[00:03:39.20] --if you discount one of your four then there seems to be a trend.

[00:03:45.27] Sarah: But adding weight should like increase friction.

[00:03:48.25] Marka: Yeah and that like makes sense to me, so I think that like the issue could just be with like the way you did your first test.

[00:03:55.00] Sarah: Yeah, yeah. The first test was less than (unclear). That makes sense.

[00:04:02.16] (long pause)

[00:04:07.26] Isaac: It might also be the fact that we assumed that adding more weight in this particular case would add more friction but (now?) because it's already on such

[00:04:16.20] a nice, metal, smooth surface, it didn't quite add as much friction as we would have been expected it to, so we, like, perhaps, maybe it would work better if we had...

[00:04:28.20] I think it might just be that we assumed that adding more weight in this particular case would impact the friction, it probably- it did, but maybe not as much as we expected it to.

[00:04:35.15] Sarah: But even if it didn't add as much as we expected, I feel like it still should have increased, the difference in slopes but it didn't.

[00:04:43.15] It did compared to like the first, the car with one weight, but not compared to the car that had no weight on it. So that's where I think there's a discrepancy in our data.

[00:04:53.22] Kapp: For some reason, I feel like adding weight doesn't necessarily increase friction. Because like if you think about, I don't know like, a really light car driving through snow,

[00:05:04.27] it's gonna, it's gonna like, the snow's gonna hold it back a lot more than like a heavier car, right? So, I don't know if like

[00:05:13.05] (laughter)

[00:05:14.00] No-

[00:05:14.28] Marka: Like a truck /can barrel through a cardboard box-
David P: /Well that's because it has more momentum
Kapp: right (nods to Marka)
Sarah: That's inertia
Marka: Okay that's even (unclear)
Emilia: But also--

[00:05:19.08] Sarah: But isn't that inertia?

[00:05:20.07] Kapp: Yeah but like how is that not relevant?

[00:05:21.25] Emilia: But also the -

[00:05:22.15] Max: I think the heavier car would be way slower

[00:05:24.08] Emilia - car is heavy and it's like pushing down the snow in a more packed trail (hands showing packed snow)

[00:05:26.00] Kapp: But (unclear)

[00:05:27.01] Marka: But that's cause the snow- (laughter)

[00:05:28.15] David R: Is it heavy or just tall?

[00:05:29.20] Marka: No, I think (unclear) like, if there's like a cardboard box on the road, like if you're in a truck, you can just drive over that like there's no problem.

[00:05:35.27] But like if you're on a bike that doesn't weight that much, then /(unclear) (laughter)

[00:05:39.21] David P: Or think of it as like a Prius,

[00:05:42.27] Audrey: A prius? (laughter)

[00:05:45.00] David P: A prius will like hydroplane easily over like a pool of water but like if you're in a truck it's just gonna go like-

[00:05:50.00] Kapp: How do you know?

[00:05:51.13] David P: - right into it.

[00:05:53.10] Yeah my Prius hydroplanes easily, it's terrible. (laughter)

[00:05:57.25] Emilia: Well, think about like the bowling ball on a pillow versus like a,

[00:06:02.01] something the exact size of that but filled with air on the pillow, Like which one is going to make more of a dent?

[00:06:10.29] David R: Wait, Say that again?

[00:06:11.29] Audrey: Wait, Can you say that again?

[00:06:12.26] Emilia: Isn't that the- I guess that's normal, but is that /(unclear)

[00:06:19.12] Colleen: /Can you repeat it for everyone?

[00:06:20.10] Emilia: Oh, ok, I said that if you imagine the bowling ball on a pillow and the dent that it makes verses a ball the size of the bowling ball but filled with air,

[00:06:29.01] then it, like which one has more force on the surface that it's on top of?

[00:06:36.23] Um, the bowling ball, because it's heavy. (laugher)

[00:06:39.28] Max: Or if you think about a bowling ball rolling down a pillow ramp versus like (laughter)

[00:06:44.15] a beach ball rolling down a pillow ramp. The bowling ball is going to like sag into the pillow

[00:06:48.10] and that's definitely going to be like more friction caused by weight.

[00:06:52.26] Versus the beach ball will just like roll over the surface of the pillow, the bowling ball will create this, this little-like ditch behind it as it goes.

[00:07:00.10] (laughter, cross-talk)

[00:07:04.06] Isaac: I guess one way to compare would be like a rotund person on ice skates (laughter).

[00:07:12.26] So like- (laughter). So like, ice skates have when you're on ice, you should be able to get really low friction so (unclear) down the ramp.

[00:07:21.15] And if you have a really heavy guy versus a really skinny guy, and like--

[00:07:25.06] I guess, although it may seem like a really low amount--so both of them will have comparatively low amounts of friction compared to

[00:07:33.14] if you're like trying to slide on a normal ground but...

[00:07:38.00] (laughter, cross talk)

[00:07:45.00] Sarah: Yeah, I feel like we're confusing inertia and friction.

[00:07:48.18] Like friction, should theoretically, now that I'm thinking about it be constant, and so it's just inertia is like how, like the object wants to stay in the same position, right?

[00:07:59.27] So like someone who is- has more mass, will, be able to go further simply because, like they want to- that- --

[00:08:06.09] like, their mass wants to stay in that moving state longer, I don't know, I just- I feel like maybe we're confusing those two things.

[00:08:13.18] Kapp: Um, so off that, maybe weight was like the wrong thing to manipulate. Cause like, as you add more weight, you add more inertia, right?

[00:08:20.04] Sarah: Yeah

[00:08:20.26] Kapp: But then if you also add more friction you don't know which-- because it's going to over-- be able to overcome that friction more, but like you don't know if they're equal, so...

[00:08:33.04] Colleen: So you're saying it's changing- it might be changing the friction but it's also changing something else- like it's also (unclear)

[00:08:39.15] Kapp: By adding weight you're changing variables that effect the motion that we don't know how they do, like how they change.

[00:08:46.24] (long pause)

[00:08:51.17] Colleen: Okay. Interesting. So. So we could like go and test more, we're not going to do that today because we need to do some other things. And, I think that starting to analyze FBD ...