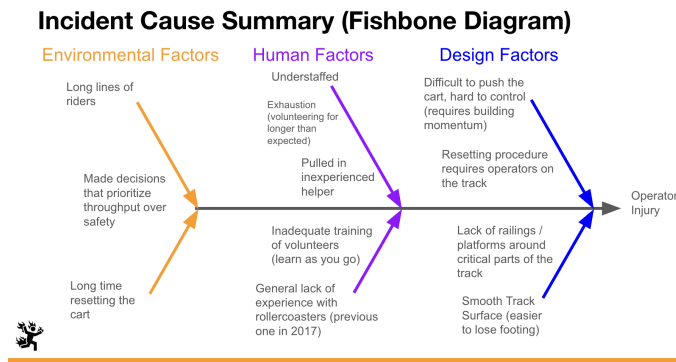


2025 EC coaster design, approval, and organization: zack's big timeline of EVERYTHING EVER pre-build

I know this is really long and dense but this is really everything everything that went into the banked curve coaster this year pre-build just so we have it all recorded somewhere

SEPTEMBER 2024:

- Knew we wanted to do a rollercoaster for reopening the next REX but found approval unlikely due to incident that took place on the 2022 coaster and the inability to get the ropes course approved that year (2024). Decided to try anyway but didn't want to commit too much time if the idea was far fetched
- Past project leads from 2024/2023/2022 (Zack, Anhad, Juan, Marlow) began meeting in mid-September to generate concepts for a proposal presentation to EHS that would detail what we'd change and how we'd go about a rollercoaster to gauge their thoughts/feasibility about a coaster the next year
 - Need to address + provide mitigating solutions to safety concerns arising from accident on the 2022 coaster
- Produced (and rehearsed) a professional (ideally) & polished presentation for them to show we were serious, however did not invest any work into CAD / calcs and presented our ideas as sketches/diagrams or in text
 - First had 2022 coaster lead (Anhad) recap the incident and what went wrong
 - Then showed fishbone diagram breaking down all the causes we identified and addressed/solved each of them with design and/or procedural changes throughout the [remainder of the presentation](#)

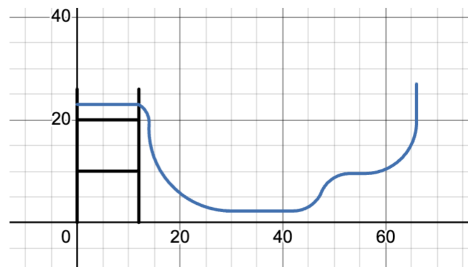


Primary preliminary proposed changes:

- Cart will be made from metal to be lighter / reusable in future years
- Cart will have two seats to allow for greater efficiency in operation and therefore reduce strain on operators
- Stronger training and volunteer organization system for staffing
- Hard limit that no one would be allowed to be on the track at any time

- Proposed a straightaway track design called the fishbowl coaster that would essentially ensure that the cart always ended up exactly below the first drop and would only need to be hauled up by the pulley system / would never be pushed by an operator from below

New Track Design - "Fishbowl"



- Only one landing area to lift cart up
- Only one lift required to reset track
- Participants exit from platform at valley, operator attaches rope to cart there and steps away from track
- Only lifted by pulley system, **never anyone standing on the track at any time**



17

We intended to finish this by the end of September but ended up taking until mid-October after a practice presentation to Marlow's mom provided a lot of helpful advice to strengthen the proposal lol

We also told them we intended to split the project lead work between a separate coaster and fort team and the coaster project leads would focus entirely on that project.

OCTOBER 2024:

- Met with all current EHS reps (Alice Ursella, TJ Kunkel, Kyle McGovern, Jeff Goupil), HRS liaison (Milo Alto), and the head of the MIT Insurance office (Sandra Mitchell) on Oct 24, 2024 and gave the presentation
 - During presentation, insurance + alice ursella (primary EHS coordinator) gave verbal confirmation that 520 CMR 5.00 was the code they followed when deciding legality + large influence of insurance's decision to approve or not

Aside from the EHS/approval process, at some point in october there was a housecomm where one of the agenda items was a more fair selection process for project leads. The result of this was a decision to have past project leads create/send out the application and have hall chairs + exec + past project leads review and select the new project leads together. Anyone applying for a project lead position would be excluded from the selection meeting and a hall could choose to send another representative if necessary.

NOVEMBER 2024:

- After about a week of insurance/ehs reviewing the information we presented, they granted us approval (was then told to us by EHS coordinator) to continue with the planning for a roller coaster in 2025

From: Alice Ursella <aursella@mit.edu>
 Date: Friday, November 1, 2024 at 11:17 AM
 To: Zack Ivanisevic <anivan7@mit.edu>, TJ Kunkel <tkunkel@mit.edu>, Sarah E Brown <se_brown@mit.edu>, Sandra L Mitchell <slmitch1@mit.edu>, Kyle McGovern <kylemcg@mit.edu>, Jeff Goupil <jefferyg@mit.edu>
 Cc: coaster2025 <coaster2025@mit.edu>, Alan Molin <amolin@mit.edu>, Elise Selinger <selinger@mit.edu>, Milo Alto <miloalto@mit.edu>, Tasha Coppett <tcoppett@mit.edu>, Kat Howell <khowell@mit.edu>, Farren Williamson <farrenw@mit.edu>
 Subject: Re: 2025 East Campus Rollercoaster Feasibility Meeting

Hello Zack and Coaster Team,
 I'm pleased to inform you that we have received all necessary approvals to proceed with the roller coaster planning. Could you please provide an anticipated timeline for the construction and a preliminary budget?
 Thank you very much!
 Best,
 Alice

--
Alice Ursella
 Environment Health & Safety Program Manager
 MIT Division of Student Life
 Office: W59-200 | Phone: 617-253-4257 | E-Mail: aursella@mit.edu

[Submit a safety plan here](#)
[Fire Safety video](#)
[Asbestos Awareness video](#)

- Also in followup email HRS (Milo Alto) asked for the 2022 coaster & fort budget as a reference for some reason and an anticipated timeline for the construction, we provided a really non-detailed table mostly derived from 2024's construction schedule

We sent out the project lead application to ec-community on Nov. 3rd (closed application Nov. 15th). We (project leads) made the application go in greater depth and ask for more detail about past experience with software / design / project management to get a more fair sense of applicants' qualifications.

I (zack) pushed for frosh to not be selected as project leads due to a lack of experience on the back end of build and little upperclassmen knowledge of frosh at the time of application. I wanted frosh to only work on small builds if they were interested and to eventually become a project lead after they already had that experience. I also felt that creating a stronger pipeline to project lead with more steps along the way to the position would make it easier to fairly select who should be the next project leads (in addition to making them more equipped to handle the job). In the end all applicants were accepted except for frosh. I personally emailed all the frosh who applied and encouraged them to do a small build / lighting project if they were still interested in being on the back end of REX and most of them did. The other applicants were split up into the coaster and fort teams based on which they said they were interested in on the application. However it still seemed unlikely that the coaster approval would actually work out so I ended up being the only past project lead to continue and the others chose to remain as advisors when needed. From then on the coaster team was me, Spruce, Fadi, and Sam.

- Notified new leads they were selected on Nov. 17th
- Did onboarding meeting with all new project leads (feat. mentors) on Nov. 29th
 - Made new onboarding presentation for them that focused on teaching the approval process / 520 CMR mostly to make sure it was understood what could and couldn't feasibly be approved
 - Wished I did a better job teaching load calcs but the way we did them with the python script before I wrote the excel workbook this year was chopped anyway and it's a lot easier now

DECEMBER 2024:

- Coaster didn't do anything until mid-December because finals but fort team started meeting around this time and worked (other than organizational logistics) completely separate from us for the remainder of the design/approval process
- CAD / solidworks onboarding meeting from Juan happened around mid-Dec as well
- Had initial ideation meeting where I explained what we had already presented and what seemed like good options to continue
- Started researching how ben katz designed his coaster / understanding the structure beneath it a lot more because the 2022 coaster was before my time and I never saw it
- I began assessing initial feasibility of doing a banked curve as well because it was always a goal of mine to make a banked curve coaster happen but I knew it had failed twice prior and massively complicated the situation and wasn't sure if I wanted to play it safe (both in terms of ease of engineering and approvability) and just do the fishbowl design we presented at the October feasibility meeting
- Did the member strength/fastener calcs in the same format as 2022/2023/2024 python code & wrote a prelim python script to calc g forces that riders would experience / forces they'd impart onto the track. These ended up being the calcs that were submitted for to the first round of structural engineer review and were nowhere near complete enough for the scope of this project
- Decided instead of submitting a design doc and a calcs doc like before I wanted to just do a design doc with all the calcs included and split all the procedural stuff into its own, more robust procedures document for ehs. Wrote this up in december based on 2022 documentation and it remained largely unchanged from then on
- Started researching the cart and what type of steering system would be required if we did do a banked curve + other considerations for a banked curve in terms of cart compatibility. Quickly realized I was out of my depth with this whole cart business bc I'm not a meche I'm a structural engineer

JANUARY 2025:

- Lighting started meeting around this time. We always included head lighting (Riya) on all project lead communications / meetings and worked very closely with her throughout the whole process to make sure the lighting projects and builds complemented each other as much as possible
- We/HRS were still unsure that renovations would finish in time to allow us to build in the courtyard so we reserved Field A again just in case
- Began sketching out ideas for the loose track shape and decided the length of the track sections + heights / curve diameter
- Came up with the main track order of tower -> front half drop -> slight increase up through the first banked curve -> drop into back half and two humps over the back half's length, the first being a bit bigger and the second being more gentle -> second curve -> straightaways unloading zone that connects to the back side of the tower with an up curve for the haul system to utilize
- Did some bending tests using leftover 1/4" ply from last year to determine if it could be bent to accommodate our banked curves / would retain its strength. We weren't really able to get a clear answer for this at the scale we tested it at in the ILG basement but it seemed fine enough ig

- I made a little model out of folder printer paper + tape to illustrate the coaster track design more clearly
- Spruce invested significant time into building and testing the coaster in Planet Coaster and determining a track layout with the highest possible Fun Factor

Set the goal of finishing the CAD by the end of IAP (LMFAO yeah right).

- I made the initial banked curve design that put them on discrete stilts with weak reinforcements between them. I also struggled a lot with figuring out how to do the substructure supports for the banked curve and went through like 5 or 6 versions over the course of the month
 - Eventually based the design on an ice cream cone (this was the vision i got idk if it's really that accurate lol) and split each curve up into 5 curve units. Each of the 5 sections, however, instead of being rectangular sheets of plywood were cut into trapezoids to allow it to curve the full 180 degrees without having to bend the plywood sheets in more than one direction (which I wanted to focus on to ensure the strength of the sheets wouldn't be compromised by them being twisted and then screwed weirdly)
 - For the substructure, I basically took a small dip like what would be found in an ordinary straightaway EC coaster and rotated it 45 degrees. This produced the top bit that held up the plywood. That top frame then attached to independent stilts for each unit which had diagonals attached to the back to prevent from overturning
 - This was way too unstable and not nearly strong enough (primarily bc curve units didn't have enough reinforcement between them and all stood on their own footprints). Will discuss more in the CAD overhaul talked about in July section.

The banked curves (both the taller and shorter first and second configurations) ended up being the only part of the CAD finished in IAP.

FEBRUARY 2025:

- Fadi did a first draft of the front half CAD section but the scaffolding structure was too thin and not based on the 8'x8' foot unit outline frame / how the ben katz coaster went about supporting its track and also didn't have diagonal supports. I redid it to be based on those rectangular units and added a lot more internal bracing
 - However this design still had too many irregularities to be well done like some reason the last scaffolding unit that the transition was on was a different length than the other ones (like 10.23' long or something rly random) and that was kind of stupid. Ideally make things repeatable and easy lengths (like the 8' length our 2x4s would be sold to us in lmao)
- I did the unloading zone + upcurve section CAD at some point but it was also not based on the 8'x8' curve unit because I was like eh it's the end it's probably fine to be smaller (it would not be)
- Spruce finished back half section CAD but also was not wide enough (the structure was only 4 ft), not based on 8'x8' ground footprints and wasn't super based on ben katz design of coaster straightaways either to support the track itself

- He also did the first draft of the transitions in/out of the curves which were one of the hardest/last things I worked out but they weren't really strong enough / still involved weak connections between wood for what we needed especially given that we were continuing with the idea to have two people in the cart
- Still didn't have great details on what the cart was going to look like and realized I would probably not have the capacity/knowledge to do it correctly and within our timeline so I asked Juan if he could do it and he said yes. I met with him and Anhad to describe the track design to them and Juan began working on it about midway through February

During this time I also made an onboarding presentation for small builds and gave it to them around mid-February. At the start of February we started doing check-in meetings with the fort team every 3 weeks to update each other on progress / stay on track / coordinate the relevant logistical information between the two projects.

Hanu and I also met with John Ochsendorf (course 1 & 4 professor, structural engineer) on Feb. 20th to try and arrange for a past student of his to review and stamp the documents for free because cost was a big concern given the scope of build as a whole. We had mostly complete documents to present to him at this point. During the meeting, he also provided suggestions as to how we could reformat / adapt what we had to be more readable and like what a structural engineer would be used to. This led us to redoing calculations by hand / on the pages in the document and no longer submitting them in code form. We also included more drawings of the load paths / which members were actually being analyzed by each set of calculations. Fort did a much better job of this than we did though (especially in the doc that was submitted for the first round of structural engineer review). This went on back and forth until about the first week of May and we went through a few different alum connections who were all too busy. Eventually we weren't able to find someone to review the documents for free, unfortunately and EHS sent documents to the same structural engineer as usual :(

MARCH 2025:

- I did the tower CAD based on the rectangular fort units we've used before. I reused a lot of their components so it only took like an hour but it didn't fit together super well and was also only an 8'x8' fort unit. There were no shear walls at this point either
- I also redid the back half section and decided to cut the second hump after a conversation with Eugeniya (2022 coaster lead) about how much more friction the coaster actually had than anticipated. I was really unsure that we'd be able to get through it given friction / track eccentricity once actually constructed etc.
 - Talked to lighting and decided to do a tunnel around the later portion of the back half that would have lighting projects / on-theme decorations etc to make that segment more interesting
 - Got Fadi working on those tunnel lights + lights around the perimeter of the track that would sync with & follow the cart as it moved along the track
- Connected everything together into one main assembly and send to part project leads chat for feedback before going to EHS

- Anhad suggested shear walls on the tower bc the tower in 2022 was apparently not super stable, after re-examining the tower design I decided to redo to be 12'x8' rectangle which would make it more stable and allow more space for the wider two-person cart to be comfortably loaded / worked with. Also added the shear walls and more diagonal bracings, primarily on the front half to make it stronger overall
- Still had the nonfunctional transitions and improperly fitting plywood and the overall CAD just didn't work. Like there were a lot of broken mates / unmated stuff or things that didn't really fit but because it was so big of a project they wouldn't be noticed by reviewers / in the EHS+insurance meeting since they weren't going to be evaluating it in the same capacity as a structural engineer would and I was stretched thin with that + classes and took that into the EHS meeting
- Sam helped me create the EHS+insurance [Real Approval Meeting slides](#), also aiming to be professional and anticipate what they might ask us. We primarily addressed:
 - Proving constructability in our time frame, especially given that fort would be being built at the same time
 - Checked back in with the fishbone diagrams / 2022 accident causes and proving the banked curve track design was also still a good solution to those logistical problems
 - Showing that the forces on riders were less than for the 2022 coaster and it's actually a safer overall design as well
 - Reiterating new operator training procedures and how those were adapted / improved in comparison to the past (was mostly the same info as presented in Sept.)
- We did a rehearsal presentation with the mentor past project leads a few days before the EHS meeting and got feedback / practice questions from them as well which was very helpful again
- Juan finished his draft of the cart and I included it in the design documents that we submitted and reused the calcs from the 2022 doc because i was too lazy to redo / didn't know the specifics of the cart until really close to the submission deadline anyway and it was pretty scuffed, i Do Not recommend this
- Spruce did a simulation of the coaster's forces that looked real nice and professional and chatGPT did none of and we used it to more completely illustrate the forces riders would experience (this was much better than my rough python script from December, in my experience EHS prefers things where they can clearly see what's going on coming from a non-technical background)

Aside from the overall design and approval process, on March 13th Milo Alto (HRS rep) reached out asking to meet regarding the courtyard and we did on March 21st. In the meeting, they gave us the news that it was unlikely that we'd be allowed to build in the EC courtyard. The renovations were going to be completed on time, they just didn't want to let us build on the grass because it was really expensive and if we built on it they'd have to redo the whole thing. A few solutions to the issues with the grass were provided to them:

- Offering to just eat the cost of it being redone and having REX pay, would be too expensive (~est. \$70k or something ludicrous like that)
- Having them just put the grass in after REX because the grass would probably be ruined during REX anyway by foot traffic / people moving in / events happening in the courtyard whether we built there or not

Meeting to continue to discuss EC courtyard + 2025 REX build

MA Milo Alto <miloalto@mit.edu> Thursday, March 13, 2025 at 2:26 PM

To: fort-team-25; coaster2025; Cc: Farren Williamson

? This message is high priority.

Hi folks!

I hope this finds you well. Do the two Moiras I've used capture everyone involved in planning for this year's build? I reach out because we'd like to continue the conversation around the courtyard and planning for the build. Could you please share your availability to meet via [this link](#)?

From the DSL side the meeting will include:

David
Elise
Milo
TJ
Tasha

Let me know of any questions. We look forward to meeting with as many of you as possible.

Thanks!
Milo

Re: Meeting to continue to discuss EC courtyard + 2025 REX build

HS Hanu Snyder <haunz@mit.edu> Friday, March 21, 2025 at 9:41 AM

To: Farren Williamson; Cc: project-leads-25; Milo Alto; +4 more

courtyard-plan-25.pdf
2.6 MB

Download Preview

Hi all,

Thanks again for meeting to relay the concerns - I know that this is not an ideal situation for any of us. I just wanted to highlight the following points:

1. The main stressor for the courtyard grass is not the build itself, but a product of having people existing in and around East Campus. The build is constructed on a cinderblock foundation that minimizes contact with the ground, and typically we notice that the grass underneath the build is in better condition after deconstruction than the grass everywhere else. Even if the build was relocated off of the courtyard grass, it would be difficult to impossible to reduce trampling of the grass enough to stay within the warranty, and I think that if the grass were to be planted we need to be aware of this reality.
2. EC build, especially this year with reopening and our 100 year anniversary, is extremely important to re-establishing our community and presence in this physical space, and we are very keen on keeping the build in the courtyard as intended. As such, we are very amicable to solutions that preserve this -

As mentioned in the meeting, the most obvious solution here, given that regardless of build the courtyard experiences its highest traffic during REX & CPW, that the grass be installed after deconstruction has completed. In this case, I think it would be reasonable to cover the courtyard with some sort of temporary ground cover, be that natural or synthetic. If this is an avenue to pursue, we can do more to look into potential options as well as how much cost they may incur.

I am curious to the cost of installing, and re-installing, the grass. If the grass must be planted on time, EC could allocate budget for repairing the grass after REX is completed. I would also remind that replacing the grass is a likely situation even if the build does not take place in the courtyard.

I'm curious to see the specifics that Elise will provide that may help us understand the situation a bit better. Our existing courtyard plan is attached below.

Hanu
EC Prez
Pres (2W)



Re: Meeting to continue to discuss EC courtyard + 2025 REX build

DF David Friedrich <dfriedr@mit.edu> Friday, March 21, 2025 at 4:47 PM

To: Hanu Snyder; Farren Williamson; Cc: project-leads-25; +4 more

Hi Hanu,

Thanks for meeting today. It was really helpful to hear your perspective and very understandable concerns. We'll work on this further to see if we can find some creative solutions and will be in touch again soon.

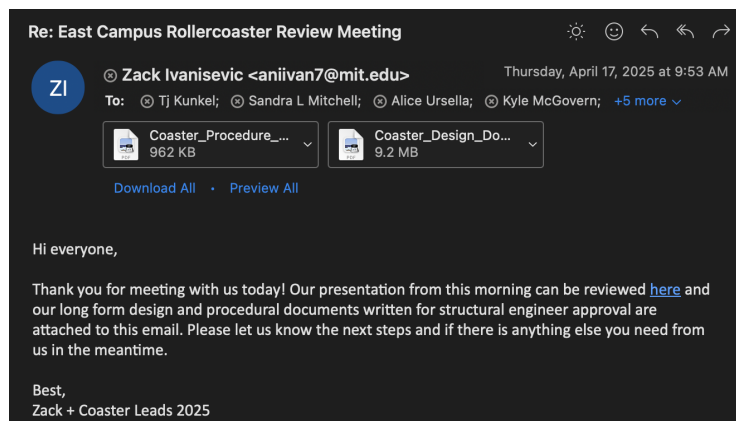
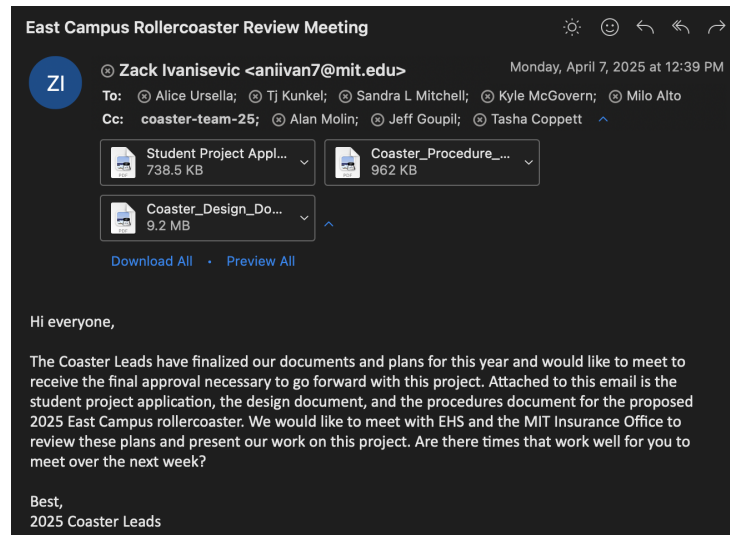
David

David Friedrich
Sr. Associate Dean for Housing & Residential Services
Division of Student Life
Massachusetts Institute of Technology

This was not resolved in March and continued on into April.

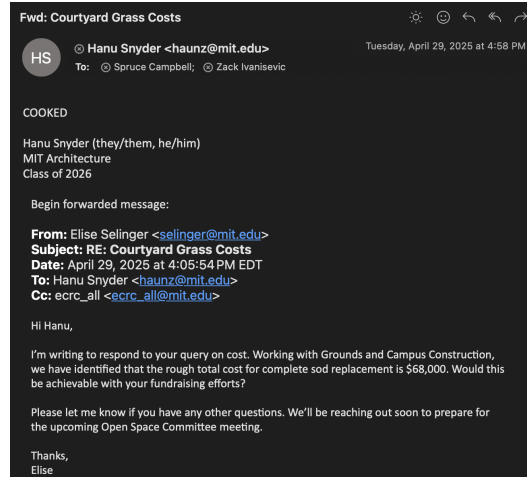
APRIL 2025:

We finished everything and emailed EHS+insurance requesting to meet on April 7th. The meeting took place on April 17th.



Tbh it is hard to remember exactly what happened in this meeting because it took place at like 8:30 in the morning that day but tl;dr they loved it (much to my surprise at least personally). They really liked how seriously we were taking the organizational and safety changes (and probably how polished it was presented to them). It was about 20 minutes of presenting and probably half an hour of questions I believe? They (both insurance and EHS) asked pretty much all the follow up questions that I anticipated they would ask and didn't bring up anything unexpected so our presentation addressed things really well.

Alice/Kyle said at the end of the meeting they'd give insurance some time to review and would get back to us with the next steps for the timeline if it worked out. But we basically left the meeting seeing the coaster as approved on the EHS side of things.



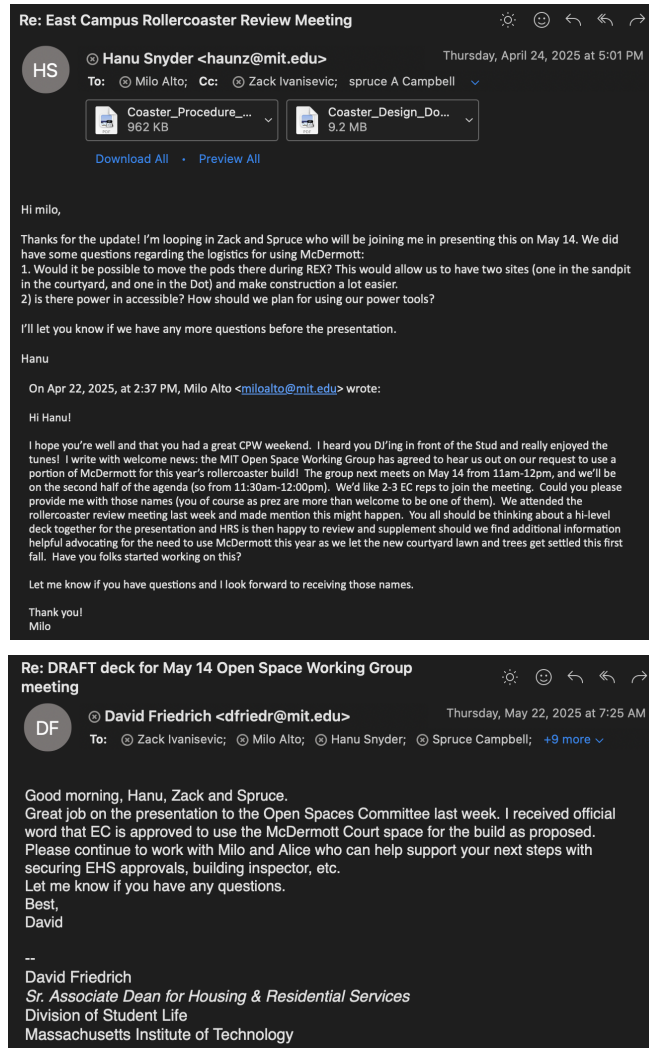
In the end it was not possible for us to be permitted to build on the courtyard grass (notified April 29th) because it would just be too expensive to pay for the grass replacement. That was fine for fort because it was small enough that they could just build it on the sand pit / sidewalk at the North end of the courtyard, but that left coaster kind of out of luck (especially since I was not willing to build it on Field A behind the tennis bubble). However, following the successful meeting with EHS and insurance (though we had not formally heard back a verdict yet) Milo reached out again with the idea to have the coaster built on either Saxon Lawn (next to Walker Memorial) or McDermott (the Dot / in front of the Green Building). However, those spaces are not controlled by HRS / DSL and it turns out Saxon wasn't possible. McDermott was pretty much the only option at that point, and it's controlled by a group within MIT called the Open Space Committee and we (me, Spruce, Hanu) had to present to them to convince them to let us use the space during August. HRS provided a starter [slidedeck](#) for us and we added some more information, photos, and personal testimonials from past project leads about the significance of build/the rollercoaster as both an educational experience and a cultural staple within EC. We also provided diagrams/site maps illustrating how the build would have minimal impact on the space itself.

Oh also I reviewed the mausoleum small build at some point around the end of April and I think most of the small builds worked everything out by then with regards to their design/calcs/documentation

MAY 2025:

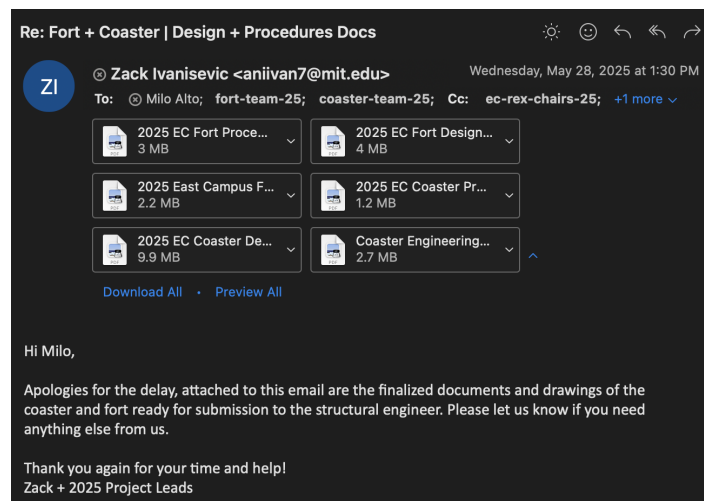
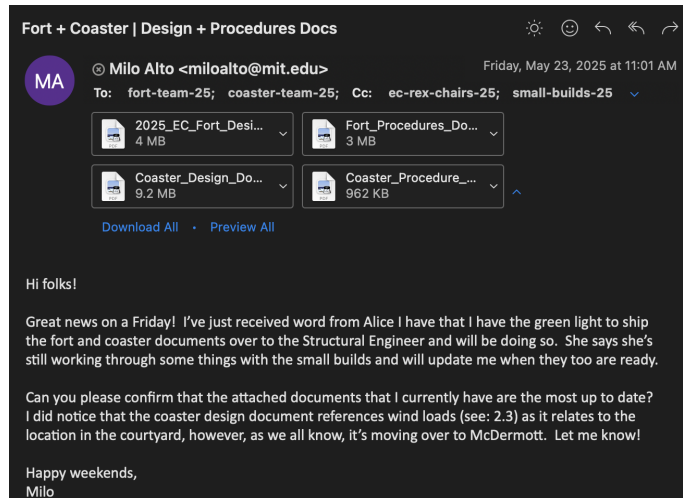
Even though coaster was still very much up in the air I wanted to at least keep fort on pace with the previous year's timeline so we reached out to Simpson on May 5th and met with them on May 12th. We presented both the coaster and fort (even though the coaster was still maybe not going to be approved) because we presented the ropes course to them in 2024 and that never actually happened so oh well. Screw order was placed May 23rd.

The Open Spaces Committee meeting took place on May 14th so we had a few weeks to prepare for it while we also waited for the outcome of the insurance decision. It was short (~10 min) and they were receptive but said they would get back to us soon on whether or not it could be done. On May 22nd, we received the news that we had been approved to use McDermott as the coaster's build site.



It seems like HRS was waiting for the outcome of the Open Spaces meeting because they gave us the news that we had all the necessary MIT-internal approval from EHS/insurance the next day (May 23rd). Now that we were actually going to the structural engineer, I made some big changes to the CAD and cleaned up the back half, front half, plywood, and tower sections in one really long all-nighter to fix all the broken geometries and nonsense things happening in there. As soon as I copied all the changes into the design doc I accidentally deleted all the changes I had made that night LMAO it was 5am and I was really tired but the images were in the doc and I was like whatever I'll deal with it later this is fine to send out now and then schedule sent the email for a normal time lol

In retrospect this document was not fine or nearly detailed enough and only had like 8 large images of the CAD in the entire thing (mostly because the CAD was bad lol) so it makes sense why he didn't like it. The finalized documents for the fort and coaster were sent to the structural engineer for the first time on May 28th.



After we secured McDermott and MIT approval, Fadi ran the BOM script to get the initial wood order ideas and counted the screws for the fastener order. Evan also did the same for fort around then (and small builds did their own too) and I started compiling a spreadsheet to estimate the cost of REX overall because we really had no idea at that point. I also started taking inventory of what tools we felt were missing last year and compared that to toolcomm's inventory + me, Fadi, and Evan did a new inventory of the pods. Looking at what we had and what we felt we needed, especially if there were going to be two separate sites, we compiled a site purchasing requests list also of tools. We got a lot more things to help with deconstruction since that was a big challenge in 2024. Even with conservative estimates of cost, I found that this rex was probably going to cost around 58k at the lowest which was 10k more than the year before and rex were already behind on funding bc the transition meeting with past chairs was scheduled much later in the year than usual and they ended up missing some big funding deadlines as a result.

Once I had a good estimate of the cost, we did a big meeting with the REX chairs (May 29th) and got all of us scared about how the fuck we were going to pay for this thing now that we were actually allowed to do it and started brainstorming some more sponsorship ideas. Spruce already had connections to some AI startup shit idk and was going to pursue that and hopefully find someone to give us a really big gift and

pay for most of it. I found a list of alum-founded companies and a bunch of other MIT funding sources REX hadn't tried before and rex chairs started working on reaching out to All The Options.

JUNE 2025:

I started my job on June 2nd and read some of the plans for the projects they had there and decided that was the format our coaster bible should ideally follow (though this would be a lot more work than the google slides I made for the 2024 fort bible). I wanted to document everything robustly enough that it could be built entirely without me there if necessary and with minimal experience with EC build. This ended up being an 88 page document of detailed drawings and instructions because the coaster has so many unique components that was split into chapters by track section (tower, front half, curves, back half, unloading zone). In the process of going through how every aspect of the coaster would be constructed I found a lot of design flaws that needed to be changed but I wanted to first get through the majority of documentation by the end of June to give us July to focus on fabricating the cart and dealing with logistical stuff. I did finish the first draft (though it ended up being greatly changed after the CAD was redesigned) around the third week of June and had Fadi review it and give me feedback.

At the start of June we also emailed out to EC community for construction leads and took everyone who applied. We made [some slides](#) and did an initial onboarding meeting with them on June 21st (and looped in small build leads since a lot of them were frosh) to just explain what the job entailed and what they needed to know going in. Because of the scope of the projects and how few project leads we had (fort team had dropped to two people and coaster down to three by the end of spring semester) we wanted to focus on doing a really good job onboarding the construction leads so they had more knowledge going in and would be able to help us a lot more during the build itself.

Spruce was working in San Francisco over the summer and found us a sugar daddy sponsor in the form of Thrive Capital who informally agreed to give us \$60k in exchange for being the sole sponsor (which is fine because everyone else just sponsored the fort LOL), us talking to a journalist they'd send over, and Spruce running a recruiting event for Thrive in EC at some point. Also on the sponsorship front, Chris (REX chair + current EC treasurer) secured a sponsorship from Art of Problem Solving through an alum but Jane Street fell through after EC failed to follow up on some of the terms of their sponsorship the year prior. However the Thrive gift was so big that it now put us with like a \$20k surplus so we added a bunch more stuff to the site purchasing list, started upgrading EC's audio equipment, and got more budget to get resurrection-themed decorations for the tunnel, fort, and mausoleum.

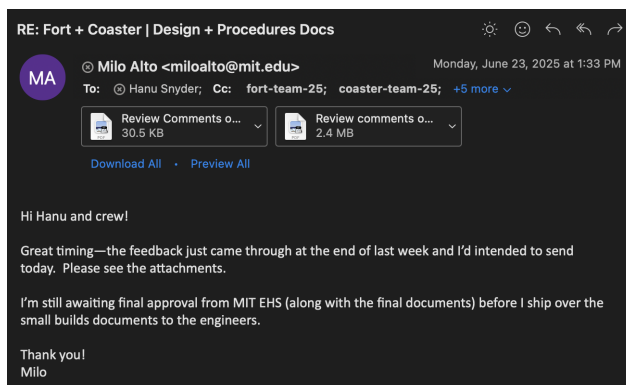
In some point around May or so [Anhad took over the cart](#) from Juan (who was also a small build lead for hamster wheel at the same time) and made some more changes / finalized the design around mid-June and sent us the cart's final BOM. The final cart did end up being about 200 lbs so it wasn't actually that much lighter than the cart in 2022 had been, but it accommodated 2 people instead of just 1 and had to have a whole steering system to accommodate the turns so the metal was still overall a better material than the wood. I placed the McMaster, Ebay, and MetalsDepot orders for the cart around mid-June as well and the sendcutsend sponsorship was finalized at the end of the month and ordered around the first week of July. The sponsorship from sendcutsend ended up saving us a little over \$1k in metal that they provided for free + they also donated \$2.5k in exchange for us promising to do a good job documenting us using their

products and publicizing our build. Thus, REX chairs (who were emailing out to ec-community for small leads at the same time anyway) also got a pub lead (Celeste) who would coordinate all the publicity for EC/build both internally & externally to MIT. In June, we started meeting with REX chairs every other week and fort & coaster teams started having our check in meeting every other week as well so we alternated which check happened on which week until August and that helped us keep on track with everything.

We also placed the site purchasing requests and Hanu and I got a uhaul to pick all the new tools up from Home Depot and take them to the pod. Also one thing to note is that because of the discrepancy between my legal name and preferred name and how much I fronted for in June, Mary Mango thought I was filing RFPs for a sibling and embezzling money from MIT and I couldn't front for a month until Chris met with her and cleared things up. So I guess that's something to keep in mind if it applies to anyone else later on.

The Simpson fastener order delivery was delayed and I didn't receive it until the end of June and some things were lost in transit (namely most of the timber screws lol oops) so I had to re-email them but the rest of everything we needed arrived by mid-July.

The first round of structural engineer feedback came in on June 23rd. Fort was approved with no notes but coaster had Lots of Notes lol.



Massachusetts Institute of Technology
77 Massachusetts Avenue, NW23-2100
Cambridge, MA 02139

June 20, 2025

Review of Student Builds – 2025 REX East Campus Roller Coaster

To Milo Alto,

This letter is written in response to the REX Construction Project 2025: East Campus Roller Coaster. BMC has reviewed the drawings, designs and procedure submitted to BMC on May 29, 2025. We have the following comments: -

Specific comments on the design are shown in Appendix A below. Calculations do not confirm how the structure is designed to resist overturning and sliding based on the lateral loads produced by the Cart as well as wind loads. Provide ballast or anchorage details to existing grade. Please provide wind load calculations indicating how wind is resisted. A temporary design load of 50 mph is considered reasonable for this temporary structure.

Calculations should be detailed to show member size, material grade, connection details. All designs should meet the requirements of the Massachusetts State Building Code 10th edition. We recommend that prior to personal use the Roller coaster cart be tested with ballast/sand bags weighing two times the anticipated weight of the personnel who are to ride the coaster. We recommend that only one person be present in the cart at a time.

In consideration of the complexity of the presented roller coaster we do not recommend that the students move forward with this project and revert back to a roller coaster design similar to the 2022 project.

Should you have any questions regarding, please feel free to contact me.

Very Truly Yours,
BMC ENGINEERING, L.L.C.

Colin J. Gallagher, P.E.
Project Manager

I redid the calculations over that weekend to include more updated load path images for the tower structure, wind load calcs (we hadn't done them in the first draft and neither did fort but with the coaster in McDermott they believed it was a more open space and we were required to do them), and made/redid all calculations in the spreadsheet worksheet that I recommend future builds pivot to using because they made things much easier to work with and update as needed. I also had to size up some members for the tower due to its larger footprint and updated the CAD accordingly. After Anhad reviewed the changes I

made, I resent everything that Monday and the coaster went to the structural engineer for the second time on June 27th.

JULY 2025:

After redoing the calculations for the second round of structural engineer comments, I decided to start adapting my spreadsheet into an easy-to-fill out worksheet that could be reused for future years and then that snowballed into writing an entire project lead bible with everything someone would need to do the job and then since I had one for project leads I figured I might as well adapt it into a shorter small build bible too. Also the history of EC build article came out of this as well so all that stuff was basically just a weekend sidequest while I was in between structural engineer feedback, the cart material delivery, and waiting for Fadi to review the bible draft. It was very helpful though to do it then tbh because after 2024 I was way more tired in the fall semester than I thought I would be and didn't produce as much post-build documentation as I thought I would, so front loading documentation over the summer when I had some spare time saved me work I would probably not have done if it was left to be during fall semester when I had other stuff going on.

That weekend I also had Fadi follow the surveying procedure I had laid out in the first draft of the bible because I was pretty sure it just didn't work i.e. the CAD just wasn't buildable in the state it was in. He did and my suspicions were right and the whole thing didn't work because the footprints were just fundamentally all different for the different track sections and incompatible with each other, making it impossible (or just way too difficult and imprecise in reality) for us to actually accurately survey or fit everything together. I had a four day weekend from work for Fourth of July and since the CAD was in this horrible frankenstein-like state from all redesigns it went through over the past six months I just started from scratch and redid the whole thing from the ground up which was an awful experience in like one 72 hour sitting but I made a lot of improvements that actually gave the coaster a chance of being constructed:

- All straightaway track sections were redone to have their footprints / scaffolding structure based on 8'x8' squares so everything was neat & actually fit together. The total length of the track's footprint was now 10 squares long with the curve footprints defining the width.
- Otherwise they were mostly the same structure but I doubled up on the track spacers and fixed the exact sizing of some of the track columns to adjust the smoothness of the humps
- The unloading zone was completely redone to have the same footprint and support structure as the other straightaways and the haul up rails attached to the back of the tower were redone as well
- I also redid the curve footprints to remove the idea of there being 5 distinct curve units each with their own footprints and support structure and instead made it all one interconnected structure at the base. This redesign resulted in 6 trapezoids which became the new curve units, though they were all now attached to one base and overall scaffolding structure, making them much stronger
 - Overturning supports were also doubled which resulted in way more wood being used but it is what it is, the track was way too flimsy before especially for the weight of a two person cart
- I finally redesigned the transitions and made them constructable. They are not as strong as the non-transition sections, but proved to be the most feasible way to do the curves (at least as best I could work out) They were still not perfect after this main CAD redesign so I went back and

redimensioned them a little better at the end of the month and made them a little bit stronger as well

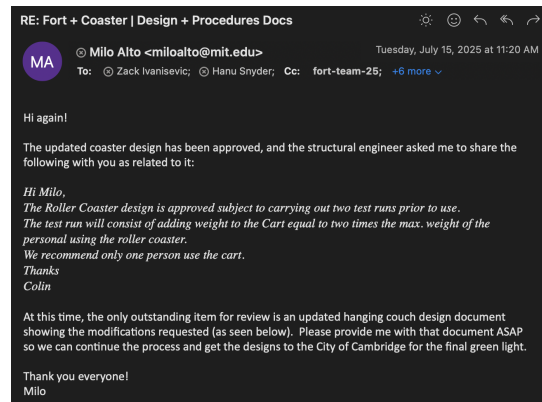
- I decided to leave off plywood because solidworks can't model it well especially at the transitions and I wanted to be able to see the support structure anyway when looking at the CAD
- Overall members were redimensioned to reduce necessary cuts, i.e. make it so wood could just be pulled straight out the pallet and immediately attached whenever possible, allowing for the new design to be much quicker to build (ideally) even though it used more wood overall

Fadi reran the BOM script to finalize the wood order and this redesign did throw on another \$5k in wood lol but just goes to show how shoddy the prior one was imo. Updated this in the big costs spreadsheet and sent to REX chairs who were in the process of closing in on a quote for the wood order around this time.

I spent the rest of that week writing up the construction schedule and the tasklists for all the components to figure out how I wanted to build everything. Redoing the CAD with the construction process far more real in my mind also made it a lot easier to work out what order I wanted to structure tasks in. I knew for sure I wanted to start with footprints of everything and build all the track sections up at roughly the same rate (sort of like a 3D printer) to make sure they all fit together instead of building it one section at a time. I also organized tasks based on how many people were required to do them and tried my best to fit them into the schedule in a way that maximized how much we were able to get done depending on my predictions of what fluctuations in manpower would look like across August / differing times of each day. The tasklists were done so they could be put up on site and allow construction leads / active volunteers to be more independent so people could do more without having to go through me and thus build everything faster.

The next weekend, we got the new round of structural engineer feedback on July 11th and the coaster was rejected again. Basically he just wanted even more details, mostly in the form of images illustrating what exactly calculations were even for. He also was not a fan of the two person cart, which still had the calcs for the 2022 one in the doc and outdated screenshots lol because that hadn't been finished at the time the last one was sent. Cue another weekend of adding a fuckton of new & labeled images from the freshly redone CAD with Anhad's reviewing and making suggestions for improvements. We couldn't really make the wind calcs work how he wanted (because he wanted us to design for full ~120 mph winds like it was a real building which imo was excessive for a temporary structure and also not something we could feasibly pass) so I removed the shear walls and took the cross sectional area down to a very miniscule amount so it passed. We also resized members as necessary to ensure all safety factors were now above 2 even for fasteners (though they come with their own built in safety factors). He also wanted us to redo everything analyzed in buckling to be done in compression so I redid those calcs and updated them in the spreadsheet template as well. I also wrote a lot more for the intro section of the design document and included far more images of the new CAD from a lot more angles to provide more context. Anhad did FEA for the cart's components and wrote up the chapter for that which was updated and included as well to justify the new two person cart. Additionally, I made a new set of dimensioned solidworks drawings for the overall assembly and each section of the track to provide even more detail and context because if we weren't able to get the stamp at this point there wouldn't be enough time for another review/resubmission before REX.

I sent it in on Sunday night (July 13th) and it was passed back to the structural engineer the next day. Instead of taking multiple weeks to review we heard back a day later (Tuesday, July 15th) that we had full structural engineer approval and EHS would move forward with filing the necessary paperwork (following one small update from one of the small builds) for a permit from the City of Cambridge and everything was completely approved (though cart was **recommended** to only have one rider. The wood order was placed by REX chairs that same day.



On July 12th we also did another meeting with construction leads onboarding them onto the [coaster](#) and fort's designs specifically and I presented to them a sample bible page and how to read the construction schedule / tasklists. Around this time I also had James (frosh, incoming construction lead) read through the bible draft and provide feedback from the perspective of someone who had never been to build before and he provided a lot of helpful notes and I redid a big portion of the bible based on them + the new CAD design changes as well (especially the curves had to be rewritten/redrawn entirely).

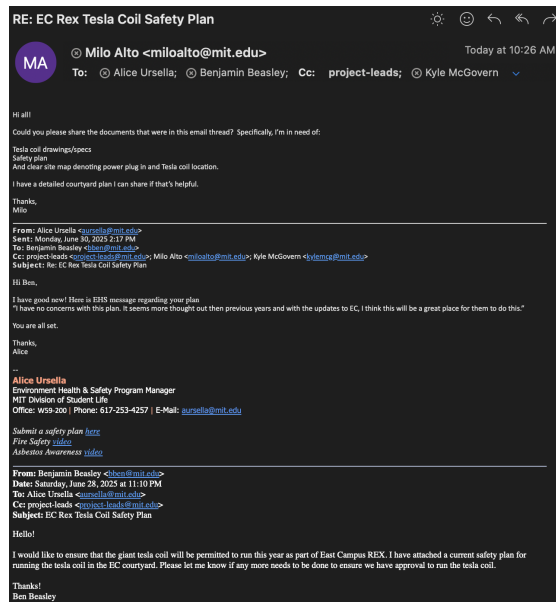
We (me, Hanu, James, and Fadi) also started fabricating the cart based around mid-July as well in a combination of MITERS, D-Lab, Metropolis and the Deep. We made it based on the CAD / [a google slides presentation](#) Anhad made since I didn't have anything to do with the cart's design. Shortly after we started fabrication I requested that Anhad add a flat piece of sheet metal to the cart's front to make sure nobody's feet could get caught in the front bogie bar as well. It ended up taking us much longer than I initially anticipated to construct the cart, mostly because we had a lot of issues cutting the metal for the frame at exactly the correct angles to fit together well. Fadi and Hanu went to the Deep a few times to ask for help from the mentors there with milling the front bearing block and that was very useful as well since Anhad was in California over the summer and couldn't help us in person.

Other than that I finalized the coaster bible more (maybe too much - hard to know when it is just too much going into something and it's fine to just explain it onsite but I wanted to be thorough and really prepared lol). I also made a scaled down version of the CAD that could be run as a 3D print as a gift for everyone (students, admin, alums, etc) who contributed to the coaster/build/rex in general this year as a thank you. I wrote up the operator guides for the coaster as well and made a bunch of the images for that / started drafting the operator schedule but it was really hard to know what to put down on them since I had never seen an EC coaster in operation before. EHS did want to see much clearer documentation for our operator training process / volunteer scheduling than ever before though. Made a bunch of other smaller PPE / organizational signage stuff and little things like that to be on site ahead of time. Started this

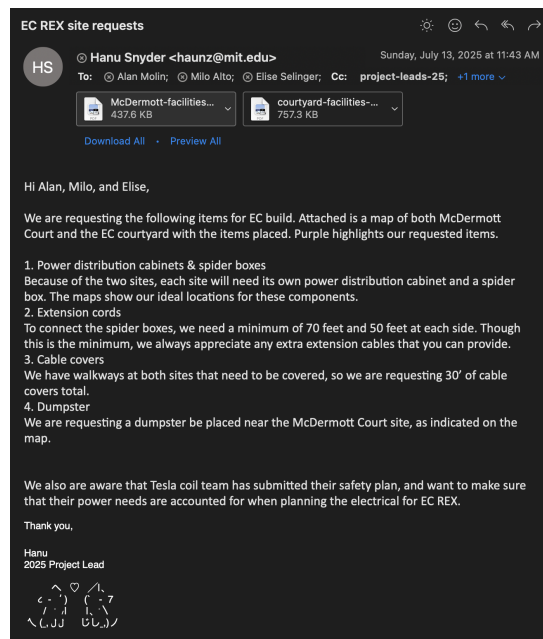
timeline and other post-build documentation so it wouldn't be forgotten about if I was burnt out after build ended.

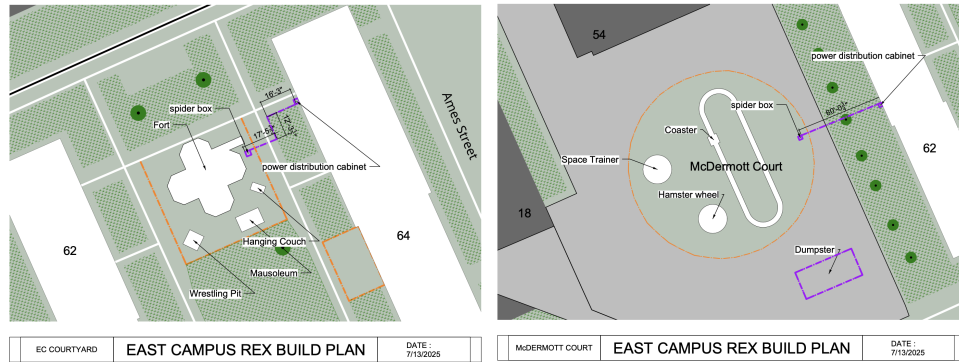
Loose list of all the million and one logistical things we dealt with in July:

- Wrangled Tesla Coil people to submit a safety plan to EHS and make sure they had everything they needed IN ADVANCE of the party lol

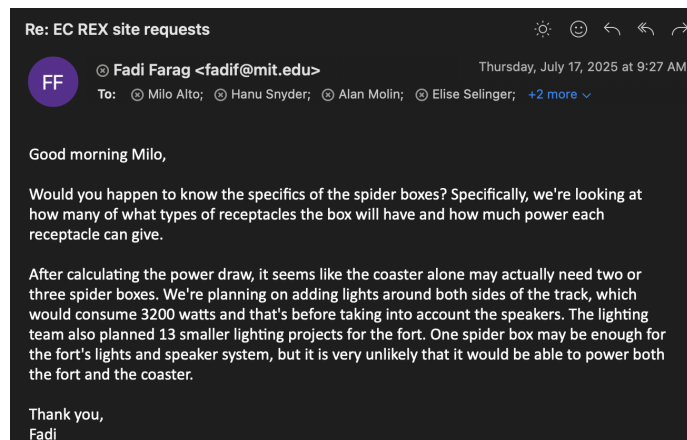
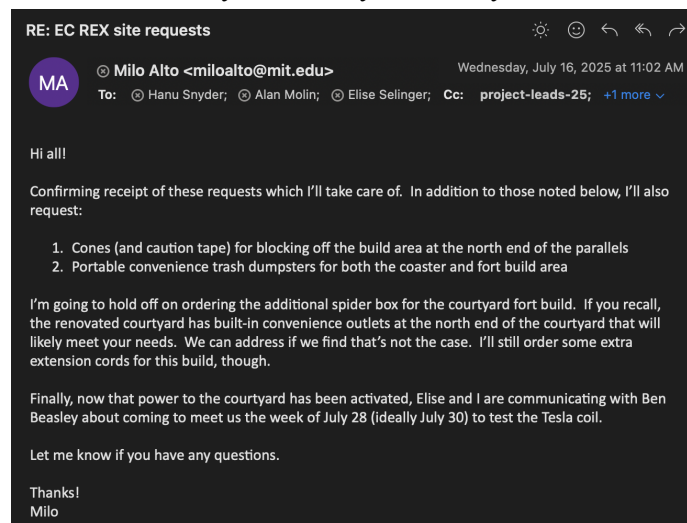


- Placed electrical spiderbox requests + dumpster request + scheduled pod deliveries to McDermott for August 6th and then they bumped it to the 4th lol





They gave us some pushback on the extra spiderboxes so lighting did the math and found out that actually they need like 5 spiderboxes total because they went really hard this year lol. The exchange was like this:



- Coordinated lumber delivery with HRS bc there was construction on Ames street at the same time, scheduled it for Wed. August 6th (the day before build's official start date of the 7th). However, the weekend before that (the 2nd/3rd) Koopman let us know that we had to pay by the end of the day on Monday (the 4th) or they wouldn't deliver. The Thrive sponsorship money had hit the account at that point, but having the B2P request approved by MIT with such quick turnaround was a big concern. There also were a lot of logistical issues with getting the delivery

truck to drive up to McDermott to drop off the wood because of utility construction on Ames street going on at the same time so we had to make a map / do some extra coordination with Milo in advance to make that work

RE: Fort + Coaster | Design + Procedures Docs 🌞 😊 ↶ ↷ ➡

 **Milo Alto <miloalto@mit.edu>** Wednesday, July 16, 2025 at 10:28 AM

To:  Zack Ivanisevic;  Hanu Snyder; Cc: **fort-team-25**; [+6 more](#) ▼

Hi again, all,

A quick follow-up. Do y'all have an anticipated arrival date for your lumber? Have you thought about where you'll stage it? I'd think within the fence on McDermott, correct? Please let me know because Eversource is doing some work along Ames so I'll need to help coordinate on the delivery details. On any given day access to EC will only be available via the north or south end of the parallels, respectively.

Thanks,
Milo

Re: Fort + Coaster | Design + Procedures Docs 🌞 😊 ↶ ↷ ➡

 **Zack Ivanisevic <aniivan7@mit.edu>** Wednesday, July 16, 2025 at 11:50 AM

To:  Milo Alto;  Hanu Snyder; Cc: **fort-team-25**; **coaster-team-25**; [+5 more](#) ▼

Hi Milo,

Our lumber supplier is currently planning to deliver on the morning of August 6th, allowing us an extra day to organize the pods and our tools given the scope of the associated tasks with moving back in. We were hoping to deliver the wood near the Northeast edge of McDermott Court to allow for close access from the courtyard builds.

Will the fence surrounding McDermott remain during the build? Do you know how much of the field will be clear by August 6?

Thanks again for all your help,
Zack + 2025 Project Leads

Re: EC REX site requests 🌞 😊 ↶ ↷ ➡

 **Hanu Snyder <haunz@mit.edu>** Today at 1:27 PM

To:  Milo Alto; Cc:  Fadi Farag;  Alan Molin;  Elise Selinger; [+3 more](#) ▼

Hi Milo,

We will work to add the Tesla coil to our site map, and get you the necessary power information. We also had a question regarding the wood delivery - should they approach the parallels from the north entrance (between buildings 62/64 and 66) or the south entrance (on gray way?)? this will help us add a wood storage zone to the map.

Hanu

On Jul 22, 2025, at 10:15 AM, Milo Alto <miloalto@mit.edu> wrote:

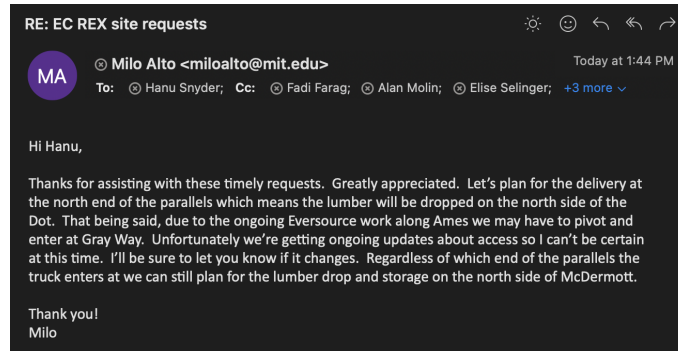
Hi again!

After speaking with some campus colleagues we're in need of the following to complete the package:

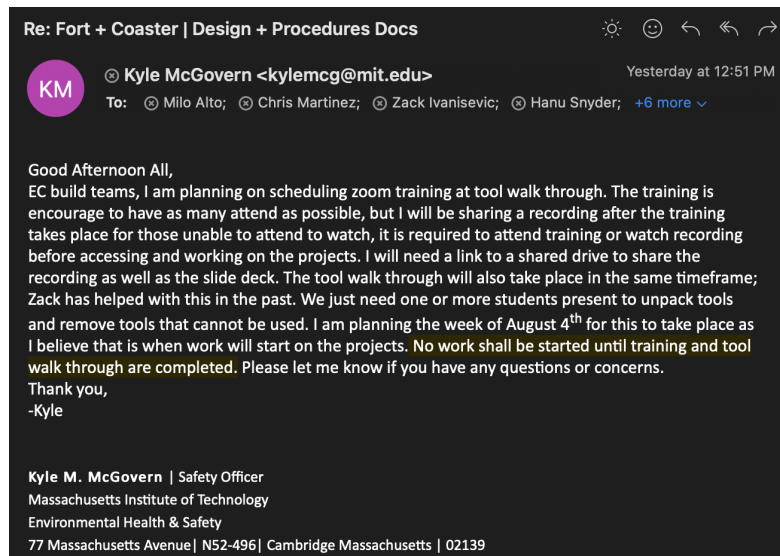
- Tesla coil design/drawings/specs
 - They're specifically interested in what the power supply will look like
- Updated, detailed site maps to include:
 - Clearly labeled small builds
 - Tesla coil cord and location

I'm still investigating the spider box questions.

Thanks,
Milo



- Scheduled tool inspection with EHS and the zoom safety training for volunteers (Sent on July 21st, safety training took place on Aug. 5th and tool inspection/makerspace walkthrough took place on Aug. 6th)



- Substance wrestling clownery - just resubmit the same safety plan and designs that were approved for 2025 ESF from now on pls lol they don't like change it seems. Update substance wrestling was not able to be approved without them getting a licensed wrestling coach to supervise and prevent injury which leads were not able to do with <2 weeks notice. So no substance wrestling happened during the Eastside Party this year.

AUGUST 2025:

We did an onboarding meeting with construction leads for the small build designs on 8/02 (small builds mostly completed their bibles by then as well - swingset did not have a bible bc it was pretty simple. Mausoleum did theirs in a google doc with the coaster bible as a reference and hamster wheel did theirs in a google slides similar to the fort bible from 2024). I finished proofreading the timeline of build history and posted it on the EC wiki as well on 8/03. The initial REX costco + home depot run took place on 8/05 and project leads/rex chairs were able to move into EC on August 6th (earliest return date).