

Lean Project Planning

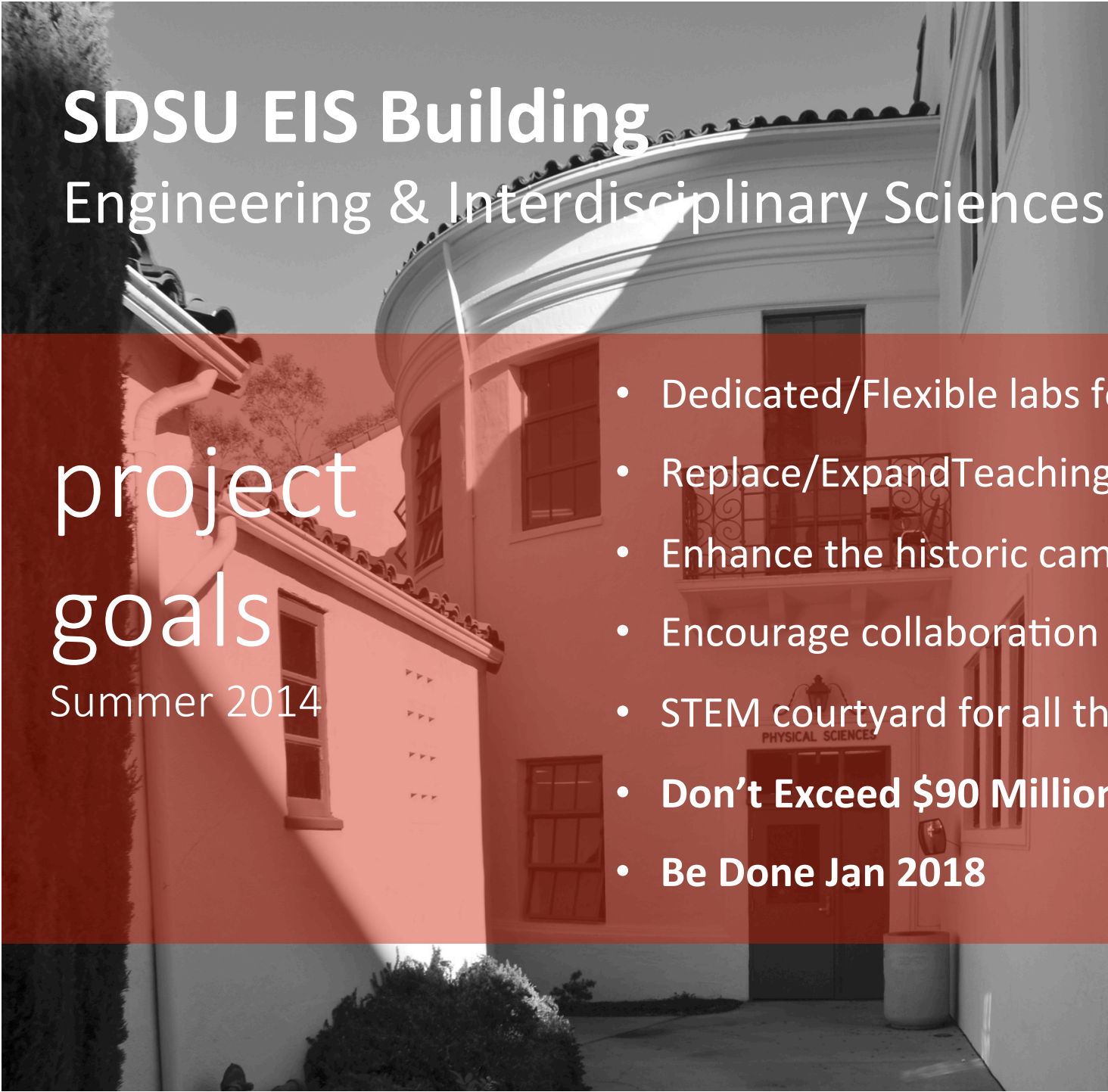
University of Iowa, 2017



or



How Fast is too Fast?



SDSU EIS Building

Engineering & Interdisciplinary Sciences

project goals

Summer 2014

- Dedicated/Flexible labs for research
- Replace/Expand Teaching labs
- Enhance the historic campus
- Encourage collaboration
- STEM courtyard for all the Sciences
- **Don't Exceed \$90 Million**
- **Be Done Jan 2018**

Schedule

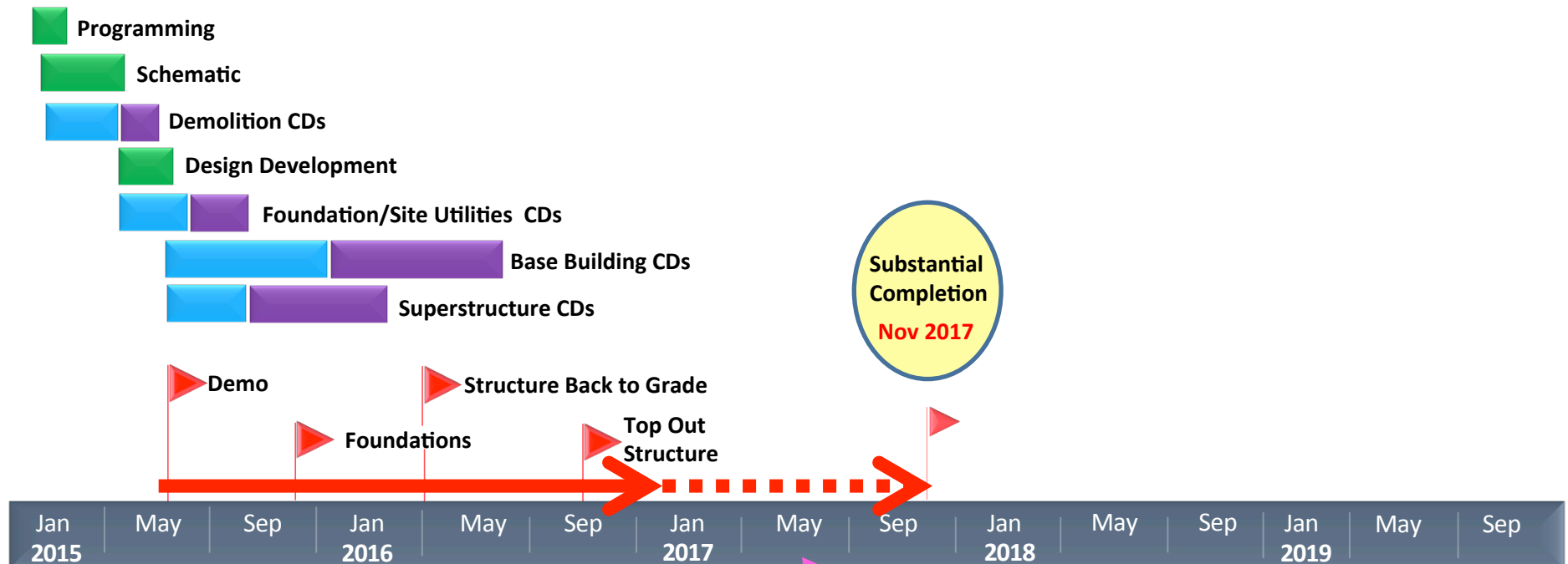
- July 2014 Meeting w/ President
- Aug-Nov 2014 Feasibility Study
- Oct-Dec 2014 Design Build RFP
- Jan 20, 2015 DB-Team Contracted
- May 2015 Demolition Starts
- Nov 2015 Construction Start
- Dec 2017 Project Complete

	CM @ RISK	DESIGN/BUILD Competition	(progressive) COLLABORATIVE DESIGN/BUILD
Budget/GMP	Budget ROM set after Design Phases with contingencies for change	Budget fixed & set before design competition begins	Progressive GMP, budget fixed after DD
Pre-work	Conceptual program required to start design	Detailed program & RFP completed PRIOR to competition	Design exploration in Program verification and Schematic Design
Schedule	longer schedule due to less pre-work	Shorter schedule if pre-work is complete	Shortest schedule
Design Control	Allows maximum design control by owner, lots of time in design process	Allows the least design control by owner	Allows design control up front by owner
O/A/C Team Communication	Allows the most design communication between O/A/C	Allows the least design communication between O/A/C	Allows design communication from programming thru start of construction
Building User Communication w/Design team	Allows dialogue with building users, builder and design team	Allows the least dialogue with building users, builder and design team	Allows dialogue up front with users campus stakeholders and design team
Changes	Changes negotiated incrementally throughout design and construction phases	All changes after RFP are Change Orders	Early changes may be absorbed/traded, later changes in construction are Change Orders
Risk	Partnered approach controlling risk/costs O/A/C in open dialogue	Designed locked early, at award, responsibility for changes are the owners	Flexibility in SD's & DD's. Design locked down after DD, later changes are owners risk

Selection Process

- RFQ
- Shortlist to 5 teams
- RFP (included feasibility study)
- 2 Proprietary meetings
- Final Presentation
- Selection – technical score, interview & fees

Compress Planning & Design, not Construction

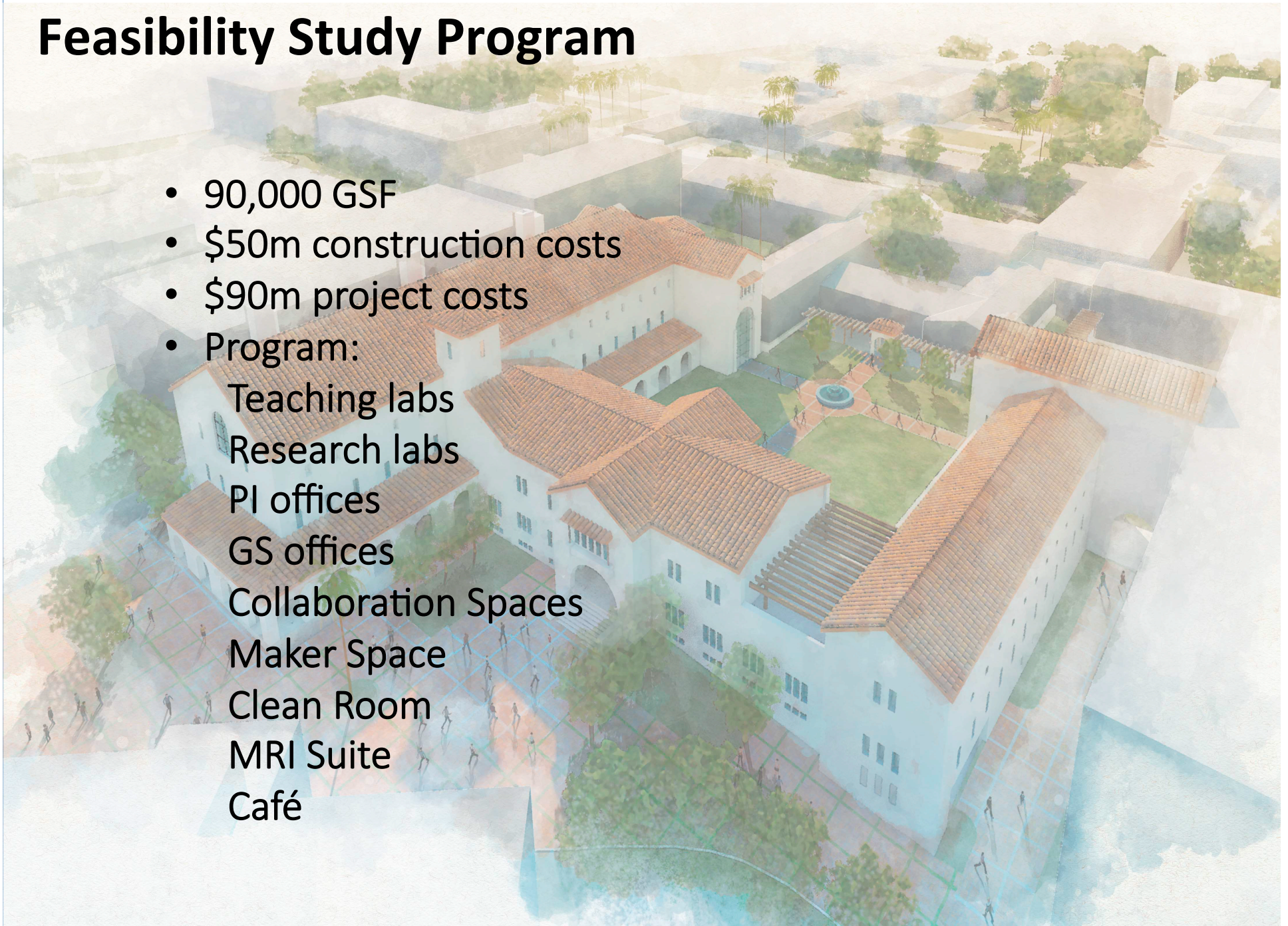


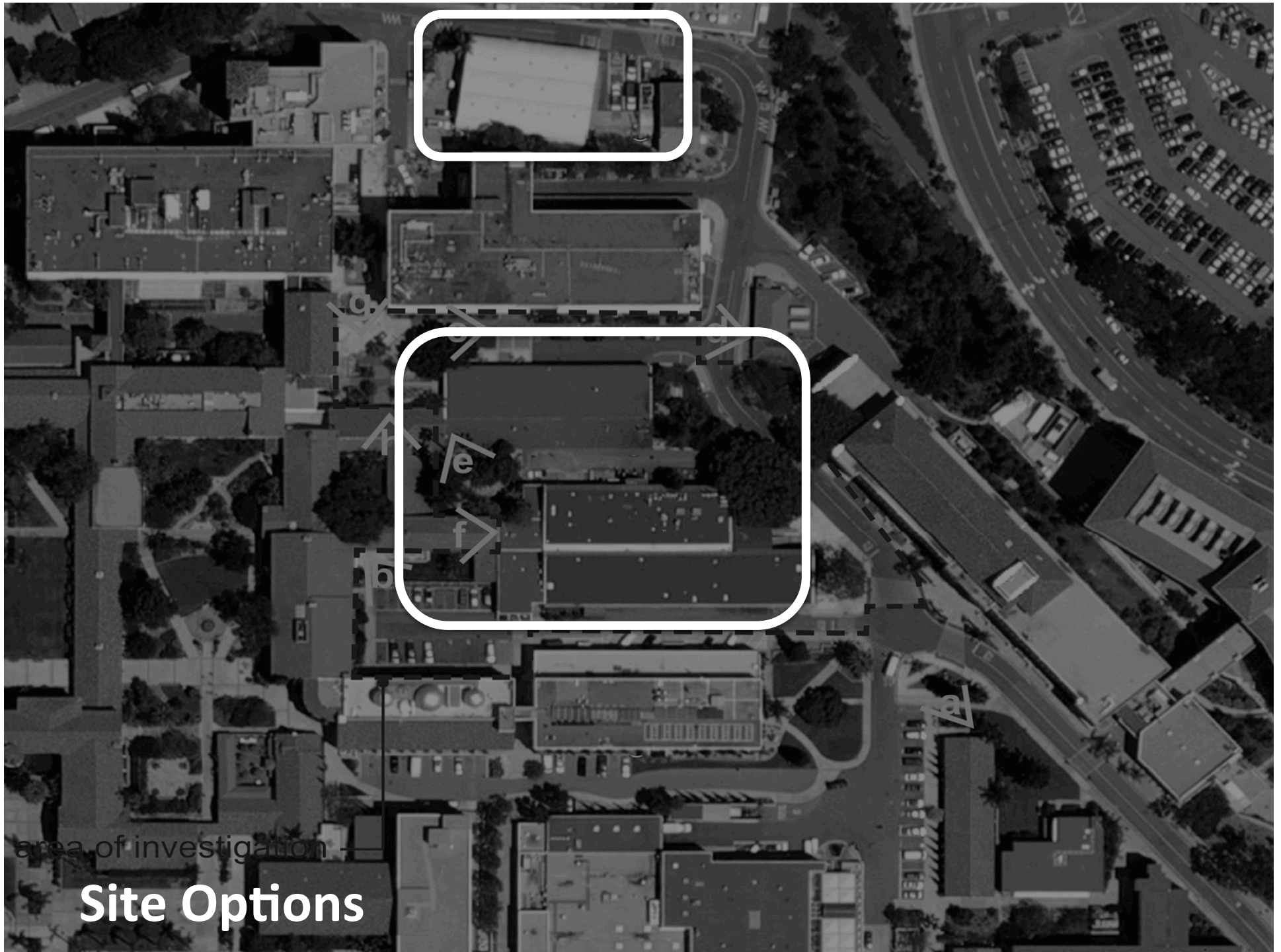
Traditional CM @ Risk Delivery Schedule



Feasibility Study Program

- 90,000 GSF
- \$50m construction costs
- \$90m project costs
- Program:
 - Teaching labs
 - Research labs
 - PI offices
 - GS offices
 - Collaboration Spaces
 - Maker Space
 - Clean Room
 - MRI Suite
 - Café





area of investigation

Site Options



c view of northwest corner



f view of existing corridor



d view of existing engineering building



g view of north area

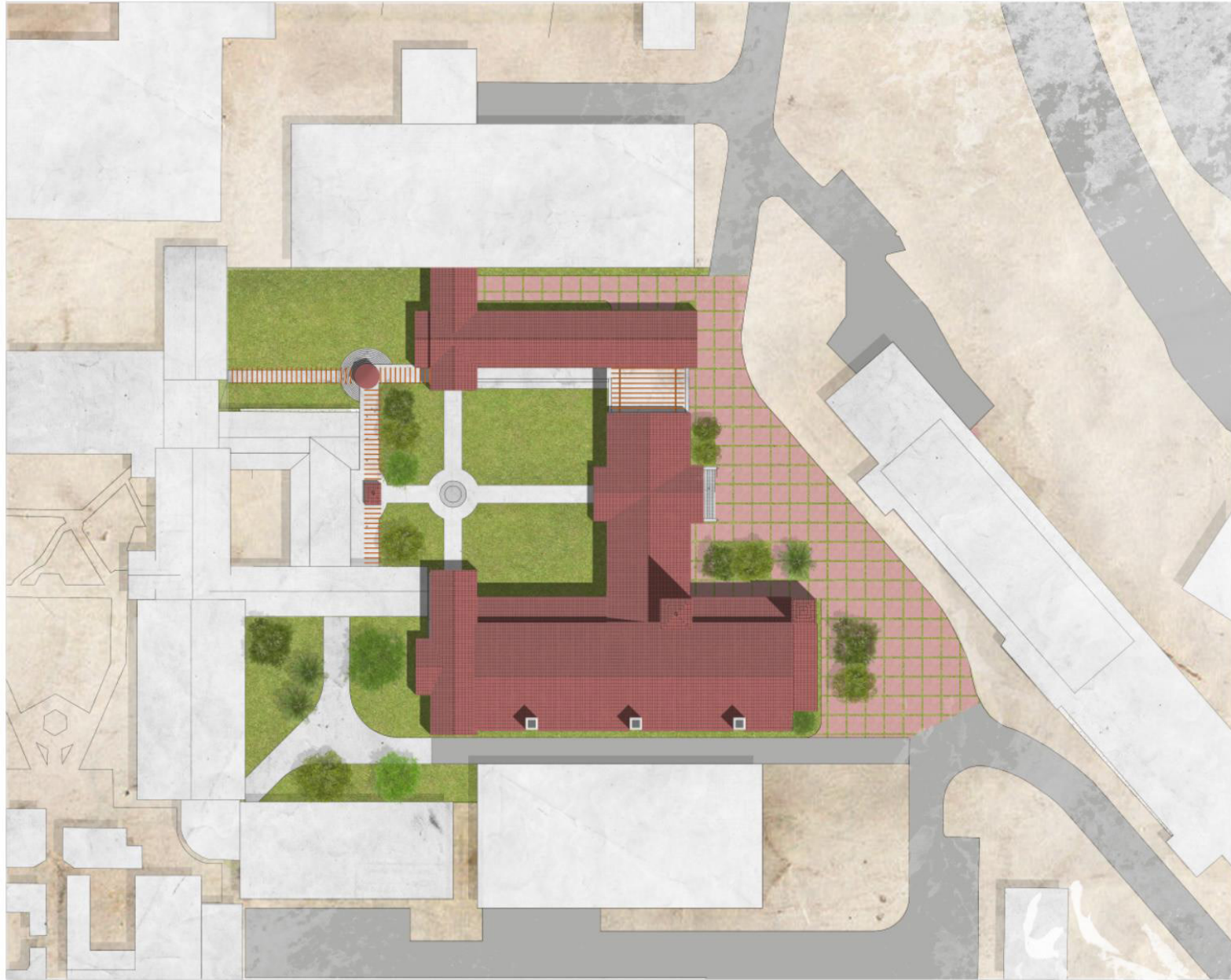


e view of existing courtyard



h view of existing courtyard to remain

Context Analysis



Feasibility Study Site Plan



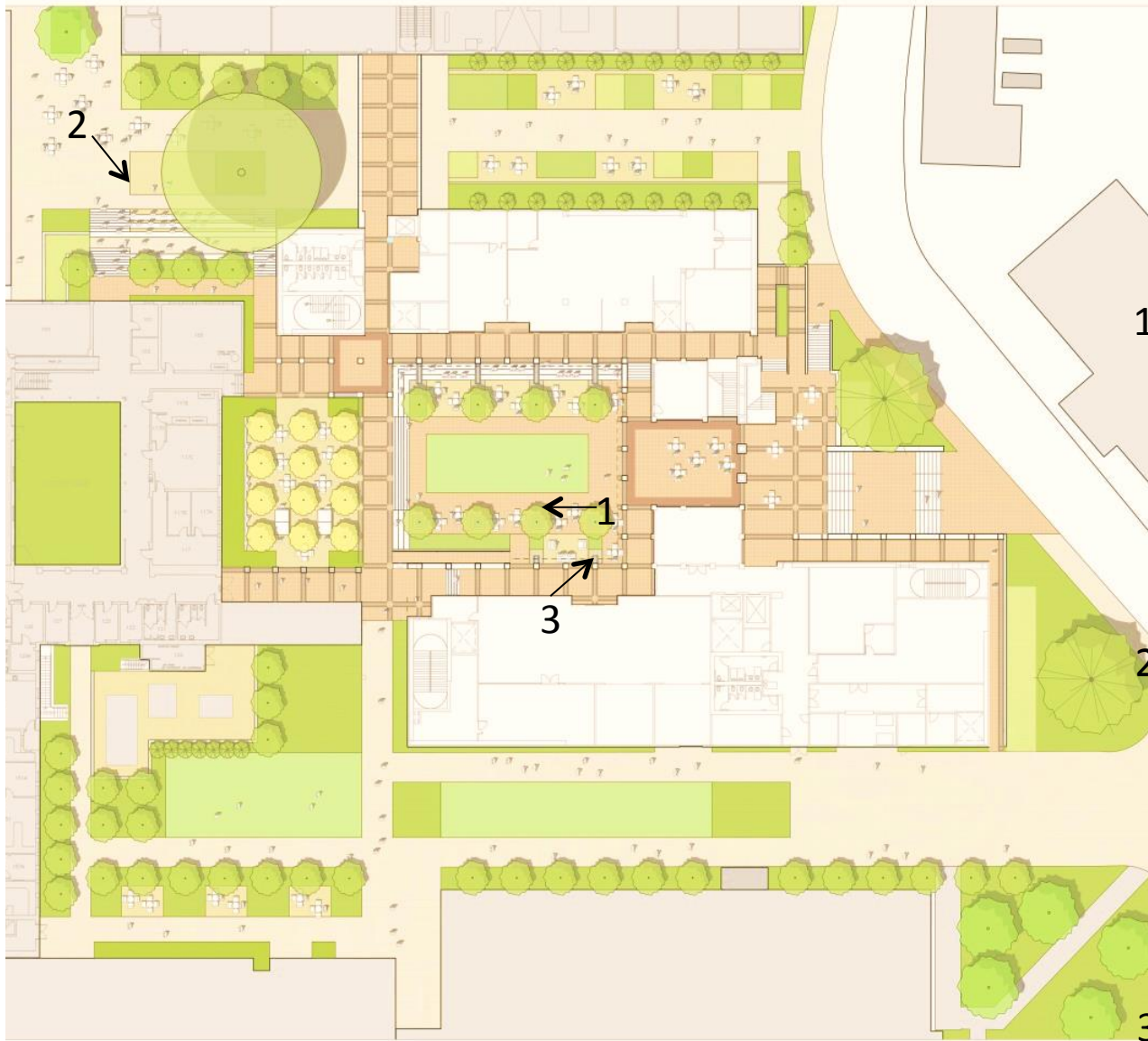
Jan 2015: A team, not a design.



Clark/ACM Proposal Design



Clark/ACM Final Design



3 Colleges, 3 Deans, 1 STEM Complex



Stem Quad



GS/PI Collaboration zone



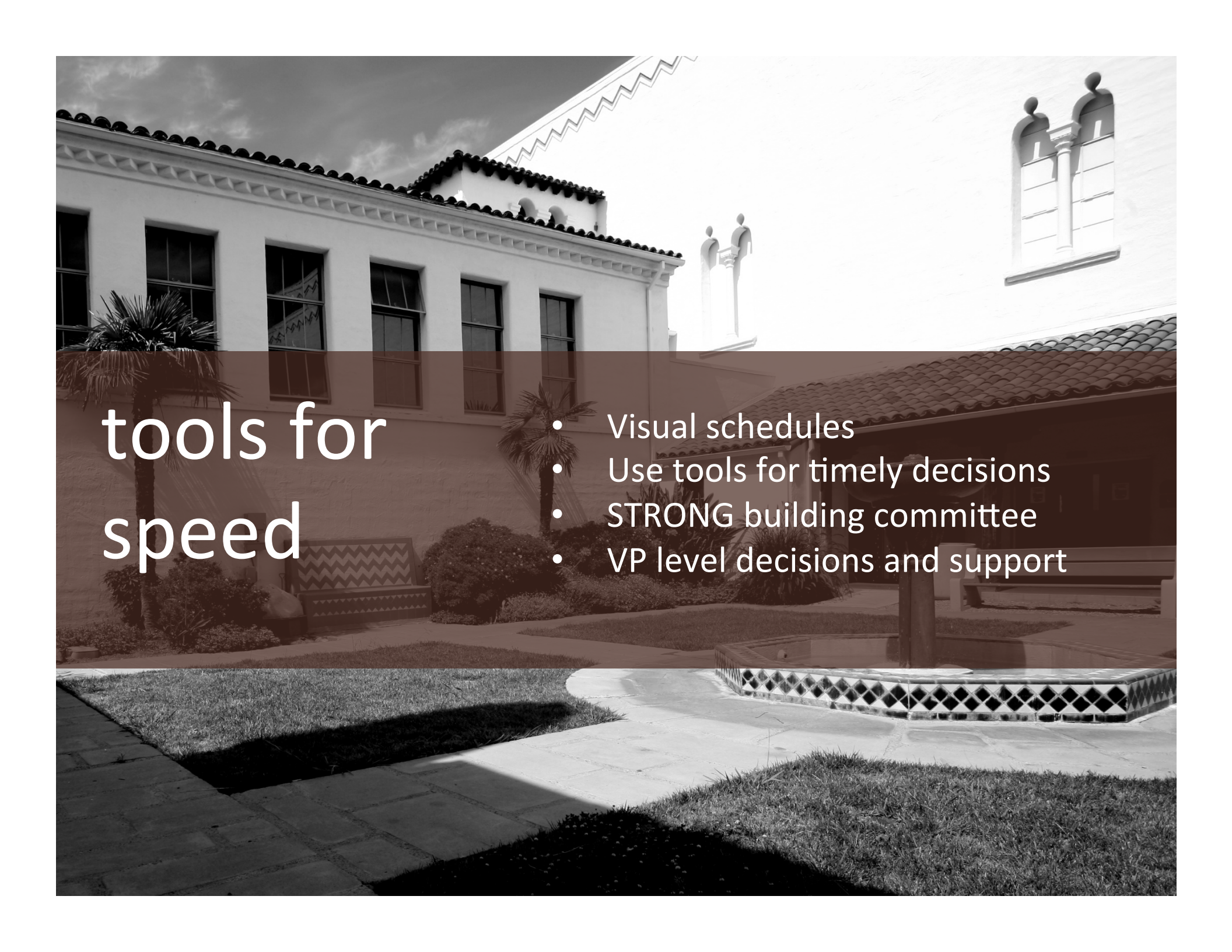
Main Entry



Design Garage/Maker Space



Pull Planning with the D/B team right after the selection, scheduling all of our meetings with the D/B Team, consultants, agency reviews, campus facilities, user groups, vendor input



tools for speed

- Visual schedules
- Use tools for timely decisions
- STRONG building committee
- VP level decisions and support



challenges of speed

- Being inclusive
- Designing w/o users
- Chemical quantities
- Vacating existing buildings
- Preparing temp spaces

Open Ended Research Labs



The appearance
of an inclusive
process

- Town hall meetings
- Build campus support for the big ideas
- Involve the Development team
- President & VP level decisions

designing without users

1

- Large group (20+) discussion, “areas of study” in Energy research

2

- Medium group (10-15) discussion about the future of Energy research

3

- Medium group (8-10) discussion looking at lab layout precedents and partnerships with other disciplines

...a process of listening, finding strengths and intersections for collaboration

designing without users

- Don't over-customize
- How would 7/10 PI's use this space?
- Trust your team's experience
- Benchmark peer institutions
- Don't over think the small stuff

ROOM LIST / SPACE TABULATION

Overall Space Summary 1/29/2015 2/16/2015 February 18, 2015

	A			B			C			D			E			F			G					
	Cannon Final 1-9-15			All - In			Reduced PI's, Large Clean Room			Reduced PI's, Small Clean Lab			No MRI Imaging			No Clean Lab			No Clean Lab, No MRI Imaging			Reduce PI's, Small Clean Lab, Small MRI		
	20 Faculty Res Allocations Clean Room Missing Chases MRI Imaging Facility & Admin No Mat'l Sci Imaging for EMs Over Budget			20 Faculty Res Allocations Bay & Chase Clean Room MRI Imaging Facility & Admin Small Mat'l Sci Imaging for EMs Over Budget			7 Faculty Res Allocations Bay & Chase Clean Room MRI Imaging Facility & Admin Small Mat'l Sci Imaging for EMs On Budget			15 Faculty Res Allocations Small Clean Lab MRI Imaging Facility & Admin Small Mat'l Sci Imaging for EMs On Budget			18 Faculty Res Allocations Small Clean Lab No MRI Imaging Facility Small Mat'l Sci Imaging for EMs On Budget			16 Faculty Res Allocations No Clean Room or Clean Lab MRI Imaging Facility & Admin Small Mat'l Sci Imaging for EMs On Budget			19 Faculty Res Allocations No Clean Room or Clean Lab No MRI Imaging Facility Small Mat'l Sci Imaging for EMs On Budget			16 Faculty Res Allocations Small Clean Lab Smaller MRI Imaging Mat'l Sci Imaging as Research On Budget		
Department	Subtotal	Total	Delta	Subtotal	Total	Delta	Subtotal	Total	Delta from All-In	Subtotal	Total	Delta from All-In	Subtotal	Total	Delta from All-In	Subtotal	Total	Delta from All-In	Subtotal	Total	Delta from All-In	Subtotal	Total	Delta from All-In
Learning	11,500	11,500	0	11,440	11,440	-60	11,440	11,440	0	11,440	11,440	0	11,440	11,440	0	11,440	11,440	0	11,440	11,440	0	11,440	11,440	0
Teaching Labs + Support	6,210			6,050		-160	6,050		0	6,050		0	6,050		0	6,050		0	6,050		0	6,050		0
Student Org's Work Space	2,600			2,750		150	2,750		0	2,750		0	2,750		0	2,750		0	2,750		0	2,750		0
Creative Design Studio	2,690			2,640		-50	2,640		0	2,640		0	2,640		0	2,640		0	2,640		0	2,640		0
Research	22,340	22,340	-2,160	23,020	23,020	680	7,030	7,030	-15,990	15,640	15,640	-7,380	19,638	19,638	-3,383	17,485	17,485	-5,535	21,483	21,483	-1,538	17,116	17,116	-5,904
Research + Support	14,280	17.0		14,960	17.0	680	3,520	4.0	-11,440	9,680	11.0	-5,280	12,540	14.3	-2,420	11,000	12.5	-3,960	13,860	15.8	-1,100	10,736	12.2	-4,224
PI Offices	2,090			2,090		0	660		-1,430	1,430		-660	1,788		-303	1,595		-495	1,953		-138	1,562		-528
Post Docs/Grad Students	4,080			4,080		0	960		-3,120	2,640		-1,440	3,420		-660	3,000		-1,080	3,780		-300	2,928		-1,152
Collaboration	1,890			1,890		0	1,890		0	1,890		0	1,890		0	1,890		0	1,890		0	1,890		0
Centers & Specialty Spaces	15,460	15,460	3,120	18,820	18,820	3,360	18,820	18,820	0	14,294	14,294	-4,526	10,700	10,700	-8,120	13,304	13,304	-5,516	9,710	9,710	-9,110	13,085	13,085	-5,735
MRI Imaging	4,000			3,594		-406	3,594		0	3,594		0	0		-3,594	3,594		0	0		-3,594	2,525		-1,069
Mat Sci Imaging / Res	0	0.0		990	0.8	990	990	0.8	0	990	0.8	0	990	0.8	0	990	0.8	0	990	0.8	0	990	0.8	0
Phage Center	3,700	2.0		3,700	2.0	0	3,700	2.0	0	3,700	2.0	0	3,700	2.0	0	3,700	2.0	0	3,700	2.0	0	3,740	2.0	40
Entrepreneurial Ctr	4,000			4,140		140	4,140		0	4,140		0	4,140		0	4,140		0	4,140		0	3,960		-180
Wind Tunnel	1,280	1.0		880	0.7	-400	880	0.7	0	880	0.7	0	880	0.7	0	880	0.7	0	880	0.7	0	880	0.7	0
Clean Room	2,480	0.0		5,516	0.0	3,036	5,516	0.0	0	990	0.8	-4,526	990	0.8	-4,526	0	0.0	-5,516	0	0.0	-5,516	990	0.8	-4,526
Shared Spaces & Bldg Suppo	5,440	5,440	0	5,500	5,500	60	5,500	5,500	0	5,500	5,500	0	5,500	5,500	0	5,500	5,500	0	5,500	5,500	0	5,500	5,500	0
Receiving + Haz Sto	2,000			1,980		-20	1,980		0	1,980		0	1,980		0	1,980		0	1,980		0	1,760		-220
Meeting Rooms	2,640			2,640		0	2,640		0	2,640		0	2,640		0	2,640		0	2,640		0	2,640		0
Café	800			880		80	880		0	880		0	880		0	880		0	880		0	880		0
Building Manager																						220		220
Total NSF		54,760	960		58,800	4,040		42,797	-16,003		46,889	-11,911		47,296	-11,504		47,745	-11,056		48,152	-10,649		47,157	-11,643

Research	17.0	PI's	Research	17.0	PI's	Research	4.0	PI's	Research	11.0	PI's	Research	14.3	PI's	Research	12.5	PI's	Research	15.8	PI's	Research	12.2	PI's
Centers	3.0	PI's	Centers	3.4	PI's	Centers	3.4	PI's	Centers	4.2	PI's	Centers	4.2	PI's	Centers	3.4	PI's	Centers	3.4	PI's	Centers	4.2	PI's
Total	20.0	PI's	Total	20.4	PI's	Total	7.4	PI's	Total	15.2	PI's	Total	18.4	PI's	Total	15.9	PI's	Total	19.2	PI's	Total	16.4	PI's
Assumed Net/Gross Ratio	62.5%		58.0%		58.0%		58.0%		58.0%		58.0%		58.0%		58.0%		58.0%		58.0%		58.0%		58.0%
Overly Aggressive Ratio																							
Estimated Building Area GSF	87,616	1,568	101,380	13,764	15.7%	73,788	-13,828	-15.8%	80,843	-6,773	-7.7%	81,545	-6,071	-6.9%	82,318	-5,298	-6.0%	83,020	-4,596	-5.2%	81,305	-6,311	-7.2%

	Cannon Final 1-9-15	All - In 2/12/2015	Reduced PI's, Large Clean Room	Reduced PI's, Small Clean Lab	No MRI Imaging	No Clean Lab	No Clean Lab, No MRI Imaging	Redc'd PI's, Clean Lab, Sm MRI
	20 Faculty Res Allocations Clean Room Missing Chases MRI Imaging Facility & Admin No Mat'l Sci Imaging for EMs Over Budget	20 Faculty Res Allocations Bay & Chase Clean Room MRI Imaging Facility & Admin Small Mat'l Sci Imaging for EMs Over Budget	7 Faculty Res Allocations Bay & Chase Clean Room MRI Imaging Facility & Admin Small Mat'l Sci Imaging for EMs On Budget	15 Faculty Res Allocations Small Clean Lab MRI Imaging Facility & Admin Small Mat'l Sci Imaging for EMs On Budget	18 Faculty Res Allocations Small Clean Lab No MRI Imaging Facility Small Mat'l Sci Imaging for EMs On Budget	16 Faculty Res Allocations No Clean Room or Clean Lab MRI Imaging Facility & Admin Small Mat'l Sci Imaging for EMs On Budget	19 Faculty Res Allocations No Clean Room or Clean Lab No MRI Imaging Facility Small Mat'l Sci Imaging for EMs On Budget	16 Faculty Res Allocations Small Clean Lab Smaller MRI Imaging Mat'l Sci Imaging as Research On Budget

Engineering & Interdisciplinary Science Building
AC Martin Architects

Clark Construction

San Diego State University
Research Facilities Design

Benchmarking Engineering/Interdisciplinary Research buildings

■ STRUCTURES & MATERIALS ENGINEERING BLDG

University of California, San Diego

Concrete Frame/Shear Wall

Floor to Floor Heights: Level 1: 7' - 7"
Level 2 - R: 7' - 7"



■ PHYSICS & NANOTECHNOLOGY BUILDING

University of Minnesota

Concrete Frame/Shear Wall

Floor to Floor Heights: Level 1: 16' - 0"
Level 2 - R: 16' - 0"



■ SANDLER NEUROSCIENCES CENTER 19A

University of California, San Francisco

Concrete Frame/Shear Wall

Floor to Floor Heights: Level 1: 7' - 7"
Level 2 - R: 7' - 7"



■ HEALTH SCIENCE BIOMED RESEARCH BLDG 2

University of California, San Diego

Concrete Frame/Shear Wall

Floor to Floor Heights: Level B: 21' - 0"
Level 1 - R: 17' - 0"



■ MATERIALS SCIENCE & ENGINEERING BLDG

University of California, Riverside

Concrete Frame/Shear Wall

Floor to Floor Heights: Level 1: 20' - 0"
Level 2 - R: 15' - 4"



■ CLEAN TECHNOLOGY LABORATORY BLDG

Washington State University

Concrete Frame/Shear Wall

Floor to Floor Heights: Level 1: 16' - 0"
Level 2 - R: 16' - 0"



■ SCIENCE & ENGINEERING BUILDING 2

University of California, Merced

Steel Frame/Braced Frame

Floor to Floor Heights: Level B: 18' - 0"
Level 1 - R: 15' - 0"



■ ENGINEERING VI PHASE I

University of California, Los Angeles

Concrete Frame/Shear Wall

Floor to Floor Heights: Level B - 1: 18' - 0"
Level 2 - R: 15' - 6"



■ ENGINEERING RESEARCH BUILDING

University of Texas, Arlington

Concrete Frame/Shear Wall

Floor to Floor Heights: Level 1: 16' - 0"
Level 2 - R: 16' - 0"



■ INTERDISCIPLINARY SCI & ENGINEERING BLDG

University of Delaware

Concrete Frame/Shear Wall

Floor to Floor Heights: Level 1: 16' - 0"
Level 2 - R: 16' - 0"



Managing design consultants

- *Clear communication*
- *Homework with deadlines*
- *Encouraging “best guess based on experience”*

1. **Take the 3 options for heating/cooling** and elaborate with LCC information and pros and cons. For each option define, size, location, make-up air options, cost magnitude and other factors that will help SDSU make a GOOD decision
 - FCU
 - Chill Beam
 - Valance
 - Other
2. **For equipment listed below provide:** size, type, site position and required clearances
 - Emergency Generator
 - Transformers and switches
 - Fire Booster Pump
 - Sewer pump
 - Other large exterior equipment required
 - Roof top make-up air units
 - Bathroom exhaust fans and shafts
 - Stair pressurization fans
 - Other required roof top equipment

bring D/B subs on early

- 2 steps - RFQ, RFP
- Program and 50% SD drawings
- overlap design engineers and D/B subs
- Involve team in selection
- Maintain appropriate contingencies



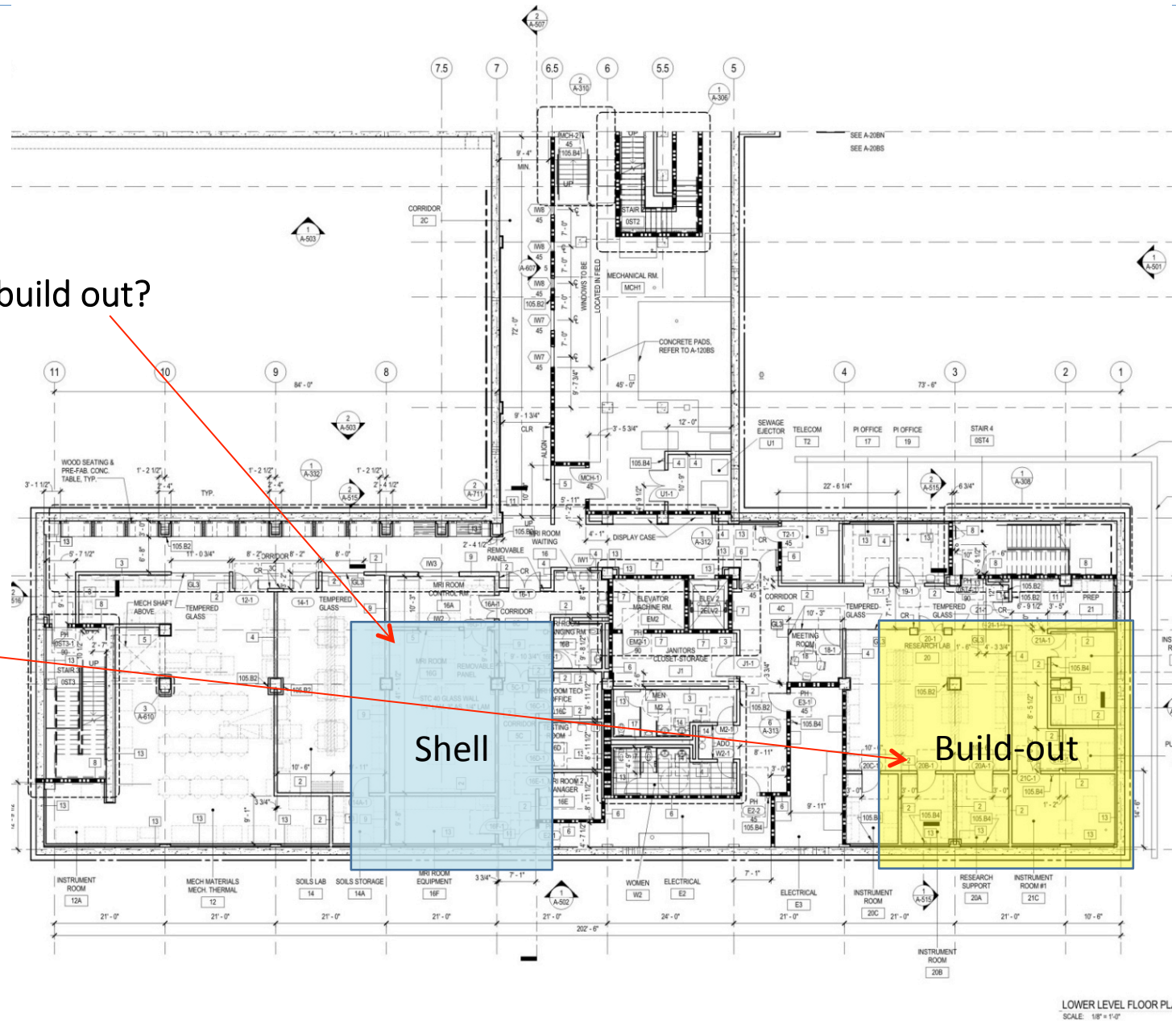
Envelope
Testing At
Schematic
Design

MRI Suite –Shell or build out?

- Future PI
- Vibration sensitive
- Magnetic fields
- Large moving objects
- Elec rooms/Elev

Materials Imaging Shell or build out?

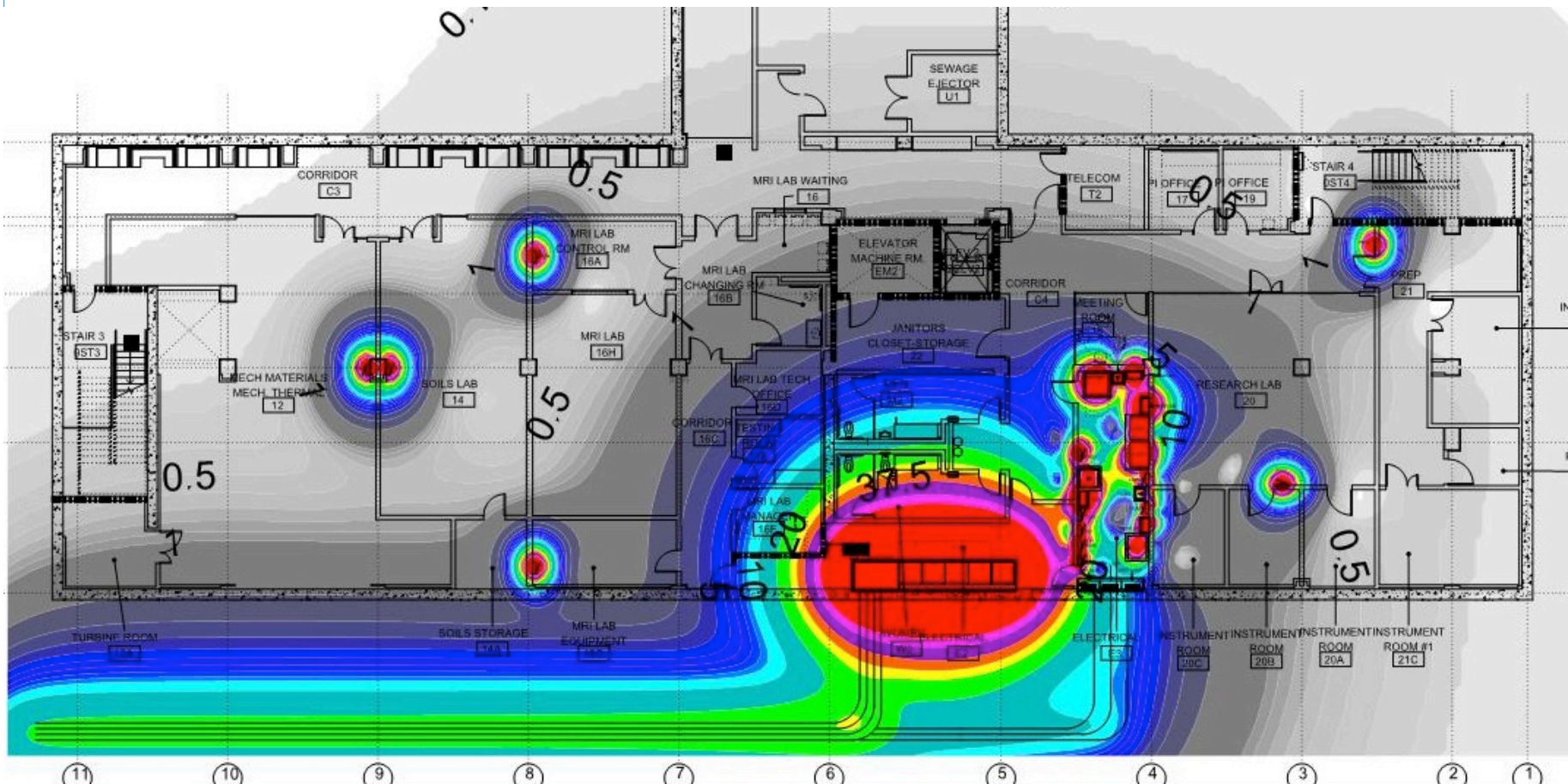
- Future PI
- Vibration sensitive
- Unknown equipment





“Dr. Marty Sereno, successful recruitment provides SDSU with a wonderful opportunity to synergize research strengths in the cognitive neurosciences...”

Steve Welter VP of Research @ SDSU



“Swing Space”



- EIS demolition displaced 35 faculty
- \$6 MM budget for “Swing Space”
- 8 months to plan, design, bid, build and move into space for 35 people
- 12 different construction projects
 - Built a new building
 - Heavy renovation in 9 buildings
 - Cost within 5% of Budget
- **Lessons Learned:**
 - Make the move decisions earlier
 - Start planning earlier
 - Budget with more contingency
 - DON'T WAIT



enemy of speed

- Academics
- CSU Peer Reviewers
 - ✓ Mechanical
 - ✓ Seismic
 - ✓ Design Engineer
- Independent Plan-check
- Health Department
- DSA
- Local Fire
- State Fire Marshall

Peer Reviewers – are not built for speed

Things to consider

- Share your overall schedule w/each reviewer
- Consider number of bid packages carefully
- Possibility and cost of “in-person” reviews
- Enlist University support w/reviewers
- Consider the plus/delta of new/unfamiliar systems

State Fire Marshal – is not built for speed

What to do when reviews are moving too slow

- SFM can change their minds
- Do not escalate, solve at the team level
- Stay calm & negotiate
- Keep the BIG PICTURE of schedule in mind
- Maintain appropriate contingencies, it will cost \$\$\$



New Student Residence Hall

\$130MM, 28.5 months



EXISTING VIEW

New Student Housing: \$130MM, 28.5 months

10 months Prop-CD's, 20 months construction, 5 separate packages

What will we do differently? (Feb 2017)

- Less time on program options – We know what we want this time
- Starting with “Entire team” Pull Planning
- Programming /Schematic - single phase
- Selection of D/B subs earlier
- Info sharing for early packages NOW
- Homework for consultants
- Starting SFM package *earlier*

How were we able to improve our process?

Plus Delta what's working? (May 2017)

- (-) Less time on program options – *"We know what we want this time"*
- (++) Starting with "Entire team" Pull Planning
- (+/-) Programming /Schematic - single phase
- (-) Selection of D/B subs earlier
- (++) Info sharing for early packages NOW
- (+) Homework for consultants
- (++) Starting SFM package *earlier*

New Student Residence Hall



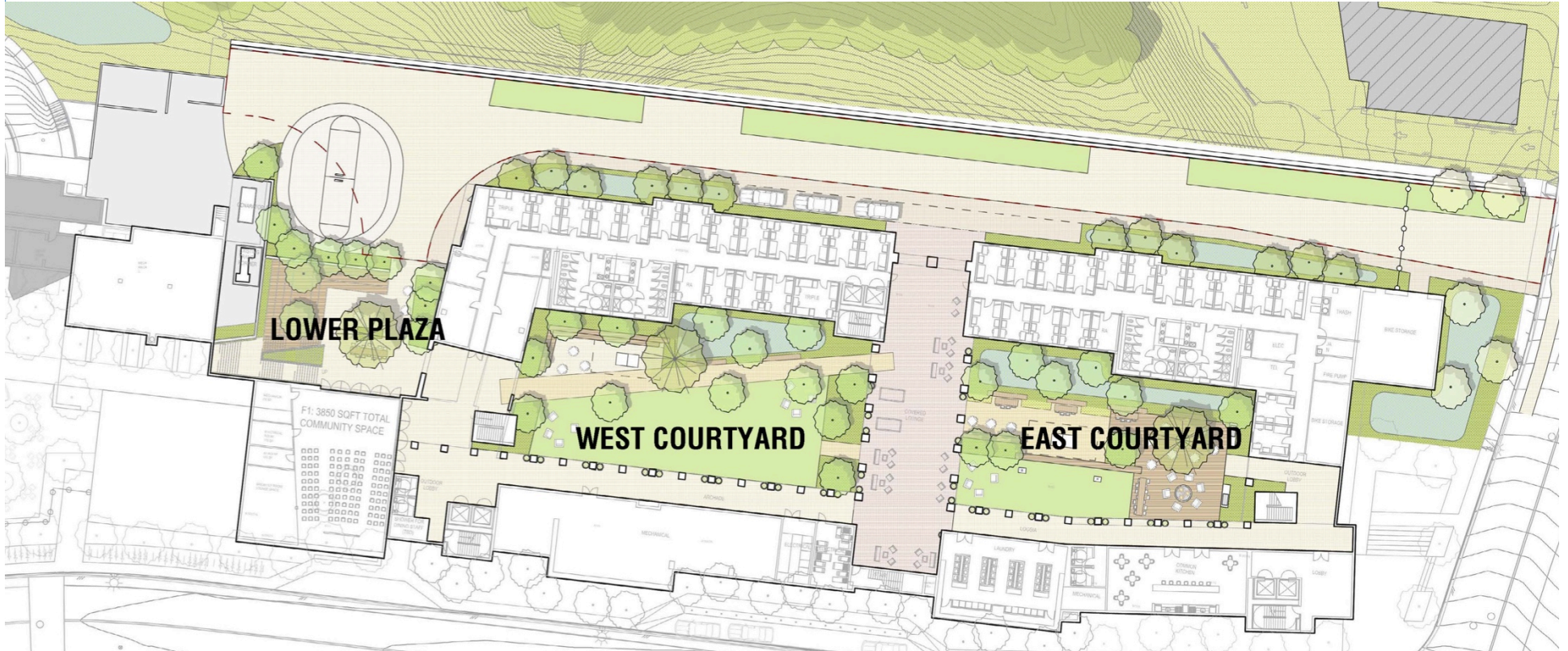
Proposal Design

New Student Residence Hall



Current Design (50% DDs)

New Student Residence Hall



Current Design (50% DDs)

New Student Housing: \$130MM, 28.5 months

10 months Prop-CD's, 20 months construction, 5 separate packages

- **Soils:** Poor soils + tight site = \$\$\$\$
- **Soils** - More site investigation before issuing RFP
- **EIR:** EIR is concurrent with Design
- **EIR** – brings entitlement risks into the project.
- **Utility connections:** Central Plant connection \$\$, City water requires major upgrade \$\$\$
- **Utility connections:** Study utility options and connections prior to RFP to allocate the budget
- **Modern to Mission Style:**
RFP Contemporary style \$\$\$
Current Mission Style \$\$\$\$
- **Modern to Mission Style:** Change in style slows D/B team, has major effects on the budget

Results

EIS

- **Completion Dec 2018**
 - **1 month early**
 - **Under Budget (barely)**

New Student Residence Hall

- **Start Construction September 2017**
(40% Purchased)
- **Lost 4 weeks in Design due to**
(Scope & budget creep)
- **EIR Approval Remains a significant risk**

Three Key Resources for a Building Project

- Real Estate
- Money
- Time

Conclusions

Managing Time like Money

- Speed has Risks & Rewards
- Compressing Planning less risky than Construction
- Use Contingencies AND Concurrencies

Design Management is a Black Art

Tools to Manage Schedule

- Multiple tools for Construction
- Basically none for Design

Conclusions

