College of Architecture and Environmental Design

Reports from:
The College of Architecture and Environmental Design
Architectural Engineering
Architecture
City and Regional Planning
Construction Management
Landscape Architecture

Above: Poly Canyon Design Village 2013; Team from ARCH 133 multidisciplinary class of architectural engineering and architecture freshmen: Left to right: Ben Johnson, Jesse Chin [and his dog], Daniel Schaunessy, Alexandra Chan and Roxanna Kermani [team member not shown: Freddy Svedskin] Student work designed in a studio, fabricated in the CAED Support Shop, mocked-up in the Building 05 courtyard, paraded two miles into Poly Canyon during Open House for erection and occupation, seen by hundreds of visitors, and recycled for future materials use.
Preface: Excerpts of CAED Visioning [Fall 2014] Relative to Facilities and Learning:

How will factors affecting higher education impact fields associated with the built environment?

Learn by Doing [LxD] experiences remain essential for an environmental design education, but will increasingly rely on knowledge provided by practitioners, practices and industry as partners, as well as faculty.

To succeed in a future hyper connected world, we will offer high quality, just-in-time, anyplace, anywhere, on-demand instruction.

As modes of learning change and the location of learning becomes more flexible, we will remodel and expand our existing buildings and sites to increase the amount of space we assign to state-of-art shops and labs. These hands-on environments will further collaboration with adjacent meeting rooms that serve as think tanks for instruction and research. We will add flexible social space where students can collaborate and study.

Faculty will continue to teach as individuals, but also as part of collaborations on campus, and in distributed open collaborative networks.

Computing technologies used for instructional communications and disciplinary applications will be fully integrated into pedagogy and practice. The college will provide seamlessly coordinated computing tools accessible to all students, staff and faculty.

As expectations for scholarly productivity increases, we will increase scholarship opportunities through external partnerships, and invest in our teacher-scholars and student-scholars, giving them the time and resources they need to collaborate on research and creative practice.

How does the global context affect fields associated with the built environment?

There will be an opportunity to market our education programs globally.

Improvements in technology and democracy/affordability of prototyping equipment means affordable customization vs. mere mass production.

Address impacts of global sustainability and integrate building and environmental performance into design.

What will future students need to learn and what competencies will they need to have?

LxD remains central - students continue the CAED experience of hands-on studio and shop-based empirical learning. These modes allow students interactions with peers, faculty, and staff unmatched in traditional modes. The meshing of experience and experimentation leads to …Shop + Labs = the Think Tank

Students will continue to be testers and early adopters of ideas and methods that add value in the market place. This also will require faculty that can direct students towards trending topics.

Curricula will incorporate state of the art technologies for each discipline to address current industry trends, while retaining adaptability that allows curriculum to change with future trends.

Students will integrate computing with technological advances. Designs will be increasingly evaluated using a myriad of performance metrics and analytics to compliment virtual representation of visual and sensory experience.

Students will learn design is part of a larger ethical material cycle from design and material selection, through fabrication, construction, occupation, demolition, and recycling or upcycling of materials.

Students will develop alongside the teacher-scholar as student-scholars. Coursework will link research to application in the lab, classroom, and ultimately the workplace.

How can the college engage with emerging fields and interdisciplinary opportunities?

Integrate internships and industry partnerships at the undergraduate and graduate levels across the CAED majors. CAED could develop research/lab-based partnered services to investigate industry problems that companies cannot address due to resources, time, or equipment.

Position CAED to become a Living Lab to export design solutions. Use of our own facilities, shop, and Poly Canyon as test beds for making, [sometimes breaking], and discovering.

Develop a fusion of arts, design, and engineering to create the new Bauhaus and a new model for the team-as-master builder. CAED would explore intersections with other colleges in areas of art, biological science, and agriculture.
CAED Mission: Continue, Upgrade, and Expand Excellence

The state of CAED at the beginning of this Master Plan window is of a set of a strong, externally vetted and ranked majors, with two, architecture and architectural engineering, impacted in a manner that suggests additional growth could be possible, including growth via national and international students. Given the trends previously noted in the fall enrollment planning exercises, changes in curriculum, technology and additional revenue support from external sources will be a part of forces that require recognition in a master plan dealing with campus uses and structures. It is critical to do so, to merely continue to maintain our enviable rankings, to remain relevant in the midst of changing technologies in the professions from how planning, design, and construction is conceived, and through to its execution and post-occupancy evaluation.

It is critical to upgrade facilities and spaces, and the envisioning process suggested that in doing so it may be possible to expand with two new majors in the college, Sustainable Built Environments and Environmental Product Design. While each of these is in a nascent stage of development [CSU Chancellor approval to develop is anticipated March, 2015], they compliment the current set of majors in efficient and productive ways, especially in the use of facilities, and so we have included a discussion of each in Tier 3.

Numerous types of spaces are included in the CAED and department narratives, and we have particularly addressed necessary spaces and functions that are different from, or variations on, those provided in the Tier 3 document Learning Environments For 21st Century “Learn By Doing”. CAED has chosen ten topics in learning environments unique to the college, and proposes three focal pieces that would figure prominently in a Master Plan, likely funded from private sources through major advancement initiatives. These are also in nascent stages, but we wish to note them.

Sustainable Built Environments is envisioned as ultimately a 200+ student, four year, non-professional degree with three concentrations, where each concentration has an optional Spanish language component:
- Concentration in Designed Environment/Ecology/Policy [deEP]
- Concentration in the Built Environment/Materials/Construction [beMC]:
- Concentration in Built Environment/Systems/Performance [beSP]

The program would be based largely on hybrid active learning, with primary use of spaces as discussed in Learning Environments For 21st Century “Learn By Doing”, but with key selective interdisciplinary interaction via the Evolving Studio, Think Tank/Maker Space, and Atrium and Integration learning space concepts discussed below.

Environmental Product Design is envisioned as ultimately a 300+ student, four year professional degree with three concentrations:
- Concentration in Environmental Product Concentration [ePC]
- Concentration in Furniture Concentration [eFC]
- Concentration in Architectural and Landscape Product Concentration [aPC]

The program would be largely based upon the Think Tank/Maker Space concept below.
1. Evolving Studio and Project-based Learning

Studio transcends any name for a learning space in CAED. The studio experience, and studio culture, will remain a core method for all CAED majors, as it mirrors professional situations. Studio culture offers a base, a home, close contact with a faculty mentor, peer collegiality, and develops long term affinity with the process of design as collaborative, iterative and evidentiary. The Learning Environments For 21st Century “Learn By Doing” document discusses Studio Lab Classrooms, and this model, while very rational, does not reflect the CAED studio culture. While digital representation and teamwork enabled by lab is a core skill and tool in some form in all of our current and proposed majors, the nature of our CAED project-based learning is projects have a visceral and representational scale or full scale material and spatial aspect that is elusive, and transcends visual representation. Because of this, we will use the term Evolving Studio for our spaces. The open-ended nature of design inquiry means we must be nimble in the studio to use any means available for project documentation, exploration and development.

In the Evolving Studio, the use of analog [physical] models remains as new modeling techniques such as 3D printing supplement, but not replace, analog modeling, in a similar manner as digital drafting and modeling has supplemented sketching. These physical artifacts suggest that storage space will become more critical, especially for classrooms with rotating student use. Additionally, accommodations for model making technologies such as laser and foam cutting, 3D printing at different scales, and small, safe tool use [typically 'Dremel' or other small hand held electric tools] should be considered carefully in sizing spaces; at many of our peer institutions they are already inside studios.

The Evolving Studio takes advantage of ancillary indoor or exterior flexible spaces for use in projects, presentations and demonstrations. The relationship for selective studios to be close to a shop/making space is critical.

The Evolving Studio builds upon the digital democratization of computer hardware and software of the 90's-2000 era. The use of computers as lab-based computers versus bring-your-own computing is also different for CAED. The ability of a person to access their hard drive, supplemental drive, or cloud based archive or software from any venue is embedded now in studio learning and it is unlikely the scale of computing and software in the model described would be applicable to our situations. Prohibitively expensive specialized software or software that requires special hardware needs or output will likely be continued in computer labs with computers shared by many students.

2. Living Lab: Outside the Class is another Classroom

In 2014 Architecture Department faculty obtained two “Campus as a Living Lab’ grants, and the idea that CAED design faculty and students can impact the campus physical fabric is something we would like to embrace into the future. The campus would entertain selective design-build projects or project stream where work would remain part of the campus. Many of our peer institutions look to design-build studios as ways to add projects like transit stops/shelters, bike racks, etc. These efforts are strong opportunities for interdisciplinary work, especially as our shop/making capacity is enhanced, and architectural engineering anticipates adding mechanical, electrical and plumbing coursework. This is also covered in a similar manner in the larger campus landscape within Landscape Architecture’s narrative.

3. External Client: Production and Communication in Virtual Spaces

CRP has been a trailblazer in the university in expansive service learning opportunities to local community planning agencies and jurisdictions. In doing so, the ability to take advantage of virtual communication vs. exclusive use of travel time and resources has been a challenge. A facility capability to have a tv-like production capacity with and multiple switchable digital channels could be used in multiple ways.

4. Think Tank/Maker Space/Workshop

For course content that involves more intensive forms of material interaction or large-scale prototyping, we wish to move to a more nimble inclusive form of inquiry where separations of studio and shop and assembly and discussion are collapsed and spatially combined.

The global democratization of technology now includes access to means of visualization, representation, rapid prototyping, and manufacturing once only in the prevue of shipbuilding, car manufacturing, or aeronautics. The
result has been a new capability for environmental project customization. The economies of mass industrialization are giving way to local specialization, high performance design adaptations, and novel product personalization.

This is already a trend in many leading smaller crossover design firms associated with critical practices. This pedagogy and methodology is embedded within the digital fabrication courses currently taught within architecture, and is possible to grow with the development of the Digital Fabrication Minor, currently on the Cal Poly Master Plan for development. The spaces are also applicable to many Construction Management courses, as well as emerging Architectural Engineering coursework.

**Master Plan Opportunity A: Workshop Spaces Supporting a New Environmental Products Major**

The proposed Environmental Products degree utilizes the above Workshop concept, and allows an industrial design approach using the latest digital representation and rapid prototyping capabilities to compliment the existing CAED ‘Learn by Doing’ capabilities in studio-initiated, shop-based, full-scale demonstrations of design through realization.

If approved for development, the new degree program will enable designers to concentrate on a spectrum of environmental product scales, from specialty tools and fixtures, to furniture and lighting, to custom building specialties critical to new performative thinking trending in building codes and societal expectations of quality. The degree supports the expansion of experimentation with new materials and processes emerging from a global recognition of best sustainable building practices.

The Workshop model consists of a set of common shared specialty shops, with adjacent meeting, project assembly and project storage spaces. The model is based upon a more efficient use of traditional studio time in these curricular/pedagogical settings,

This would be a major advancement initiative for CAED and we would look to renovate and expand the spaces associated with our current Support Shop and Architectural Engineering Concrete and Testing areas in Building 21 to embrace the Workshop model. To support a 300+ student major and associated courses in Architecture and Construction Management [and others] we are envisioning almost 30,000 sq. ft of program and renovation, based upon very preliminary program discussions internal to CAED. This intervention could also solve problems of circulation and proximity for users of Building 21, and correct critical deficiencies in our current shops.

Due to the nature of this significant intervention, we would look to possibly combine a move of other CAED assets such as the Presentation Facility [‘Photo Lab’] and Neel Resource Center [NRC], and computer support staff to more centralized locations, freeing building 05 up for additional Evolving Studio space accessing Building 05 courtyard/patio spaces. [see below]

5a. **Embedded: Real World Lab**

Architecture has been using an embedded studio [“Professional Studio”] concept within a host professional firm, where 20+/− hours/week co-op/internship is combined with a separate studio component based on host firm expertise. This model has been tested for several years and has been beneficial for advancement as well as student: professional relations. It has become a popular option, especially for students who wish to have an off-campus experience but are not able to afford the current fee structures with many of those self-support options. This is a unique spatial type that costs the university little to nothing, and is noteworthy as a non-entity. This kind of initiative by the department allows for spaces for students in the program over and above the apparent carrying capacity of the college holdings and will continue to be explored as an option for mitigating impacts of student/program growth.

5b. **Embedded: Co-op/ Internship**

Co-op has long been an opportunity in our majors, but usually for only a small portion of the cohorts. It is possible that as our advancement efforts move forward, especially considering a true four quarter model, Cal Poly could develop a constant flow of interns through professional internships with no economic or progress penalty for summer in residence. This would be another factor in determining growth capacity relative to facilities holding capacity.

5c. **Embedded: Real World International/Domestic Alternative Off-Campus Academic Experience**

Off-campus academic programs, and the Cal Poly International Center initiatives aimed at internationalizing the campus, similarly aid in addressing CAED growth and campus holding capacity. CAED majors currently have some of the highest participation rates on the campus for international programs and faculty-led travel and this is anticipated to continue at current levels.
6. Atrium and Integration: Between Class is as Valuable as Class

The success of the recent conversion/re-envisioning of space in Kennedy Library and the intensive use of the common spaces in the University Union call attention to the intangible value of ‘between class’ spaces as social attractors. The ability to simply find an attractive place to sit, to eat, to utilize social media outside of class confines is appreciated. This class of spaces shows students that all of their time is appreciated with due respect and architectural attention. The down time between classes is a possible active learning time apart from the scheduled class. This kind of space is frequent in contemporary design, and two examples below illustrate the path as place where passage and repose exist concurrently, in two academic structures.

Master Plan Opportunity B: Atrium Spaces Supporting a New Sustainable Environments Major

The ability to have smaller breakout areas, niches, selective seclusion as well as possible ad hoc lecture or seminar space, or even commencement could be accomplished with the enclosure of the Building 05 stair court. While the existing space is selectively used for events and exhibition, the damp evenings, frequent winds, nesting fowl, and ubiquitous concrete surfaces preclude a host of more intense and continuing uses. The newly proposed Sustainable Built Environments major will likely have a nomadic base of campus classrooms, and the ability to give a sense of place and ownership via a ‘home’ in the atrium would accomplish multiple goals. [see below]

7. Event Space: Gallery/Installation/Exhibition

With the production of provocative evidence of learning emerging from so many labs/studios and activities, the venues to review and evaluate as well as celebrate and promote the culture of making become important. This begins with the foundational aspect of critical reflection upon work itself in an academic setting- the critique, the review, the show is an opportunity see the outcomes of a class in evidence. The work and review is also a vehicle for gathering alumni and professionals as critics, and as a result, is a bridge in building professional relations for the student and institution.

The nature of the venues may be as varied as the work. This includes consideration of multi- and dual-use space from as simple a concern as a widened hallway that can support limited forms of representation and artifacts, to flexible use spaces such as internal rooms and external courtyards, internal flexible spaces such a dedicated gallery space, to exterior spaces and surfaces capable of supporting large scale mock-ups and long term evaluation of building elements across time.

Duration plays into these spaces, as some materials may only require review for a class period, others involve up to days or even weeks of installation, and there is Advancement and event value gained from a permanent or semi-permanent collection being able to be accessed by public or invitation.

An example of this value is the way CAED has leveraged Parent’s Weekend to feature student work at a major reception. This exhibition of initial studies, sometimes documenting of only four weeks of freshman studio production, is capable of significant intangible value, and where the decision of major and university is tangibly reaffirmed. Similarly, events that are built around the celebration of Senior Project or collective Architecture fifth year thesis, housed recently at Chumash Auditorium, have grown to draw almost 1000 visitors, with alumni and professionals making repeated appearances.
Master Plan Opportunity C: College Exhibition and Event Space

Significant in the current CAED array is the position of building 05 relative to one of the campus feature spaces, Dexter Lawn. The current 05 Dexter Lawn façade is a concrete frame and concrete infill panel with high windows and no doorways— a lost opportunity. One of the major proposed CAED initiatives is to study relocation of the CAED and Architecture Administrative spaces, perhaps to a new third floor suite addition [level above Dexter Lawn], and open the Dexter Lawn level of Building 05 as a major event/gallery space capable of interaction with Dexter Lawn. This holds possibilities of greater support of University events on the lawn, as well as college or department specific backdrops for Commencement or advancement. Upper level building 05 spaces would consolidate administrative offices and provide spaces for meeting and advancement that overlook the Dexter Lawn as well as possibly Madonna and Bishop’s Peaks. [see below]

8. Enabling the Teacher-Scholar and Student-Scholar

The emphasis on and continuing development of the teacher-scholar model creates an issue when the nature of the research becomes spatial, material and/or temporal. For many faculty, the same problems that occur in the studio model, of space for exploration, fabrication, testing, and realization, require properly addressed. Storage, and other meeting areas may be able to be absorbed to a degree in the above Workshop/New Shop goal, but this is a consideration across campus where work-in-progress resides.

9. Continuing Legacy: Full Scale and Real Time: Poly Canyon

The San Francisco Chronicle of January 5, 2015 ran a two page illustrated spread, Architecture Graveyard Beckons which featured the twelve acre CAED Experimental Construction Laboratory as part of a San Luis Obispo destinations series of articles. The structures date from an era when complex, occupiable, full-scale work was realized. After many years, and recent bouts with vandalism, this capacity is now differently sought and continues its appeal to faculty and students in its allure, in addition to regional tourists. The annual Design Village CAED Student Club event, where almost 300 students from Cal Poly, other architectural programs, and California community colleges compete in a design-build-occupy contest, has in recent years been joined by almost 300 additional architecture and architectural engineering freshmen residing in their own designs apart from the main competition. This event, during Open House, attracts hundreds of visitors and is mentioned by many students as a reason for their choice of Cal Poly as a program. This has generated a continuing interest in not only the student club, but the canyon. The canyon is cherished and currently in review as part of an internal CAED facilities master plan. This effort hopes to create a path via advancement where alumni may help steward a sustainable program of canyon use. Student and faculty projects would continue to be welcomed on a case-by-case basis via external funding.

10. Advancement and Destination Entrepreneurial Learning

Almost all of our majors carry with them a professional need for continuing education. Continuing education is often at the local level where one resides, but is also possible at conferences and symposia. The beauty and draw of the central coast suggests that Cal Poly could possibly be a continuing education destination for alumni and professional colleagues for continuing education. The spaces for these efforts would need to be supplemental to year-round academic spaces, but could be flexibly assigned shared space in a highly organized calendaring system.
The same facilities that are generating knowledge could be a draw for returning professionals. Additionally, professional certificate programs are ways to focus offerings in a similar manner without competing for university spaces.

11. Partnerships
None of the initiatives identified above are intended to be conceived as necessarily exclusive to the college. CAED is a willing participant in exploring partnerships across the university and beyond in realizing these learning spaces and opportunities. In particular, we envision growing relationships with the following:

Internal:
OCOB: Industrial Technology. We have similar making interests that any new workshop model would benefit.
CAFES: Agricultural Engineering
CENG: Making capabilities in all disciplines, and shared knowledge and capacity of the existing Bonderson Center.
CLA: Art and Design is a natural ally and partner in making and representation and installation/exhibition. CAED by historic path has not enjoyed the symbiotic and humanities influences of the art and design fields and we hope to find ways to share.
Swanton Ranch and Cal Poly Pier offer environmental opportunities yet untapped for all our CAED majors.

External:
Professional Firms and Organizations
Manufacturers

Master Plan Opportunities
A. Reimagined Shop: Think Tank/Maker Space/Workshop
B: Atrium/Integration Student Space
C: Exhibition and Event Feature Space Fronting Dexter Lawn with Relocated Administration Upper Level Addition
Memorandum

California Polytechnic State University
San Luis Obispo, CA  93407

To: Christine Theodoropoulos, Dean
    CAED

From: Al Estes, Department Head
      Architectural Engineering

Date: March 5, 2015

cc: Assoc. Deans, CAED

Subject: Master Planning Tier 3 Narratives

This memorandum provides the Architectural Engineering program response to the Master Planning Tier 3 questions. This is a dynamic evolving process, so these responses are still being developed and discussed.

1. Summary Relative to Facilities and Master Plan

Based on Fall 2014 Master Plan Narrative, briefly describe areas of potential program growth or change in undergraduate, and graduate programs, and in continuing education or other course/curricular/program offerings, that has a potential impact on existing facilities change or expansion:

The ARCE Department is currently investigating three options with respect to its undergraduate program over the next two decades:

Option 1: Protect the program we currently have. The trend over the last two decades has been to reduce the number of units in the ARCE program from 210 quarter units down to 196 units, put more students into the classroom, and reduce the student-faculty interaction in the interest of improved efficiency. The faculty believes that the recent reduction to 196 units may have bought us five years before we are asked to reduce again. The biggest challenge over the next two decades may well be to preserve the currently rich ARCE experience from increased pressure to sacrifice learn by doing for improved efficiency and lower cost. This option has the least effect on increased costs, increased course offerings, and new facilities. We would remain a program of 350 students and would need to renovate, update and maintain the facilities we currently have as well as adopt new technologies as they develop.

Option 2: Grow the current program and incorporate more interdisciplinary experiences into the curriculum. The inclusion of the ARCH, ARCE and CM disciplines into a single college is unique to the CAED. No other university in the nation has this mix of disciplines combined into a single college. We could grow the enrollment of the college (currently the smallest college at Cal Poly) and increase the interdisciplinary collaboration opportunities. The ARCE program could grow to 500 students and would expect the other disciplines in the college to grow
accordingly. The new course offerings would involve increased collaboration between disciplines. The initiative would require new studio, classroom and laboratory facilities as well as new faculty lines. Some of these facilities would be different than those that currently exist such as an interdisciplinary studio that meets the needs of all disciplines participating in the effort. The new faculty positions would be more interdisciplinary and have more joint appointments. If the intent is to grow without new resources, we are opposed as it would inevitably hurt the quality of the program.

**Option 3:** Incorporate the electrical, mechanical, and plumbing (MEP) disciplines into the college curriculum. Cal Poly has the only ARCE program west of the Rockies. There are a number of MEP firms in the western states that would embrace our graduates. With the MEP disciplines, the college would be represented by the entire design-construction industry. This is the boldest option where an additional 300 students could be admitted to the college either as part of the ARCE department or a newly-formed department. It would require collaboration with CENG where a Heating, Venting, Air Conditioning (HVAC) program already exists. It would require new classroom and laboratory space for the new disciplines as well as faculty hires to support the electrical and mechanical disciplines. While this addition will be attractive to many potential donors, it will need to be supported by university resources as well. The commitment of university resources would have to come first.

**Master’s Program**
The ARCE department started a blended master’s program in 2008. It has attracted 12 – 16 students per year since its inception. Until last year, there was a mandatory thesis requirement when a coursework-only option was added to the program. The program has the potential to grow but not at the expense of the undergraduate program. The graduate program is the key to a more robust research program. Growth in the graduate program would require an additional graduate laboratory and increased faculty lines to accommodate more students. Degenkolb Engineers has sponsored our current graduate laboratory but increased enrollment would require more space.

The program has increasingly taken in students from outside the blended ARCE undergraduate program. The master’s degree will grow in demand and popularity because:
- Modern building design requires more sophisticated analyses pointing to a much higher demand for Master’s degrees.
- The Master’s degree will likely become a future requirement for professional licensure.

**Continuing Education**
Cal Poly Continuing Education represents a great opportunity to expand the curriculum to outside industry and to develop new master’s degree programs. These opportunities can be more easily realized if the restrictions that forbid mixing State and Continuing Education resources can be eased. Furthermore, Continuing Education needs to develop a pricing structure that is more flexible, transparent and realistic. If these challenges can be overcome, the opportunities to expand the curriculum and appeal to the continuing education of the industry become much greater.

2. Possible Impact of Research Models
Based upon continuing development of the teacher : scholar model in conjunction with the student : scholar and student research, and possibly in conjunction with community or industry partners, describe the kinds of spaces necessary to continue to deliver the program at a high level or achieve excellence:

Research will require updated equipment and spaces. The ARCE labs currently have testing machines and a shake table that are 30 to 50 years old. Most ARCE equipment supports undergraduate engineering education. The best research will use this same equipment, involve undergraduates, and allow a faculty member to leverage their research across multiple domains.

Additional thoughts on research models include:
- Increased reliance on technological developments such as 3-D printing, digital fabrication, advanced BIM applications, compatibility of software across disciplines will be necessary for interdisciplinary research.
- The teacher scholar model must be modified specifically to Cal Poly. We should greatly enhance undergraduate research opportunities, we should strive to make this a major selling point of our program, i.e. the possibility of co-authoring a peer reviewed paper as an undergraduate
- Cal Poly’s current model for encouraging research is inadequate - $250,000 for the entire campus is not a serious amount. The theme of innovative research and partnerships does not apply with full time teaching.
- Faculty time needs to be allocated for research
- Make undergraduate research a top priority, make it a marketing tool, provide incentives to faculty and students to allow it to flourish
- Teaching loads are currently too heavy to have meaningful research.
- In a predominately undergraduate university, those most successful in employing the teacher-scholar model will be those who find a specific niche of research; exploit it across all domains of teaching, scholarship and service; involve undergraduates in the effort; and collaborate with other faculty members.
- The resources for research for faculty MUST NOT be cumbersome to obtain. Currently faculty have to compete amongst themselves – this is a burden and it does not support seamless research. It is a stop and start model. Currently the faculty have to find or fight for resources, this takes time anyway from research efforts.
- Increased summer funding of faculty research is needed
- A flexible definition of professional development and scholarship needs to account for the composition and mission of a department. The ARCE department faculty is half seasoned practitioners whose scholarship and professional development is going to be different than a Ph.D. credentialed faculty member. If we create a scholarship definition that is too narrow, we risk losing the industry contact and practical experience that the practitioners bring.
- Acknowledgement and credit for cross-disciplinary work needs to be integrated into value system
- The elimination of the thesis requirement in the master’s program has reduced the research capability of the program. We would need to create new incentives for students to choose to do a thesis or present more opportunities for independent study projects for students to support faculty member research.
• Opportunities for undergraduate research opportunities need to be built back into the curriculum. The mandated reduction of the ARCE program to 196 units removed all electives from the program. The electives provided students with the opportunity to take the independent study courses that facilitated undergraduate research support.

3. Description of Expanded, New, or Evolving Teaching Situations

Based on continuing development of curriculum and/or pedagogy in any of the above, describe the kinds of spaces necessary to continue to deliver the program at a high level or achieve excellence [provide some detail as a placeholder where specifics may not be available]:

The college’s top priority needs to be the upgrade and synchronization of our laboratories and shop facilities. The Learn by Doing pedagogy that will continue to make us successful relies heavily on space and facilities. Three big ideas flow from this:
• To support this hands-on learning environment, the college needs to upgrade and enhance the college shop, digital laboratories, project space, experimental laboratories, Poly canyon, and studio space
• The college should acquire Crandall Gym as interdisciplinary project and shop space.
• The university should consider a consolidated shop space on the same order and magnitude as the current Recreation Center. It would be making a bold statement on a national level about our Learn By Doing philosophy.

The university’s main priority needs to be more classroom space with a greater variety of options. There is a push for more students in the classroom. Those who try to do this quickly realize that the university has only a few classrooms that will accommodate larger numbers of students. Computer labs are at a premium. Classroom availability has become so constrained that programs are being asked to teach more classes at inconvenient hours. As interdisciplinary education increases, the scheduling has to be sufficiently flexible to accommodate these various disciplines. Current classroom space does not accommodate this flexibility.

The new and evolving teaching situations include:
• Understanding of underlying theoretical principles
• Hands-on demonstration of principles
• Use of computers to model and solve complex problems
• Personalized small-group instruction in critical areas
• Collaboration with other disciplines
• Real world projects included in the curriculum
• Balance between practical and theoretical (balance on the faculty)
• In the ARCE department, we are caught between two models. We embrace the concept of studio and laboratory instruction that involve small class sizes and strong student-faculty interaction, which happens to be more expensive. The rest of the academic world is moving toward a different model with more students in the classroom, increased use of teaching assistants and more reliance on technology to deliver instruction. We need to experiment with and adopt the latter to be allowed to keep the former. We need to use the more efficient delivery means on the fringes to be allowed to protect the core of the curriculum. If we stick to a model that we know to be effective, our case will be proven over time and those who follow the latest
fad will realize that we were right. But our model has to evolve to accommodate and effectively use new technology.

- It is important keep up with technology. The industry is currently experimenting with advanced applications of BIM, 3-D printing, digital fabrication, robotics, etc. We need to be at the leading edge of those developments and we are not.
- The studio atmosphere is the critical component of our program. It begins in the first year architecture studios, it continues in design labs (studios) and it carries on into design studios at the graduate level.
- Savings can be made in the future as computing infrastructure and software on the cloud eliminates the need for so many computer labs. Increasingly, students will be required to purchase their own computers and with standardization, the computer classes can be taught in any other classroom with software accessed off the wireless network.

4. Possible Partnering

*Describe any potential internal university stakeholder partners that may be engaged in developing research or curriculum or pedagogy above and that may benefit from a shared space/use strategy:*

- Clients are demanding increased services and at the same time there is pressure for lower fees driven by competition, automation and outsourcing. Our students might be better prepared to deal with this with appropriate Business courses – perhaps at the graduate level.
- With the addition of an MEP component, the opportunities to seek industry support and develop partnerships expands considerably. There are far more suppliers of electrical and mechanical components than there are structural components.
- Few universities teach HVAC and electrical power distribution in buildings. ARCE programs typically teach this. As the only program west of the Rockies, there are a number of MEP firms that would embrace our graduates if we taught these disciplines.
- We looked briefly at partnering with an existing firm to leverage a new shake table and conduct testing on smaller items of equipment. It did not work out but the model makes sense. With available student labor and licensed faculty members, we are an attractive partner for conducting various materials tests on a contract basis. Our equipment must be updated and calibrated to perform such services for fees.
- Currently California does not required professional development (continuing education) points to maintain licensure (unlike many other states); yet if this changes there will be a strong demand for courses aimed at the profession. Private industry usually steps in to fill this need, but there will be opportunities for engineering programs who have ties to the profession. This opportunity will be made easier if Cal Poly Continuing Education can remove some of the current restrictions on mixing and combining State funded and continuing education programs.
- ARCE and Civil Engineering (CE) can collaborate more on the courses offered to master’s degree students.
As the teacher-scholar model expands and becomes more integrated into the culture of learning at Cal Poly, the Architecture Department is positioned to develop this hands-on learning through industry-academic partnerships providing a view into the profession, while at the same time enabling students and faculty to design and develop innovative solutions grounded by real world parameters.

Design thinking at the core of architectural education can and must be expanded beyond the traditional scope of buildings. 21st Century design problems work across multiple scales from the design of nano-coatings for architectural applications to urban infrastructure. At the same time, architectural design is increasingly complex and specialized with demands for environmental performance while enabled by design flexibility and mass-customization afforded by advances in manufacturing technology.

Design thinking is cultivated through the learn-by-doing studio-based education central to architectural education. Maintaining and expanding this studio culture is the number one priority, with the expansion of the shop as vital to the identity of hands-on learning in the Architecture Department.

Space and spatial arrangements that support the range of dynamic, spontaneous, interactive, and creative teaching and research activities are needed to maintain the department’s international reputation for hands-on learning, and to attract new faculty to continue this legacy.

**Studio Priority**
The studio remains the core of architectural education and its project-based learning. Studio culture is a primary barometer of an architecture school’s health, and this studio culture develops from a strong sense of community. There are two aspects of studio culture and community that need to be addressed: identity and inclusiveness

**Studio Culture and Identity**
As the architecture program has expanded, studios have been distributed in four different buildings: Architecture and Environmental Design Building, Engineering West, Dexter Building, and the Construction Innovations Center. The architecture building has a good sense of community as a result of its density (primarily 3 stories) and circulation that connects to outdoor spaces and the strong central staircourt. Rethinking this central staircourt could have dramatically focus this sense of community.

Engineering West, however, does not have any sense of community based on its physical design, poor circulation, and studios turning their backs to an underutilized and ill-designed courtyard. Creating a sense of identity and community through a rethinking of the central courtyard, circulation, and façade design of Engineering West should be a primary focus, and this can be done through an expanded shop as the core aspect of identity for studios that surround Engineering West.
Studio Culture and Inclusivity

A strong sense of identity and studio culture in architecture can also have the ill-intended effect of shutting others out. An expanded sense of studio culture that fosters inclusivity is both a curricular and spatial problem. Contemporary demands for multi-disciplinary practices suggests we also need to get students out of the studio, as well as bring other collaborators into the studio. Spatial opportunities within expanded studios as well as flexible collaboration / pin-up spaces directly adjacent to studios are needed to enable these kinds of collaboration. Formalized gallery spaces as well as foyers and other flexible display areas are needed for the long-term display of work to invite others into the work. Transparency into studios and studio collaboration spaces would do well to maintain identity while fostering inclusivity.

Expanded Shop and Digital Fabrication Hub

The CAED support shop is a heavily utilized resource at the core of the Architecture Department’s identity of learning-through-making. The shop at the core is vital to the identity of the Architecture program both metaphorically and spatially. With years of deferred maintenance and restricted budgets, compounded by increasingly heavy use be an expanded student body, the support shop should be a primary area of focus for renewal and expansion. Computer-controlled fabrication equipment from laser cutters, CNC routers, water-jet cutters, and robotics, have become a staple in architectural education nationwide. In 2008, through the support of CBF funds, the architecture department opened a very modest Digital Fabrication Lab in 600 sf space. This space has become a vital resource for the students and culturally has developed as a knowledge hub through the display of work and resource for students to get help.

Creating a maker community at the core of Engineering West through an expanded shop integrated with traditional and digital tools will form a strong sense of identity while providing these assets as a hands-on knowledge hub that is inclusive to the wider Cal Poly community. In addition to the Integrated Research labs (described below), both the more connectivity facilitated studio spaces and the shop are vital to the Teacher Scholar Model.

Enabling the Teacher-Scholar: Integrated Research Labs

Coupled with a new digital fabrication curriculum, the Material Innovation Lab (MiL) began in Spring 2012 as an applied research lab developing full-scale building assemblies through industry/academic partnerships. This has resulted in funded research in composites, concrete masonry, and phase change materials while connecting students with innovative industry partners bringing real-world design problems into the lab. As exemplary of the teacher-scholar model, there are multiple avenues of research which have developed from this each with demands for new dedicated spaces:
**Casting Lab**
With opportunities for industry / academic partnerships in large scale precast concrete systems, lightweight glass-fiber reinforced concrete (GFRC), thin castings with ultra high performance concrete (UHPC), as well as concrete masonry, a dedicated casting lab would provide the space, heavy equipment, as well as appropriate facilities for concrete casting.

Potential Funders: LaFarge (Ductal Concrete), TAKTL (UHPC), Walters and Wolf (Precast concrete and GFRC), Concrete works, the Concrete Masonry Association of California and Nevada, and the Masonry Institute of America. (image: [http://www.gtresearchnews.gatech.edu/computer-to-construction-technique/](http://www.gtresearchnews.gatech.edu/computer-to-construction-technique/) [http://itaphdtalks.blogspot.com](http://itaphdtalks.blogspot.com), and our own images!!!)

**Composites Lab**
Demands for high-performance lightweight facades and building components is increasingly met through recycled plastics, fiber-reinforced polymers (FRP) and other hybrid materials through fabrication processes such as thermoforming, molding, which require specific equipment, ventilation, and space requirements.

Potential Funders: Owens Corning

**Ceramics Lab**
Architectural ceramics was a staple of architectural expression in the early 1900’s, exemplified by the Reliance building in Chicago (1890), and is now reinvigorated by needs to reduce glazing coupled with cost effective customization of mold
making through digital fabrication. In addition to messy design and assembly spaces, the ceramics lab requires large-scale kilns, rack space, and mixing equipment.

**Robotics Lab**

Large-scale industrial robots are the current state of the art in digital fabrication research, and in 10 years will be mainstream much as today’s common use of CNC technologies was new to architecture only 15 years ago. Industrial robotics is a research area in its own, and links closely with other areas of material innovation including mold making, composites, as well as on-site construction. Industrial robots provide an open programmable infrastructure to develop custom task-specific end-effectors for particular applications.

Potential Funders: Kuka Robotics, Staubli, ABB Robotics.  

**Physical Computing Lab**

Today there is a proliferation of “smart” sensing systems through on-board microcontrollers such as Arduino. As opensource technology becomes truly ubiquitous, so does the opportunity to design sensing technologies integrated into the built environment – the internet of things (IoT). The electronics lab provides a working environment for the prototyping of physical computing with important proximity to the larger shop environment as these become integrated into “smart” building systems.

**Constructed Environments Lab + Remote Test Site**

As Climate Change becomes an increasingly pressing issue, research into the mitigation and adaptation of built environmental responses is already escalating. Currently, much of this research is speculative, necessitating further physical study...
related to the interface between built and Earth/living systems. A 21st century teacher-scholar research approach would necessitate a Constructed Environments Laboratory and Outdoor Test Site. These pieces of critical infrastructure would facilitate study into topic areas such as envelope performance, low-carbon operational strategies, temporally tuned building performance, organic building materials, and ecosystem service support, particularly as they further architectural intent.

The Constructed Environments wet/dry lab would combine typical Environmental Control System experimentation spaces such as a small lighting lab with Heliodon, small wind tunnel, and small anechoic chamber with wet lab benches equipment with grow lights, water tanks, temperature controlled microenvironments, and other substrates for working with living organisms.

The Remote Test Site could easily be situated in Poly Canyon, or another wilderness site near campus given minimal, but critical upgrades including an access road, the provisioning of electricity and potable water, and dedicated plot space for undisturbed long-duration experimentation. Other test sites could include Swanton Pacific Ranch near Davenport, CA or the Redwood Forest Institute near Willits.

Potential Funders: AECOM, ARUP, Buro Happold
CONSTRUCTION MANAGEMENT
COLLEGE OF ARCHITECTURE AND ENVIRONMENTAL DESIGN
Construction Management Department:

1. Summary Relative to Facilities and Master Plan
Based on Fall 2014 Master Plan Narrative, briefly describe areas of potential program growth or change in undergraduate, and graduate programs, and in continuing education or other course/curricular/program offerings, that have a potential impact on existing facilities change or expansion:

Undergraduate education in Construction Management (CM) should be the epitome of Learn-by-Doing pedagogical practices and theory. At its core, CM is a practice-based discipline dependent upon experiential learning gained from years of applied professional background. The construction professional is an excellent example of Donald Schöns’s “Reflective Practitioner”, and the educational preparation for this profession must include Schöns’s examples of professional education including studios, case studies, residencies (internships), and management/legal simulations. Elements of each of these are included in the new CM curriculum implemented for all undergraduate students in 2009.

Because of the new facilities constructed to support this curriculum, there are spaces provided in the Construction Innovations Center and the Simpson Strong-Tie Materials Demonstration Lab that provide many opportunities for project-based learning that form the foundation for this undergraduate education. However, these facilities were developed to support a throughput of around 100 to 120 graduates per year assuming four quarters of instruction per year. With 102 new freshmen, six transfers, and 20+ change of majors during the 2014-15 academic year, the CM department is now at this capacity. So, there are two problems to be addressed related to undergraduate program offerings in CM: year-around education and meeting expanding student demand.

The first problem calls for a robust summer school program similar to what was being developed prior to recent offerings of summer school through Extended Education. Addressing the causes behind declining summer enrollment can have an obvious potential impact on the utilization of existing facilities and the need for expanded ones. In the case of CM, student internships are available at any time during the year and the sequence of lab courses can be started during any quarter enabling CM majors to easily transition to non-traditional academic years. In addition, there are sufficient numbers of CM faculty looking for year-around teaching or alternative quarters off contract to meet the demands of a four-quarter schedule. Since we are now at capacity with the assumption of a four-quarter model, failure to provide a robust summer school program will generate an immediate need for additional space allocation and further development of the unique spaces needed to support this curriculum.

The second problem related to undergraduate offerings is the intent of the College to increase the enrollment in CM. The industry demand for CM graduates is now very high with over 200 companies interviewing our graduates through the departmental recruiting program alone. This has led to placement levels of nearly 100% that the department’s graduates have traditionally enjoyed with the exception of times of severe recession in the construction sector (e.g., 2008 to 2011). The application pool for CM also has seen a significant increase in recent years with a 40% increase from fall 2013 to fall 2014 and an additional 10% increase for the fall 2015 class. Nationally, applicant pools remain strong in times of strong capital development markets and the strength of the current market is projected to remain high for the predictable future. For these reasons, the CAED Dean has identified CM as a potential growth area for the College and is supportive of further expansions of student enrollment through student recruitment and eliminating barriers to changes of major into CM. Any further increase in undergraduate enrollment will strain existing facilities and create the demand for additional space allocation of similar facilities.

Beyond the undergraduate program, there has been increasing interest in recent years for developing graduate offerings in CM. Currently, the department has had two Professional Certificate Programs approved by the Academic Senate. One is in Facilities Management and Operations (24 units) and the second is in Construction Management (20 units) intended for non-CM majors and for practicing professionals who do not have a CM degree. Both of these Certificates are built on 500-level graduate coursework and are intended to be offered through Extended Education. Depending on policies related to mixing graduate education supported by State dollars and graduate coursework supported by Extended Education, these Certificates might contribute to the formation of a full Master’s degree in the department. There has been interest in the Civil Engineering Department to offer a dual-degree Master’s in Heavy/Civil Construction Management that would lead to a Master’s degree in Civil Engineering and a Master’s degree in Construction Management. Any graduate program in the department would require the allocation of additional spaces for graduate student offices and research activities as well as the potential need for remote facilities.
2. Possible Impact of Research Models
Based upon continuing development of the teacher: scholar model in conjunction with the student: scholar and student research, and possibly in conjunction with community or industry partners, describe the kinds of spaces necessary to continue to deliver the program at a high level or achieve excellence:

Much of the student research related to Senior Projects is focused on management systems and case studies from project sites. This type of research does not have a major impact on space needs. The same can be said for much of the research completed by faculty. The Construction Innovations Center includes seven Faculty Research labs of about 300 SF each which function more as extended offices for the assigned faculty in support of their research and teaching activities. One of the primary uses of these spaces is for student group use both related to classes and in preparation for regional and national student competitions. These competitions have become a major way for the department to enhance student learn-by-doing opportunities and to assess student achievement against students from peer institutions. About 150 students – nearly half of all the students in the department – participate in competitions or other student professional development each year. The department invests nearly $100,000 per year of privately raised funds to support these important activities. The only potential impact on space utilization is the potential need for additional “Collaboration Classrooms.”

There is an important area of teacher/scholar research that is not now prevalent in the department, but which has a high potential for faculty success and for benefit to the industry. This is in the area of testing for building systems. With modifications and expansion of the Simpson Strong-Tie Materials Demonstration Lab, the Support Shop, the Digital Fabrication Lab, the Poly Canyon, and other hands-on resources in the College, interdisciplinary research into mechanical and electrical systems, sun screening devices, structural connections, glazing and waterproofing systems, and many others can provide excellent opportunities for student experiential learning and for faculty and student interactions with practicing professionals. As existing facilities are fully utilized, this research will have to expand to new facilities on campus. The department sees this as one of the major activity centers in a campus-wide “Makers’ Space” bringing together students and faculty from many disciplines and Colleges. Current College spaces can start to support this research, but additional lab and construction areas are needed to bring this area of inquiry to its fullest potential.

3. Description of Expanded, New, or Evolving Teaching Situations
Based on continuing development of curriculum and/or pedagogy in any of the above, describe the kinds of spaces necessary to continue to deliver the program at a high level or achieve excellence [provide some detail as a placeholder where specifics may not be available]:

As a result of a major capital upgrade coming on line starting in 2008, the Construction Management (CM) Department may be ahead of the curve on issues related to facilities and the curricular programs they can support and enhance. The departmental spaces in the new Construction Innovations Center (Building 186) were programmed, designed, built, and furnished specifically to support a new curriculum in CM. Known as the Integrated Curriculum – developed through a series of pilot studies from 2005 to 2009 – this unique approach replaced 75% of the existing CM coursework when it was fully implemented in 2009.

The Construction Innovations Center includes eleven 2,000 SF “Studio Labs” (as described in Learning Environments for 21st Century “Learn By Doing”) which also function as “Collaboration Classrooms” with some features described as “Smart Classrooms.” In addition, students have access to a 5,000 SF hands-on, full scale construction lab with an equal sized outdoor learning area in the Simpson Strong-Tie Materials Demonstration Lab and Plaza. These spaces support very well the project-based teaching approaches that are at the core of the CM Integrated Curriculum. (For a more complete description of the development of this curriculum and the pedagogical theory which underlies it, reference Monson, C. and Hauck, A. J., “A Comparison of Two Inquiry-based Construction Management Curricula”, 48th Annual Associated Schools of Construction National Conference Proceedings, 2012.)

However, while the Construction Innovations Center and the Materials Demonstration Lab have been highly effective in support of the existing undergraduate program at about the student enrollment levels we are now experiencing, they were not designed to support a graduate program, an enlarged undergraduate enrollment, or expanded programs offered through Extended Education as described in Question 1 above.

As noted before, how much additional space will be needed is directly dependent on University investment in year-around education to more efficiently utilize existing facilities. Utilization of the building four quarters per year and allocation of the two labs on the third floor of the Construction Innovations Center now assigned to the Architecture Department could support growth in student throughput to about 150 graduates per year – about 600 total enrollment
at the undergraduate level. Expanding beyond these levels would necessitate the allocation of spaces – primarily “Studio Labs” of similar size – in other buildings or bringing additional capital projects online.

If the decision is made to pursue a Master’s degree offering in CM, additional “Collaboration Classrooms”, graduate student offices, and assigned research lab spaces (perhaps in the Simpson Strong-Tie Lab) would be needed. If the dual-degree Master’s program with Civil Engineering is determined to be a viable option, some shared resources might be utilized in existing spaces in the College of Engineering, but the availability and allocation of those spaces have not been researched.

The space requirements to support the two Professional Certificate programs described in Question 1 above present some unique challenges. The Construction Management Professional Certificate is primarily focused on an on-campus audience completing their undergraduate programs in related degrees and looking for additional credentials to support a career in construction management or to function better on the interdisciplinary teams associated with nearly all construction projects. For this Certificate, existing spaces will suffice for now, but additional “Collaboration Classrooms” may be needed in the future if the program grows.

The Facilities Management and Operations Certificate is directed at a different audience: the practicing professional looking to complete the Certificate as a standalone alternative or as part of a graduate degree at Cal Poly or elsewhere. The demand for this Certificate exists in the Bay Area, especially in Silicon Valley which is now experiencing a development boom in new facilities for multiple players in the high tech market. Departmental contacts in this market through the International Facilities Management Association Silicon Valley Chapter and the contractors serving this market would supply the training spaces needed in the area initially, but currently, objections from other CSU campuses in the area are preventing the offering of these courses in that area of high demand. As an alternative, all courses in this Certificate have been approved to be offered online, but to date, this has limited the demand for the Certificate to unsustainable levels. Immediate space implications are twofold. To support the online or hybrid offering of these courses, a highly effective “Distance Learning Classroom” would help increase the attractiveness of these offerings to students in the targeted geographic areas and enable the utilization of adjunct faculty physically located neither on campus nor at the students’ location. If the objections of Bay Area campuses can be overcome, the CM department would benefit from a Cal Poly presence in this location. We are aware that other campus entities – such as the Center for Entrepreneurship and Innovation – have considered the benefit of a remote presence in the Bay Area. The CM department could help facilitate that through our contacts in the area and would utilize those spaces if they were available.

4. Possible Partnering
Describe any potential internal university stakeholder partners that may be engaged in developing research or curriculum or pedagogy above and that may benefit from a shared space/use strategy:

The most immediate opportunities for partnering with space utilization exist with the other departments in the CAED. As noted above, expanded hands-on learning labs, such as the Support Shop, Simpson Strong-Tie Lab, and Poly Canyon, would benefit all of the departments and these spaces would be energized by more interdisciplinary projects. Within the College, CM’s closest ties will continue to be with Architecture and Architectural Engineering. Joint research and teaching opportunities are available in the areas of construction/architectural materials, building systems, digital fabrication, and simulations of integrated project delivery methods. While some of this is occurring now, we as a College have yet to live up to the potential for collaboration among our own disciplines.

Outside the College, the most logical partners are in the College of Engineering. Several CM faculty are already engaged in interdisciplinary research projects as co-PI’s with Civil and Electrical Engineering. Two of them also teach in the Fire Engineering program. Additional opportunities for collaboration and the sharing of physical resources are possible through this College which has a more established funded research history. Shared use of their research labs might prevent unnecessary duplication of facilities in our College.

As cited above, if Cal Poly is successful in creating a campus-wide “Makers’ Space” to support a “learn-by-making” pedagogy, this would fit very well into undergraduate and graduate construction management education. Potential partnerships with Engineering, Business, Science, and independent Centers and Institutes (e.g., the Center for Entrepreneurship and Innovation) can be imagined. Faculty in CM strongly support the development of such a centralized production facility as a distinguishing feature of the Cal Poly campus symbolizing its commitment to a Learn-by-Doing approach to education as a differentiator.
Finally, also as listed above, if Cal Poly were to develop a presence for its programs in the Bay Area, the Construction Management Department would be an active participant. Many of our external constituencies are located in that area and the inability to provide course offerings, Certificate programs, and joint programs in that area is a hindrance to further advancement. In addition to support from Bay Area IFMA Chapters and many of the contractors in the area, we are also in the process of developing potential partnerships with the other accredited CM programs at six other CSU campuses. Specific to the Bay Area, we are exploring with CSU East Bay ways that the Cal Poly Professional Certificate Programs might meet their needs to provide additional technical elective options for their graduate program in CM. From a facilities perspective, office and/or training spaces in the area would help to facilitate these options.
Department: **City and Regional planning**

1. **Summary Relative to Facilities and Master Plan**

*Based on Fall 2014 Master Plan Narrative, briefly describe areas of potential program growth or change in undergraduate, and graduate programs, and in continuing education or other course/curricular/program offerings, that has a potential impact on existing facilities change or expansion:*

The CRP Department has four major themes that cut across and respond to the changes anticipated in the profession of planning, which are intrinsically related to the changes anticipated in the demographic, economic, and, environmental conditions in California. These are described in the (tier 2) narrative in the CAED Master Plan. The changes referred to include: student composition – more Hispanic and Asian, more women, more transfer and ICMA students; pedagogic emphasis – sustained commitment to practice based learning - more undergraduate and graduate students who are seeking to practice in California and seeking an education that features a practice-based learning; globalization and local impacts - an increasing need to respond to global economic ties that are deeper and have ubiquitous impact at the local planning level on real estate and business; and climate change and adaptation in land use and environmental planning.

These changes will affect regulatory and governance practices of cities in California and cause the departments pedagogic efforts to: further strengthen our relationships and service to external clients; to broaden and internationalize our efforts to do embedded work; and, to build increased research capacity that allows us to assume an enhanced visibility in featuring our applied research productivity and contributions so that it can help shape practice at the local, regional and state/national levels. By “learning from California” we aim to be the go-to source for exemplary planning practices that attract international attention.

To support these pedagogic and research trajectories a variety of physical spaces and infrastructure will be needed that can be summarized into three categories:

1. Physical enhanced lab/studio spaces that are flexible, smart, allow digital and virtual communication and diminish the friction of distance.
2. Laboratories that enable modeling and three dimensional, visualization technology to enable visioning and “futuring” research at the city and specific plan scale.
3. Infrastructure and space to launch and maintain a digital, virtual “gallery” that features the work of students and faculty in the studios, in applied research, and in academic publications and scholarship that are more theoretical in nature.

2. **Possible Impact of Research Models**

*Based upon continuing development of the teacher : scholar model in conjunction with the student : scholar and student research, and possibly in conjunction with community or industry partners, describe the kinds of spaces necessary to continue to deliver the program at a high level or achieve excellence:*

To enable the work of the department in the above three categories there is a need for the following categories of spaces and infrastructure:

1. Interactive laboratories equipped with digital technologies that allow live and seamless interaction between Cal Poly students, faculty and researchers and national and international “clients” or collaborators with whom instruction and interaction is developed. Labs will be equipped to enable high quality digital and visual recording and documentation of these interactions. Flow of information will include dialogue between participants, interactions with three-D virtual and physical models, drawings and numeric and statistical data. These labs will need to be organized and furnished to enable rearrangement from seminar format to “open plan” office like spaces that will enable small team discussion and production. Four to six of these laboratories would support both teaching and research needs and enable collaborative engagement of partners located nationally and internationally.

2. Visualization laboratories to enable engagement with a regional and city scale level using cutting edge technology to do virtual models that embed projects in real geography/topography. Current practice in planning and urban design utilizes holograms and 3-D technology which students and faculty must embrace
and be versed in. These laboratories would enable faculty to develop applied research in urban and regional planning involving scenario planning, visioning and projection. A research use of these facilities is anticipated.

3. Infrastructure and personnel to create and maintain a Web-based “gallery and library” of cutting edge work of students, faculty and researchers. This would include video archives, models, presentations, collaborative discussions, urban planning and design games and tutorials. It would also feature conventional academic production such as papers, books, publications, white papers and other scholarly output.

3. Description of Expanded, New, or Evolving Teaching Situations
Based on continuing development of curriculum and/or pedagogy in any of the above, describe the kinds of spaces necessary to continue to deliver the program at a high level or achieve excellence [provide some detail as a placeholder where specifics may not be available]:

The three types of spaces and infrastructure described above (item 2) will all contribute to a more flexible, distance-bridging style of teaching that will enable the department to potentially serve a larger community of students through distance and hybrid learning modes and facilitate research that is based on student work and effort. The department’s practice which served to blur the line between student academic effort and practice/ applied research will be strengthened by the facilities and infrastructure described above.

4. Possible Partnering
Describe any potential internal university stakeholder partners that may be engaged in developing research or curriculum or pedagogy above and that may benefit from a shared space/use strategy:

In the area of urban scale real estate development partnerships internally in CAED (CM, LA, Arch.) and with the real estate and finance department of the Business School are envisioned.

In the area of climate change and environmental planning efforts in research and sustainable development with Agriculture and Natural Resource Management and Environmental Science are envisioned.

In the area of transportation and land use a deepening of the established relationship with Civil Engineering is envisioned.
1. Summary Relative to Facilities and Master Plan
Based on Fall 2014 Master Plan Narrative, briefly describe areas of potential program growth or change in undergraduate, and graduate programs, and in continuing education or other course/curricular/program offerings, that has a potential impact on existing facilities change or expansion:

The Landscape Architecture Department’s vision for 2030 focuses around the creation of a learning centered living laboratory. This living laboratory will be designed to embody holistic ecological systems spaces for teaching, research, interdisciplinary collaboration and experimentation. (See Item 2 below.) The development of this living laboratory will address the need for spaces to provide for the following:

- The continuation of a nationally ranked undergraduate program.
  - Developing curricula, which embody state of the art technologies with global and regional concerns and trends.
  - Continue to develop landscape architecture students to be part of a profession with dynamic leadership roles and responsibilities
- The development of a Master’s Program in Landscape Architecture.
- The development of a minor in landscape architecture, which would serve as to provide non-major students exposure to the profession while developing an appreciation and understanding of global issues and regional issues. Specifically, the cultural, natural, political and economic issues related to sustainable environments, urban agriculture, storm water management and climate change issues.
- Increase the enrollment of international students (bilingual course offerings), students from out-of-state, and non traditional-age students. This will include students who may be pursuing and engaged with distance and remote learning (off campus and online) course offerings.
- Develop a strong connection between the teacher-scholar and the student-scholar to enhance the educational experience for both students and faculty.
- Increase new educational experiences in other urban and rural areas.
- Continue and enhance a long-standing tradition of the departmental study abroad program.
- Continue the long-standing tradition off-campus study programs and exchanges.

2. Possible Impact of Research Models
Based upon continuing development of the teacher:scholar model in conjunction with the student:scholar and student research, and possibly in conjunction with community or industry partners, describe the kinds of spaces necessary to continue to deliver the program at a high level or achieve excellence:

The creation of a holistic ecological systems living laboratory should set educational and environmental precedence as well as be a showcase for the state of California and the nation. The actual site and integrated facilities will need 5-10 acres to develop. This living laboratory will include the following flexible and seamless indoor/outdoor spaces for teaching, mentoring, research, interdisciplinary collaboration, and experimentation:

- A facility, which integrates seamlessly both the interior and exterior environments.
- Collaborative indoor/outdoor spaces, which enhance and provide opportunities for partnerships with engineering, agriculture, kinesiology, biological sciences and art.
- Studio spaces which permit the choreography of technology to advance learning outcomes
  - Digital integration of studio spaces to maximize flexibility and use of those spaces
  - Potential for virtual design technologies, 3-D modeling and other experimental technologies
- Dark rooms to employ augmented reality sandboxes that explore topographic design alternatives in a hands on laboratory
- Spaces and overall building technologies which will enhance the ability to examine how the landscape changes, grows and evolves
  - Example: the study of storm water management techniques and urban forestry issues
- Studio space for hybrid Internship/Design Studio Courses with professionals
- Indoor and outdoor gathering areas for discussions, lectures and presentations (both formal and informal).
• Indoor and outdoor spaces for social interaction and spaces for quiet study/meditation
• Shop spaces for:
  o building, experimenting, testing and storage (support the "learn by doing" emphasis)
  o develop an understanding of materiality and landscape performance issues (support the "learn by doing" emphasis)
  o opportunities to develop and test prototypes in the landscape industry
• Administrative spaces, which provide the following:
  o Department Chair (Head) office
  o Offices for reception, administrative assistants, student assistants
  o A place to develop, administer and house partnerships and research projects.
  o Meeting place provide and enhance collaborative relationships.
  o A place to display current student and faculty research and work (both interior and exterior spaces)
• Graduate student office spaces for research, mentoring, and discussions
• Faculty office spaces for research, mentoring and discussions
  o Faculty meeting space (indoor and outdoor) for discussion and collaborations

3. Description of Expanded, New, or Evolving Teaching Situations
Based on continuing development of curriculum and/or pedagogy in any of the above, describe the kinds of spaces necessary to continue to deliver the program at a high level or achieve excellence:
In addition to the needs identified in the previous item:
• Sustainably designed and built spaces
  o Water retention, detention, and water harvesting building technologies
    (example: University of Arizona, Tucson architecture and landscape architecture building)
  o Smart rooms with integration of technology that connects with other smart rooms, studios, and labs across campus that support interdisciplinary teaching opportunities
  o Conference space for graduate student seminars with connectivity capabilities to public partners and private entrepreneurs
  o Dark rooms for exploration of landscape representation technology
  o Publication/presentation/production facilities to disseminate research and design ideations
  o Studio connectivity to outdoor labs and landscape holistic systems infrastructures
  o Physical connectivity to campus core and through alternative transportation systems
  o Accommodations for guest speakers and department business partners
• Interior and exterior spaces should be seamlessly integrated
• Exterior fields that can be developed too mimic urban, suburban, and rural landscape scenarios that facilitate testing of holistic design solutions concerning:
  o Urban agriculture issues
  o Urban forestry issues (healthy street trees and streetscape experiences)
  o Low Impact Development scenarios for stormwater management issues
  o Solar and wind power energy generation footprint’s impact on the landscape
  o Habitat restoration and enhancement

4. Possible Partnering
Describe any potential internal university stakeholder partners that may be engaged in developing research or curriculum or pedagogy above and that may benefit from a shared space/use strategy:

Collaboration within the University:

**College of Agriculture, Food and Environmental Sciences**
- Potential to develop partnerships in research and curriculum, to address topics in urban agriculture and rural landscape issues.
- Develop research and curriculum to address soils including but not limited to watershed management, soil erosion, slope enhancement and urban agricultural issues.

**Orfalea College of Business**
- Continue to nurture the relationship with the MBA program as a potential for continued education for students of Landscape Architecture
- Develop a partnership to develop collaborative courses for landscape architecture students that emphasize business and leadership development, marketing potential, etc.

**College of Science and Math**
- Enhance relationships and develop strong partnerships with the following departments to develop potential research projects and apply for appropriate funding: (examples)
  o Biology: plant habitat and growth issues in urban areas (street tree planting), wetland mitigation projects
  o Kinesiology: health (social, cultural, medically) issues related to obesity, exercise and outdoor spaces
  o Liberal Studies: the impact of art in public spaces, the landscape as art
  o School of Education: how does K-12 school designs impact the education of the children, study of children’s play areas, potential for schools to have wetlands, forests, gardens, agriculture to study the sciences, etc.

**College of Engineering**
- Develop a stronger relationship with the Civil and Environmental Engineering Department to engage with common courses for watershed management issues

**College of Liberal Arts**
- Using the arts as a muse/inspiration to design
• History of Landscape Architecture as a course for art and design majors

Collaboration within our own College of Architecture and Environmental Design: research topics and project types for partnership
• Architecture/Architectural Engineering:
  o Interface between the built and natural environment
• Construction management
  o Project Delivery
  o Budgeting
• City and Regional Planning
  o Housing development
  o Climate change
  o Walkability
  o Transportation

Partnering with other Universities, nationally and internationally
• Establishment of more off campus study opportunities for both faculty and students.
• Establishing partnerships with universities that may have similar research agendas to share information

Partnering with other Governmental Agencies including but not limited to the following:
• National Park Service
  o Visitor services
  o Campsites
  o Trail design
  o Entry experiences
  o Accessibility issues
• California Department of Transportation (using research Grants and other funding): soil erosion and slope management, wetland mitigation projects, watershed management projects
• Cities: potential projects
  o urban renewal, street tree planting, park development, neighborhood restoration, playgrounds
• Counties
  o Regional park development or enhancements
  o Trail and bikeway enhancements
  o Rural landscape issues such as agriculture preserves, viewshed protection and management,

Partnering with Industry:
• Nursery Growers Association of California
  o California native plant specifications and availability
  o Drought tolerant plant specifications and availability
• Irrigation Manufacturers
• California Landscape Contractors
  o Enhancement of design/build scenarios within the curriculum

Partnering with Landscape Architecture and Allied Professionals:
• LADAC: Landscape Architecture Department Advisory Council
• Northern and Southern California Chapters of the American Society of Landscape Architects
• AIA: American Institute of Architects