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New Directions in the College of Engineering

A Master Plan for the New Century

The Facilities Master Plan for the College of Engineering was prepared following Berkeley's campus wide planning effort, documented in the *New Century Plan: A Strategic Plan for Capital Investment at UC Berkeley*. The College of Engineering Master Plan takes advantage of this opportunity to shape the future of much of the NE quadrant of the UC Berkeley campus. The time for this study is opportune: significant changes are now underway throughout this precinct. The landmark Hearst Memorial Mining Building renovation is nearing completion and there are plans for other new and renovated facilities. The Davis Hall North Replacement Building for CITRIS, the Center for Information Technology Research in the Interest of Society, currently being designed, is a new building that will set the mark for engineering facilities to come. At the same time, the future of the Richmond Field Station, a significant holding of the university with an historic connection to the College of Engineering, is under review. The ultimate role of the Field Station, and the efficiency and utilization of existing campus sites, must be defined as the engineering disciplines evolve in new directions.

The master plan looks globally at the College of Engineering, focusing on the following issues:

- Supporting social interaction: strengthening and creating community
- Supporting interdisciplinary research and teaching,
- Responding to change, reconfiguring with flexibility
- Adapting to changes in information infrastructure and the mobility of students and faculty
- Strengthening the College's sense of place.

The master plan is derived from the needs of both the College and the UC Berkeley campus. Within its 20-year horizon, the master plan anticipates the scope and character of future facilities needs and sets the urban design parameters for those facilities. The master plan also defines, very generally, the role of the Richmond Field Station, although the physical plan is for the Berkeley central campus only. The Richmond site gives flexibility to the facilities plan and offers opportunities for considering new directions.
Current Trends in Engineering Education

Engineering education will be a very different endeavor in ten years. Changes will result from evolving technology, from the redefinition of traditional engineering disciplines and from the multi-disciplinary future of the sciences. There is rapid growth in new and emerging fields, such as bio-engineering and computer science. The traditional disciplines are also seeking to re-define their roles in society. In the future, both instruction and research in the College of Engineering will be explored in interdisciplinary environments. The newly created CITRIS will be a model for interdisciplinary research, encouraging and supporting interactions between engineering disciplines and others on the campus. As this research grows and changes, facilities will need to adapt to the changing agenda. There will also be incubator space where the College can both integrate research into its educational program and interface with the world of industry and the private sector economy.

Pedagogy. At the same time that engineering research is changing, the education of future engineers is changing as well. Consider these changes at Berkeley as education engineering, that is, applying the problem-solving methods and rigorous thinking of engineering to the processes of education itself. The College is moving away from the batch processing of students and is, instead, encouraging idea exchange among faculty, post-doctoral researchers, graduate students, and undergraduates. In some ways, the idea of an academic department is becoming a virtual concept: teaching, as well as research, is increasingly crossing disciplinary lines, and education is happening in more diverse kinds of spaces and by non-traditional means. For example, students and faculty alike use laptop computers with wireless Internet access to conduct their work and to facilitate their communication. The library is now a place for meetings, no longer just a warehouse for books. The educational future of the College also includes distance learning and life-long learning.

Adapting space to the changing discipline. Most of the College's physical plant dates from the early 1900s the middle 1900's. The physical plant also includes several older, historic structures, but the College's future, but its future should not be constrained by the limitations of any of these structures. Some historic facilities have Some facilities have already been adapted to the new needs of instruction and research. The Hearst Memorial Mining Building, for example, will house, in addition to modern teaching and research facilities, a new nanosystems program under the CITRIS umbrella. Other historic buildings, such as Naval Architecture and McLaughlin Hall, can be renovated for classroom and office uses appropriate to their scale, form, and location. Seismically poor buildings, such as Davis Hall North, can be replaced with new buildings that meet the latest needs of the College of Engineering. The Davis Hall North replacement building, currently being designed, will house a new microfabrication laboratory and the new CITRIS program as well as a center for distance learning.

1 “CITRIS” refers to the research center as an institution; “CITRIS II” refers to that part of CITRIS that will be housed in the Davis Hall North Replacement Building. Additional CITRIS components will be housed in the Hearst Memorial Mining Building, the Stanley Replacement Building, Soda Hall, and other buildings in the College.
Planning Objectives

Campus Wide Goals

The College of Engineering Master Plan looks at the needs of the College through the policy framework of the *New Century Plan: A Strategic Plan for Capital Investment at UC Berkeley* (version 01.1, 2001). Using that framework, the recommendations of the College of Engineering Master Plan focus on the particular needs and interests of the College of Engineering within the context of the campus as a whole.

The New Century Plan defines six strategic goals which inform the overall organization of the plan and guide its recommendations. These goals directly apply to the College of Engineering Master Plan as well. The following five goals, emerging from the New Century Plan, create the framework for College of Engineering Master Plan concept, facilities and development plans.

**Optimizing limited resources.** The New Century Plan calls for the campus to make decisions that optimize investments in terms of their overall benefit to the campus. In the College of Engineering this applies to several major existing facilities, including Cory and McLaughlin Halls. The nearly completed renovation of Hearst Memorial Mining Building is an excellent example of leveraging seismic retrofit funds to stabilize an important building and adapt it for current academic needs. The COE Master Plan considers the College facilities needs in the context of funding opportunities and investment return.

**Planning for growth.** The College of Engineering, as well as the campus, continues to discuss and debate the impact of additional new students. This growth, of course, will can best be accommodated not only by the most efficient possible use of available space but also by operational changes in the management and organization of administration, research and instruction.

**Creating Interdisciplinary models.** Research both campus wide and within the COE has become increasingly interdisciplinary. Through CITRIS, and similar groups on campus, connections will be made with other departments and colleges and with other campuses as well as with private industry. These connections will generate new kinds of research facilities in the College as well as new approaches to research management.

**Maintaining a competitive edge.** Nowhere has this been more evident than in the need to build and retrofit buildings that serve the rapidly advancing fields of electrical engineering and computer science. However, this is critical for the other disciplines as well. The COE Master Plan anticipates the on-going need for new facilities and equipment with a series of strategic options that allow the College to prioritize its needs for advanced research and development space. The plan also anticipates collaborative models of research and instruction with related private and public concerns.

*Excerpts from The New Century Plan: A Strategic Plan for Capital Investment at UC Berkeley, 2001*
Creating public space. Public space in the College is limited. There are few opportunities for the informal exchange of ideas and there is no identifiable College center. Without public space, the College cannot successfully build a community. An integral part of the College’s development strategy must be to provide such places for its faculty, staff, and students, and for the campus community at large. The College must do this not only to compete with the private sector but because it is the university’s responsibility, as a public institution, to set the standard for environmental quality.

College of Engineering Mission and Goals

Mission and vision of the College. The Dean of the College has stated that, “The mission of the College of Engineering is to educate men and women for careers of leadership and innovation in engineering and related fields; to expand the base of engineering knowledge through original research; to develop technology to serve the needs of society; and to benefit the public through service to industry, government, and the engineering profession.” This mission aligns with an educational vision that sees that increasingly rapid advances in technology are creating unprecedented opportunities for innovation in every field. Today, opportunities to benefit society by means of engineering advancements are unparalleled in history. As a national leader in engineering education, UC Berkeley’s College of Engineering is positioned to make major contributions.

Goals of the College.

1) Retain and strengthen a faculty and staff of world-leading quality. Assure that excellence and diversity are reflected in the faculty, staff and student body.
2) Foster high-impact research in multi-disciplinary areas and maintain the highest standards in traditional research areas, increasing research opportunities for graduate students.
3) Continuously improve the education and preparation of undergraduate students by offering innovative programs and excellent teaching
4) Provide a world-class infrastructure of laboratories and classrooms, allowing top-quality research and teaching to flourish.
5) Heighten teaching productivity and outreach by the creative and effective use of instructional and distance learning technologies.
Objectives of the Master Plan.

To meet its goals, the College identified the following objectives for its Master Plan and master planning process:

1) Define a space model for the College that moves away from self-contained departmental centers toward a model based on College-wide space needs for instruction and research.

2) Improve circulation pathways between College buildings to allow for easier pedestrian movement in this precinct. Maximize passive ADA disabled access throughout the precinct.

3) Plan for flexibility and adaptability in facilities and operations.

4) Evaluate food service and other common facilities to enhance the Berkeley social experience and create a College gathering place.

5) Standardize classroom design throughout the College and incorporate the latest instructional technology.

6) Locate general assignment classrooms and undergraduate classes so that students can attend undergraduate classes without crossing Hearst Avenue.

7) Evaluate current space usage and combine duplicate functions to achieve additional use from existing space.

8) Combine departmental shops to improve space efficiency, protect jobs and improve shop services.

9) Identify space large enough to consolidate the Dean's office staff, centrally located to the College.

10) Maximize the use of assets at Richmond Field Station by relocating appropriate research and testing equipment to Richmond when possible.

11) Relocate large scale projects and/or underutilized research equipment from the central campus to more functionally appropriate locations.

12) Incorporate CITRIS, central campus and seismic renovations plans in a strategic plan for development.
Summary of Planning Purposes.

The above objectives fall into two groups: in one group are those that address the physical plan of the College, in the second group, are those that address the policy implications of the physical plan. The Master Plan primarily defines a physical development plan for the College. The Master Plan respects the historic plan of the Berkeley campus and suggests ways to reconstitute the relationship between College of Engineering buildings and the university's central open space and to improve linkages between the College and the rest of the campus. The Master Plan also proposes ways to improve circulation through the College. The Master Plan includes a proposal for a pedestrian link across Hearst Avenue, recognizing that the presence of COE departments across the street create a second address for the College on Hearst Avenue. By re-establishing connections to the campus core on the south and by creating links to the north, the plan seeks to promote an open and accessible character for COE that will encourage broader College-wide and campus wide interaction.

In addition, embedded in the first group of master plan objectives is the need to understand how space in the College is currently used. The Master Plan should improve space utilization efficiencies, acknowledging the current movement toward interdisciplinary activities. In the present model, individual departments dominate the control of space, with individual buildings identified with a particular department. In recent years there has been some movement toward shared tenancies. For example, Etcheverry Hall houses Mechanical Engineering, Nuclear Engineering, and Industrial Engineering and Operations. There has also been a trend toward interdisciplinary research projects and other collaborations among departments and across disciplines. These have, of course, administrative implications beyond the scope of this master plan, and these are reflected in the second group of objectives.

The Master Plan proposes flexible strategies for meeting instructional and research space needs that allow for change and that make institutional and organizational barriers more transparent. The College views itself as growing in the direction of an interdisciplinary core with research-oriented satellite departments. This interdisciplinary model would replace or reprogram other buildings at the core location with facilities similar in their space and use mix to CITRIS II (Davis Hall North Replacement Building), which is intended to attract research from outside the College as well as from within. This new core could take on either a research or instructional emphasis and relieve the space demands within each of the satellite facilities. (For example, an instructional emphasis in the core could allow expanded research facilities in the vacated instructional space in the satellites).

To further develop this conceptual model, planning and administrative decisions must should:

1. Support the development of a new interdisciplinary core;
2. Encourage interdisciplinary efforts; and
3. Adapt and expand existing and proposed buildings to support those interdisciplinary efforts.
A spatial organizing model for College of Engineering planning, based on an interdisciplinary core with research-oriented satellite departments.
Planning Background

**Development opportunities.** A survey of existing conditions confirms that every feasible building site in the College of Engineering precinct is already occupied. Growth of the College on the Berkeley campus can therefore only occur by combining replacement with intensification.

- The *Hearst Memorial Mining* and *Naval Architecture Buildings* are both historical buildings. An extensive renovation of HMMB is almost complete. Some space has been added. Naval Architecture will not be demolished and it is unlikely that any addition to it will substantially intensify the use of its site.

- *McLaughlin Hall* warrants retention.

- *Cory, Soda, and Etcheverry Halls*’ high level of utility and satisfactory seismic ratings make them unlikely candidates for replacement. All three buildings maximize their site development capacity. Future improvements to these buildings are unlikely to alter the fundamental structure of the master plan.

- *Hesse and O’Brien Halls* are both less developed than their sites permit. While Hesse has been poorly modified over the years, and is arguably approaching the end of its usable life, O’Brien is a sound and well-functioning building. Taken together, however, the combined site represents a significant redevelopment opportunity; taken separately, the redevelopment potential of each is limited.

- *Bechtel Hall* provides valuable amenities: an open space with food service and southern exposure, the College library, and the largest auditorium within the COE. However, it underutilizes its site, occupying space that could profoundly alter the character of the COE if developed in a different manner.

- *Davis Hall North* has been identified as the site for the new CITRIS II project.

- *Davis Hall South* is earmarked for seismic remediation by 2005, and the State has provisionally allocated $49 million for this purpose. The cost of seismic rehabilitation is likely to be high, and the quality of the building is questionable given its inflexibility to meet future needs. The cost-to-value ratio of rehabilitation is expected to indicate that demolition and replacement of the building may be the most feasible option. Civil and Environmental Engineering Department representatives, who are the primary tenants of Davis Hall South, have stated their preference for replacement of the existing building.
Open space opportunities. To be successful, infill development in a dense urban context, as in this campus precinct, must satisfy a number of criteria. It should typically maximize development opportunities, minimize disruption, integrate its parts through coordinated design, and be phased to maintain satisfying quality of life during construction periods. Infill development also carries with it a special obligation to improve relationships between buildings. This involves careful consideration of the spaces that separate buildings when they face one another and attention to the common foreground when they are side-by-side.

The common elements are the spaces that separate buildings and/or provide their settings. In the College of Engineering these spaces are Hearst Avenue and its sidewalks; the landscape around the Naval Architecture building; the two north-south terraces on either side of the Davis Halls, Bechtel Terrace, the route from Hearst Mining Building to Founders Rock; the avenue that leads from North Gate to Naval Architecture (Soulé Road); and the space between Cory and Hearst. There are also the proposed east/west internal streets as well as the edge established by the Central Glade south of the COE buildings.

Definition of Project Areas. Using these criteria, three project areas have been defined for the COE:

1. Davis Hall North /Naval Architecture. This project area should include both buildings and should also include both sides of Hearst Avenue between Etcheverry and Cory Halls. This includes the pedestrian crossings as well as the transition from public right-of-way to the north-south terraces. Other spaces that are part of this project area are the landscaped area surrounding Naval Architecture from North Gate to CITRIS and the part of Soulé Road that provides handicapped access at grade from North Gate to the West Terrace.

2. Hesse/O'Brien/McLaughlin. This project area will be developed as a replacement for Davis Hall South and will include further development of the West Terrace. This project area also includes the rest of Soulé Road between the West Terrace and North Gate, the McCone/McLaughlin plaza, improvements to University Walk and connections to the Campanile Promenade as proposed in the New Century Plan.

3. Davis Hall South/Bechtel. This project area will include the completion of the East and West Terraces and University Walk and the creation of new internal east-west streets. Long range development of this site is earmarked for interdisciplinary facilities building on the CITRIS concept.

More than just the “spaces in-between,” open space should serve as a major organizing principle for the College precinct.
RECOMMENDATION
Given that new buildings will be replacing older ones, and that growth will be limited to the resulting net increases, every future development opportunity should be maximized in terms of density and building intensification, within design limits that will safeguard and ensure the quality of the physical and social environment at the College.
Master planning principles: Establishing a sense of place for the College.

General Organizing Principles for College of Engineering Facilities

The Master Plan proposes a set of recommendations that will create a clear sense of place for the College of Engineering. These recommendations define the five main principles of the College of Engineering Facilities Master Plan.

1. Establishment of an Interdisciplinary Core to accommodate future directions in engineering education and research and to respond to campus wide trends. The CITRIS II project is a first example of an interdisciplinary academic facility.

2. Restoration of a functional circulation grid that will strengthen the north-south pedestrian corridors implicit in the formal axes of the 1914 John Galen Howard plan. This will re-establish east-west linkages within the College precinct that facilitate movement and communication between McLaughlin Hall to the west and Cory Hall and the Hearst Memorial Mining Building to the east. A logical circulation grid will also help address the problem of pedestrian crossings at Hearst Avenue, a busy public street.

3. Creation of a public center for the College by improving the West Terrace, the space between Davis and O’Brien Halls that aligns with the Campanile axis. Planned to provide a central focus to the precinct, the West Terrace will take its life from accessible public activity spaces located on the ground floors of surrounding buildings. As the first new building to have a frontage on the West Terrace, the Davis Hall North Replacement Building, CITRIS II, provides an opportunity to introduce such activities to this space.

4. Distribution of functions based on frequency and type of access, placing the more public student and campus oriented uses on the south edge of the
The master plan for the campus prepared by John Galen Howard in 1914 established the primary design principles that continue to guide campus development.

 precinct where higher volumes of student traffic are closer to the campus center. Place the more private research oriented functions at the north. This same principle also locates the public and student oriented space at ground-level floors and the more private research and faculty space on upper levels.

5. Reinforcement of college identity, defining its presence both on the Central Glade to the south where it joins the larger university, and on Hearst Avenue to the north, where its address is more public. The College Master Plan calls for development of a new University Walk along its southern edge and for improved frontage design and street crossings on Hearst Avenue.

Design Principles

Campus planning framework. The master plan for the College takes its references from the 1914 John Galen Howard plan for the campus. The structure of the Howard plan embodies a very clear idea: a central open space spine, tightly edged by buildings that define the space. In Howard's plan this Central Glade establishes the main axis from the hills to the east to the bay and the Golden Gate to the west. Campanile Way forms a parallel east-west spine.

The master plan also respects the objectives of the New Century Plan, which emphasizes that "the quality of [Berkeley's] open space [is] a critical factor in faculty and student retention," and notes that "decades of under-investment in the campus 'public realm' have led to the perceptible decline in the visual quality and social amenity of the campus." First class buildings and the quality of their settings are thereby regarded as reciprocal attributes of a premier campus.

The master plan for the campus prepared by John Galen Howard in 1914 established the primary design principles that continue to guide campus development.
Integration with the campus. To promote improved long range integration of the College of Engineering into the campus framework, several principles are recommended:

Re-establish the relationship of the College of Engineering to the Central Glade, in the manner intended by John Galen Howard.

- Introduce University Walk as a formal east-west pedestrian promenade at the south edge of the College of Engineering. The walk should improve access through the Central Glade and provide an accessible path of travel.
- Along this edge new buildings should conform to a build-to line and cornice height established by McLaughlin Hall and the Hearst Memorial Mining Building.

Promote greater interaction of the College with the larger campus.

- Locate the most general uses those with the greatest potential participation from the general campus population, such as student services, classrooms and other amenities at the southern edge of the College along University Walk.
- Organize the College around a central spine that consists primarily of interdisciplinary and common uses, and establish physical and organizational linkages to departments farther from the core.
- Reconfigure McLaughlin Hall to provide more general assignment classrooms.

Improve linkages between the College and the campus by enhancing the two north-south terraces and the McCon/McLaughlin plaza.

- Transform the West Terrace and East Terrace, now functioning merely as pedestrian corridors, into a series of well-landscaped, sunlit spaces and places of interaction.
- Create a graceful grade transition from the West Terrace to the Central Glade and the Campanile Esplanade.
- Landscape the West Terrace to strengthen its spatial perception as an extension of the north-south Campanile axis.
- Locate a 24-hour center along the west side of the West Terrace that would provide an auditorium, food facilities, social amenities, and 24-hour study facilities for students and faculty.
- Improve and activate the plaza between McCon and McLauglin Halls as a sunny terrace overlooking Memorial Glade and as part of the diagonal movement through the College from the Glade to the high ground along Hearst Avenue at Cory Hall.
Integration with the community. As the College has a major frontage on both sides of Hearst Avenue, strong pedestrian links across the street will better address the integration of the College into the physical fabric of the adjoining Berkeley neighborhoods.

Design the Hearst Avenue frontage to provide an enhanced public entrance into the College, to include:

- Improved pedestrian crossings at LeRoy Avenue and a mid-block pedestrian crossing between LeRoy and Euclid, including the use of bump-outs to narrow the length of roadway traversed by the pedestrian;
- An improved landscaped open space at Davis Hall North Replacement Building and Naval Architecture to provide a new entry into the College precinct.
Facilities Requirements

Space Needs Program

Instructional and research programs in the College of Engineering have changed dramatically in the years since most buildings in this precinct were built. Space appropriate for interdepartmental and interdisciplinary teaching and research has become an increasingly important priority for the College. Emerging technologies also require new facilities. The percentage of UC Berkeley students enrolling in the College has increased as well, creating demand for additional instructional facilities.

All feasible building sites in the College have already been used. The College must meet its demand for change and growth in one of two ways: either by replacement and intensive redevelopment of existing campus buildings, or by relocation off campus at satellite sites such as the Richmond Field Station. As discussed later in this chapter, there is disagreement in the College about whether or not programs located at RFS can be successfully integrated into campus academic life.

The need to renovate or replace seismically deficient buildings provides opportunities for the College to keep pace with advancing technology and changing work, study and administrative environments. In its statement of purpose, the New Century Plan emphasizes that “the quality of our facilities [is] a critical factor in faculty and student retention,” that there is a need to “upgrade or replace those [facilities] which no longer meet the needs of today’s academic program,” and that the “increasingly interdisciplinary nature of both instruction and research has begun to fracture the traditional model of campus organization based on self-contained disciplines.” The sum of these factors, especially the seismic limitations of existing College of Engineering buildings such as Davis Hall North, Davis Hall South and McLaughlin Hall, is driving redevelopment and new construction for COE. In the long term, future building on COE sites should be planned to optimize the development capacity of those sites.

General Space Plan Summary

<table>
<thead>
<tr>
<th>Category</th>
<th>Existing</th>
<th>Long Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>997,000 gsf</td>
<td>1,277,000 gsf</td>
</tr>
<tr>
<td>(excluding Stanley Hall)</td>
<td>587,000 asf</td>
<td>755,000 asf</td>
</tr>
<tr>
<td>Net increase:</td>
<td>280,000 gsf</td>
<td>168,000 asf</td>
</tr>
</tbody>
</table>

Assumes the demolition of:
Davis Hall North, Davis Hall South, Hesse and O'Brien Halls

Assumes the renovation of:
Naval Architecture, Cory and McLaughlin Halls

Assumes new construction of:
Replacement buildings on the sites of Davis North, Davis Hall South, Hesse/O'Brien
The role of Richmond Field Station. The College of Engineering manages the off-site research center at the Richmond Field Station, a 152 acre site approximately eight miles northwest of the Berkeley campus. Located in Richmond, directly on San Francisco Bay, the site contains environmentally sensitive areas of salt marsh, native grassland, prime coastal prairie, and old stands of eucalyptus that seasonally host large flocks of monarch butterflies. A total of 87 acres, however, is available for development, and currently approximately 80 buildings totaling 500,000 asf serve four colleges, the Northern Regional Library, and the Lawrence Berkeley Laboratories. This Master Plan identifies COE's options for future use of the RFS.

At this time, a broader university task force has been appointed to review and make recommendations about the use of the Richmond Field Station. Long recognized as a valuable potential asset to the campus, the Richmond Field Station has typically housed College and some university research activities that could not be accommodated on the central campus. There are also some non-campus groups at the RFS. A mid-1980s development plan for the RFS identified it as a research center with the COE as primary user.

Current university facilities at RFS vary from large-scale testing equipment for which there is no space on the central campus to Department of Art Practice painting studios. The definition of what appropriately belongs at Richmond has changed over time. The College's on-campus wind tunnels and combustion laboratories, for example, were once located at RFS but were moved back to campus in the late 1970s because, not only was it more convenient to the users, but, importantly, on-campus space was available at the time.

Existing Occupancies at Richmond Field Station

<table>
<thead>
<tr>
<th>UC Berkeley</th>
<th>Other agencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture .......................... 200</td>
<td>Northern Regional Library (UC) 156,000</td>
</tr>
<tr>
<td>Art Practice .......................... 6,600</td>
<td>EPA Laboratories 40,000</td>
</tr>
<tr>
<td>Engineering ........................... 210,700</td>
<td>Subtotal, Other 196,000 asf</td>
</tr>
<tr>
<td>Forest Products ........................ 37,500</td>
<td>Total 495,400 asf</td>
</tr>
<tr>
<td>Lawrence Berkeley Laboratories .... 1,700</td>
<td>Subtotal, UC Berkeley 299,400 asf</td>
</tr>
<tr>
<td>LOHP ................................... 2,200</td>
<td></td>
</tr>
<tr>
<td>Support .................................. 40,500</td>
<td></td>
</tr>
</tbody>
</table>

The university's Richmond Field Station is located some 8 miles distance from the Berkeley campus on a 152 acre site that currently contains approximately 300,000 asf of university research facilities as well as the Northern Regional Library and laboratories for the U.S. Environmental Protection Agency.
Even without a comprehensive plan for its use or future development, RFS offers substantial benefits to programs located there. RFS offers a secure, easily controlled environment for sensitive activities, and has a high-capacity communications infrastructure in place. It provides unique space for dirty, dangerous and difficult functions such as the large-scale structural shake tables, automated cars and model helicopters. RFS might also be an appropriate site for other types of research that cannot be done on campus. It is an excellent location for activities that typically do not involve large numbers of students.

There is, however, a general reluctance to locate at RFS. Faculty and students note that one missing quality is interaction with the larger academic community. RFS, about eight miles from Berkeley, is too distant, according to this view, for people to maintain a connection to campus. Support services are missing at Richmond. Without food or coffee services, without study and academic support functions, it is difficult to maintain a cohesive academic community. Transportation is a problem as well, and the travel time required to get to RFS is considered a major obstacle. Although travel is routine at institutions such as Harvard and MIT, people at Berkeley are not accustomed to traveling. Students might find the commute worthwhile if they could spend an extended period of time on site. Faculty and research staff find that the problem of parking their cars on their return to Berkeley after visits to Richmond is a significant problem. Current plans do call for improved transportation services in coordination with the DHS shuttle from downtown Berkeley.

Perhaps the most serious disincentive to locating at Richmond, however, is that activities have not been located there as part of a comprehensive development plan. For the most part, Richmond has been used for spillover functions from campus, and so it has been perceived as a place of exile to which no one willingly moves. Those who do move, however, enjoy the bay view setting, free parking, and space to expand. To overcome resistance, the university should take the lead role in developing RFS. Development should include a service core with food service, social facilities, student study centers, and conference facilities. Very important is to have a critical mass of people at the site. To succeed as a campus satellite, RFS will need to maintain strong physical links with the Berkeley campus, and will need occupants whose prestigious research programs come from a cross-section of university departments and programs. Instead
of spillover functions, RFS must have attractor activities. Use of the site for surge planning may aggravate rather than help the negative perception of RFS. Surge space will also be needed sooner than the necessary critical mass of attractor uses can be developed at Richmond. The College of Engineering should take a lead role in assembling a consortium of other campus departments, research units, and off-campus users to be a core user group at the RFS.

With a comprehensive and proactive development plan in place at Richmond, there will be opportunities to integrate the Berkeley and Richmond campuses. For example, Bio-Engineering is currently offering well received course modules with lab-classes at Richmond. With additional classrooms and study support facilities, such as computer labs and library study rooms, RFS could be a magnet for other departments to offer such courses as well. Building on the small core of existing research management groups already located there, Richmond could become a center for clusters of administrative functions. As back office operations for major ORUs are moved or surged off campus as part of seismic projects, some of these may locate at Richmond contributing to the critical mass there. Distance learning and life-long learning centers could also be at RFS. Other strategies for integrating the RFS with the core campus could include developing recreation facilities, greenhouses, student machine shops, a conference center with lodging or a small suite hotel for visiting scholars. RFS is a good location for some biology field studies and campus clubs. With a clear framework the university could issue requests for project proposals for programs and space use at RFS.
Conditions at the Richmond site represent a unique opportunity for planning and action. As the development climate has slowed following recent years' unprecedented growth, the university can plan now to take advantage of the next upturn's demand for shoreline development. The City of Richmond continues to express interest in the university's use of the site and may be interested in ways that the university and the community can pursue programs of mutual benefit such as employment opportunities in connection with the physical and economic development of the site. Plans by private owners of adjoining sites might afford an opportunity for private-public partnerships in technology research and development. Industry was enthusiastic about earlier proposals to build a research center at a site nearer to campus, and there may be potential donors in the real estate community or other sectors who would be interested in investing in such a joint venture.

The task force studying the Richmond Field Station options should consider a range of approaches to University development of the site. The three options that follow are compatible with current Master Plan direction for the College of Engineering. The College Master Plan assumes that, in the future, the RFS will accommodate research or research-centered instruction whose equipment requires large area or special criteria along with other activities that complete the student experience.

**Option 1.** Growth at Richmond continues to occur incrementally but with a more aggressive marketing of the site to university users.

**Option 2.** A satellite research campus is developed at the site and promoted for a range of academic facilities, including instructional space and student support facilities.

**Option 3.** A public-private venture with private developers and with the City of Richmond is pursued to develop the site as a research center that includes conference-type facilities, lodging, and other amenities.

One conceptual framework for Richmond Field Station would establish it as a satellite campus with research ties to industry.
Facilities Requirements

College of Engineering space falls into five functional categories:

**Administrative facilities** include office space for the Dean, for departmental administrative functions, and for the College's Organized Research Units (ORUs). Student affairs offices and the COE Development Office are included in this category.

**Instructional facilities** include general assignment, departmental and College classrooms, seminar rooms and instructional laboratories.

**Laboratory and other research facilities** include wet laboratories, equipment rooms, testing equipment, and flexible space used for computation, robotics, and other technology.

**Academic support facilities** include libraries, student computer labs and study centers, student organization offices, machine shops, food services and other amenities.

**Building support facilities** include building service, shipping and receiving and storage.

**Administrative Facilities**

**Dean’s office.** The administrative center of the College of Engineering, approximately 16,000 asf, is located mainly in McLaughlin Hall with additional functions in Naval Architecture and Bechtel Hall. Approximately 8,500 asf is the core administrative function; other functions include a publications unit (900 asf), an industry relations unit (400 asf), a student affairs unit (2,200 asf), and academic advising (3,900 asf).

An important part of the core administrative space is the Dean's office itself and its associated reception area and conference room. In this area the College hosts academic and non academic visitors, prospective faculty, researchers, students and private and corporate donors. These facilities present the College's public face. Two very appropriate options for housing these Dean's office spaces are Naval Architecture with its public orientation on Hearst Avenue and its easy access from the College precinct center, and Hearst Memorial Mining with its highly imageable presence on Hearst Mining Circle. While current plans for occupancy of Hearst Memorial Mining are research-oriented and do not include provision for administrative space, such a location for the Dean's office should not be precluded in the future. Naval Architecture could be renovated to accommodate these core functions although this location would require either locating Dean's office functions in two or more places, or compressing these administrative activities since Naval Architecture has about 1000 asf less than current Dean's office space.

**RECOMMENDATION**

Move most of the Dean's office to Naval Architecture.

If necessary, expand the building below ground, taking advantage of the construction process associated with the Davis Hall North Replacement Building to do so.

Co-locate the student affairs and academic advising functions of the Dean’s office with other student-oriented activities in a 24-hour center on the West Terrace.

Create a student and visitor welcome center as part of the West Terrace that orients visitors and prospective students to the College’s programs and facilities.
Other Dean's office functions are oriented toward the general life of the College and should be located near the center of student life. Essential student services could join other support services as a part of a 24-hour center accessible from the proposed West Terrace, the lively new public space proposed for the College of Engineering.

**Departmental offices.** Most administrative and office space in the College is distributed throughout the buildings in departmental and research offices. These facilities play a central role in the life of each department. These spaces should be designed as distinct centers with associated amenities, exhibit areas, meeting spaces, and a character that reflects the departments they serve.

**Organized Research Units (ORUs).** Significant users of space within the College are its principal Organized Research Units, established by the university to manage the research projects that engage faculty, graduate students, and research associates. Many of these projects are interdepartmental and interdisciplinary in character. ORU staff manage research project budgets, support faculty seeking research funding, work on publications and do other administrative work associated with research. The core spaces and functions of each ORU are administrative. Often, ORUs are closely affiliated with a specific department, and some departments and ORUs share the same staff. Laboratory space for the research itself is usually the purview of the departments although there are many exceptions to this. Approximately 45,000 asf of research space is assigned to an ORU.

ORU activities also include reaching out to other institutions and to private industry. Space for ORUs is severely limited on the central campus and there are often constraints placed on the use of campus space for public-private collaborations. The university's New Century Plan generally identifies ORUs as candidates for nearby off-campus sites.

Engineering research units are good candidates for a new University Research Center at the Richmond Field Station and would help such a center achieve a critical mass of users.

**RECOMMENDATION**
Departmental offices should remain decentralized in close proximity to related departmental facilities and their respective faculty.

Each departmental cluster should have a core, with break areas, mail and copy rooms, conference rooms, etc.

**RECOMMENDATION**
Consider relocating the offices and laboratories of College of Engineering ORUs to a new University Research Center in Richmond. Such a center would be enhanced by new buildings, improved transportation connections, support services and amenities, and adjacency to new nearby industry facilities.
Instructional Facilities

**General assignment classrooms.** There are currently 16 general assignment classrooms located in four buildings within the College of Engineering. In all, these classrooms occupy approximately 14,000 asf and provide a total of 850 classroom seats.

<table>
<thead>
<tr>
<th>Building Location</th>
<th>Number of rooms</th>
<th>Number of seats in each room</th>
<th>Total number of seats</th>
</tr>
</thead>
<tbody>
<tr>
<td>McLaughlin</td>
<td>1</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Davis South</td>
<td>2</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>Etcheverry</td>
<td>2</td>
<td>75</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>300</td>
</tr>
<tr>
<td>Cory</td>
<td>2</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>150</td>
<td>150</td>
</tr>
</tbody>
</table>

There are a number of problems with these locations. First, most of the classrooms are located at the northernmost edge of the precinct and are farthest away for students coming from the central campus. Moreover, the large number of classroom seats in Etcheverry in particular (420 seats) leads to high volume pedestrian crossings of Hearst Avenue. There would be many fewer crossings if this number of seats were available elsewhere in the College. Placing classrooms in buildings more directly accessible from the campus core would create connections between the campus core and the COE as well as discourage north-south pedestrian traffic crossing Hearst Avenue to COE facilities to the north.

Second, in both Davis and Etcheverry Halls, the classrooms are on the upper floors. This results in large numbers of students in parts of the building where occupants are engaged in research or administrative activities unrelated to instruction. This can be inconvenient for students and distracting or disruptive to the occupants. High-volume, frequently used classrooms should be located in the most easily accessed parts of the building.

Third, there is a significant need on the campus as a whole, as well as within the College of Engineering, for larger classrooms, those that can accommodate 150 students or more. Currently there are many more small rooms and the distribution of sizes is not compatible with schedule needs.
College and departmental classrooms and seminar space. In addition to the general assignment classrooms, there are many classrooms and seminar rooms located throughout the College. These are under the control of individual departments or programs. Many of these spaces are conveniently located near faculty offices and research workplaces, and help to reinforce connections between instruction and research. The separate management and scheduling of these classrooms, however, may lead to some inefficiencies of use. A utilization review should be pursued to explore possibilities for increasing overall classroom capacity in the College. The College should consider central management of at least some of these spaces.

Instructional laboratories. Specialized laboratory and related instructional spaces are essential components of a department's instructional program and should remain within its management. Where feasible, such instructional labs should be located near related research laboratory facilities, but where the scale or sensitivity of the research precludes this, the instructional labs should be located at or near the ground plane for ease of access.

In some cases research laboratories and instructional laboratories are one and the same. In the case of large-scale and large equipment-intensive laboratories, space for their instructional function must be found if the research component moves to an off-campus location. Some such functions may be replaced on campus with computer simulations of the work done outside; others may require some small scale duplication of equipment and space on campus in order to provide students with appropriate hands-on experience. Still others, however, may require transporting students to the offsite location to engage the research experience.

Laboratory and Other Research Facilities

Laboratories. Special use laboratories, wet labs, and laboratories that have special equipment, unusual service needs or abatement requirements for potential environmental impacts, are the most specialized and private functions within the College. Access to these labs is usually restricted for health, safety, and security reasons, and such labs should be located in the least accessible or most protected parts of the College. These labs belong below grade where they are free from vibration impacts or on upper floors away from the most heavily trafficked parts of the campus.

Large-scale research. There are several facilities in the College that occupy large areas and that use large pieces of equipment in specialized environments. These facilities occupy approximately 36,000 asf, primarily in Davis, Hesse, and O’Brien Halls. This research space includes the structural test bay and shake table, ceramics lab, combustion labs, wind tunnels and hydraulic research flumes.

There is a relationship between these large-scale laboratories and the academic research and instructional programs of the College. However, these functions might be enhanced through collaboration with other
institutions and private industry, and space for the expansion of their activities is severely limited on campus. For these reasons, the College should consider relocating these specialized research facilities to a new University Research Center at the Richmond Field Station. Such a center would have the greatest possibility of success if it were established with a substantial and prestigious critical mass of occupants and if engineering research facilities were an essential component.

As noted above in the discussion of instructional laboratories, if these large-scale laboratories are relocated off-campus, their instructional function will need to be recreated. Ways to do this may include on-campus computer simulations, small-scale duplication of equipment and space on campus for hands-on student experience, or transporting students to the offsite location to engage the research experience.

Other research. As part of an emerging concept of interdisciplinary and interdepartmental approaches to research, flexible and adaptable research space is likely to be the fastest growing need in the coming decades. This space, similar to that planned for CITRIS II, can form the core of new development in the College responding to engineering research’s increasing orientation toward computer modeling and simulation, and greater integration with the work of other disciplines.

Academic Support Facilities

Libraries. The College of Engineering currently houses three major libraries. The largest of these, the Kresge Engineering Library located in Bechtel Hall, is a branch of the UC Berkeley Library. The other libraries include the Harmer E. Davis Transportation Library, a component of the Institute for Transportation Studies, located in McLaughlin Hall, and the Water Resources Center Archive in O’Brien Hall.

The Kresge Engineering Library currently occupies approximately 22,000 asf on the ground floor of Bechtel Hall, and is the most heavily used library in the College of Engineering. Libraries are increasingly used in ways not anticipated when they were first built, acting as media centers and study spaces for both faculty and students. The Kresge Library currently lacks adequate study space especially for groups. More and more student work is done in interactive groups often involving students gathered around computers, and this work can be disruptive to the traditional calm of a library. Ultimately, the Kresge Library may need to expand to accommodate this change in work style, as well as to accommodate its growing collections.

The Harmer E. Davis Transportation Library is used principally by graduate students and faculty. It is too crowded for its growing collections and there is no room for study groups. The Davis Library also functions as a national clearinghouse for transportation publications, serials, and monographs. Important work includes cataloguing new materials and printed matter and distributing these to its other constituent campuses in northern and southern California and throughout the United States. The library thus has a public role as a traditional reading and reference room and a more private function as a workplace for the library staff. Its current facility of approximately 4,000 asf on the fourth floor of McLaughlin Hall is not only difficult for students to access, but undersized for its bibliographic mission.

RECOMMENDATION

Provide open area, flexible research space in new or renovated interdisciplinary facilities at the core of the COE.

RECOMMENDATION

Expand Kresge Engineering Library on the ground floor of Bechtel using space currently used for classrooms and meeting rooms.

Relocate the Transportation Library and the Water Resources Archive to space in the ground floor of Davis Hall South or its replacement as part of the development of the West Terrace. Both libraries should be accessible from the new West Terrace.

Seek opportunities for sharing resources and space that result from new adjacencies created by relocating and expanding the libraries.
The Water Resources Center Archive is a State of California facility occupying approximately 6,500 asf on the fourth floor of O’Brien Hall. Its collections are accessed by members of the general public as well as by university users. Its location in O’Brien is almost invisible.

Each of these libraries would benefit from a more public location and orientation. They should be accessible from the West Terrace, the new COE center and public space.

**Computer labs and study centers.** In general, there are not enough computer labs and study centers available for COE students. Currently such spaces are located throughout the College of Engineering, some in places that lack services and security. Many are difficult to access when buildings are closed. These labs should be located in places with good security where students can easily access them.

**Shops.** There are currently seven machine shop clusters in five buildings in the College:

<table>
<thead>
<tr>
<th>Department</th>
<th>Building</th>
<th>Area (asf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE</td>
<td>Davis</td>
<td>6500</td>
</tr>
<tr>
<td>EE ERL</td>
<td>Cory</td>
<td>2800</td>
</tr>
<tr>
<td>CE ERL</td>
<td>Soda</td>
<td>1000</td>
</tr>
<tr>
<td>Nuclear Engineering</td>
<td>Etcheverry</td>
<td>1200</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>Etcheverry</td>
<td>8000</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>Hesse</td>
<td>1600</td>
</tr>
<tr>
<td>MSE</td>
<td>Hesse</td>
<td>500</td>
</tr>
</tbody>
</table>

The shops provide a range of services, including support for research laboratories and equipment, fabrication of components for research, and support for student classroom and laboratory projects. Issues that result from the distribution of the shops include inconvenience in transporting parts and finished work and inefficiencies of scale.

**RECOMMENDATION**

Locate additional computer laboratory facilities for students near the center of the COE complex with access directly from the West Terrace.

These facilities should be part of a 24-hour center that incorporates food service, space for student organizations, classrooms and small group study rooms. The center should be close to space used for student advising.

**RECOMMENDATION**

Consolidate machine shops to provide economy of scale and efficiency of service to the laboratories and fabrication facilities they serve.

Shops should also be accessible and located to support their instructional function, including training of students in the use and application of fabrication equipment.

Reduce the number of shop complexes from the current seven to three:

- Retain the Computer Science and ERL shops in Soda Hall for their current use;
- Consolidate the Mechanical Engineering shops into Etcheverry Hall, together with the Nuclear Engineering shops in Etcheverry, utilizing space in the former nuclear reactor area;
- Relocate the Electrical Engineering shops in Cory Hall and the Materials Science Engineering shop in Hesse to new space in Davis North Replacement and/or in Davis Hall South. In Davis South, these shops could be consolidated with the existing Civil and Environmental Engineering shops, using space vacated by large-scale research functions.

Backfill the vacated Cory Hall space with research space for CITRIS, and retain the vacated space in Hesse Hall for surge space and, ultimately, replacement with a new building.
**Student activities and organizations.** The College of Engineering hosts many student organizations, clubs, and support groups. The groups provide academic and social support to engineering students, addressing issues of student recruitment and retention as well as issues of social and cultural integration. Many of these organizations serve under-represented minority students and all provide crucial services to students and to the College. Student organizations have been given home bases in several locations in the College precinct, primarily in Bechtel Hall and Naval Architecture. The space includes offices, student lounges and study labs. Total area for all student organization space is approximately 8000 asf.

Students appreciate the provision of space most when it is secure and accessible 24 hours a day, when it is shared with a critical mass of other student groups, and when each group’s space takes on the character of that group. Student organization space is most effective when it feels the least institutional, and it is least effective when it is hard to access, when the area in which it is located is dark and feels unsafe at night or when the area is deserted. Student organizations should be housed in space that is visible and accessible, in a neighborhood of other like groups, with access to study facilities, food service, and other amenities that help it feel like home.

**Food service.** Having food and drink available throughout the day and night contributes to the ability of students and others to carry out their work over an extended day. Having food and drink available also injects energy into the campus setting, providing a comfortable location for the impromptu meetings and discussions that form a critical part of university life. At present, the food facility on the roof of Bechtel is open only during weekday business hours, limiting its ability to play this role. Moreover, as a rooftop facility, it is removed from what might be the liveliest pedestrian level of the College.

**Other amenities.** Other services support student activities and College life besides food service. Many were suggested by students, faculty and staff during the planning process. One important idea is a 24-hour center that could serve student needs throughout the day and night in a variety of ways. For example, the 24-hour center could include a business center like those in hotels: this might provide access to business machines such as coin operated copiers. A student store selling notebooks, printer cartridges, batteries, pens and other supplies should be considered. Such a store might even provide an outlet for sundries, film, over-the-counter drugs and other conveniences. Game rooms and informal social rooms could be stocked with computer games and other diversions. An exercise room could help support the health needs of students. There is a strong demand for child care although this is an issue that may more appropriately be addressed campus wide.
Building Support Facilities

Building service, shipping and receiving. Vehicular access to buildings for service and deliveries is difficult for many College of Engineering buildings because they do not have clear back door zones. Moreover, every potential access route on campus is also a pathway for active pedestrian circulation, creating the risk of conflicts between pedestrians and vehicles. Because of the landlocked character of many COE buildings and because some of its departments require heavy service, the potential for such conflict is high. In response, changes should be made in the way that large-scale deliveries are made. In some instances, grade separations of pedestrian and vehicular functions should be considered.

The two principal sources of conflict are the delivery of large scale components to the high-bay Structural Testing Lab in the lower levels of Davis Hall South, and the delivery of liquid nitrogen (LN$_2$) to the storage tanks at the southeast corner of Cory Hall. The structural component deliveries, while infrequent, require access by large tractor-trailer trucks through the relatively narrow confines of the access loop road around Hearst Memorial Mining. The access and turning radius requirements of these large vehicles dictates driveway configurations that constrain the pedestrian passage that it intersects. Eliminating this particular source of conflict is one of the reasons that the Structural Testing Lab should be considered for relocation to Richmond Field Station or another off campus site.

The liquid nitrogen deliveries pose similar problems, requiring access to the Hearst Memorial Mining loop by 60-foot tanker trucks that are difficult to back in or out. During the Hearst Mining construction period, LN$_2$ has been delivered remotely from a temporary valve on Hearst Avenue. With the appropriate technology, it is possible to perform the fill remotely without an operating cost premium; such an approach should be planned with pipe connections from the LN$_2$ tanks to Gayley Road with either a pull-out or an access area to the east of Donner Hall. Either way, this function should be designed into any future plan for the renovation or replacement of Donner.

RECOMMENDATION

Develop a primary service core to the north of Hearst Memorial Mining Building, with common service facilities for CITRIS II, Davis South, Bechtel, and, through new service corridors under the West Terrace, to new development in the Hesse/O’Brien replacement site.

Wherever feasible, encourage the servicing of buildings from the COE complex perimeter, especially for those functions requiring large-scale truck access or special materials handling such as LN$_2$. 
Major Features of the Plan

The master plan retains the fundamental spatial organization of the present College of Engineering campus, and proposes a series of incremental but important improvements.

1. The College will continue to be oriented to the center of the campus.

2. The Bechtel garden terrace, largely obscured when seen from the Central Glade, will remain intact for the foreseeable future. The Glade and proposed new University Walk will replace it if it is redeveloped, and it is likely that Evans Hall will have been removed by that time. The new orientation directly onto the Central Glade will be a dramatic improvement that will thrust the COE into greater prominence in campus life.

3. The two north-south terraces continue to be the primary connections to the campus, and foster movement through the College to Hearst Avenue. New social amenities along the West Terrace will invigorate the core of the College.

4. Hearst Avenue will be improved with streetscape improvements and street crossings, at LeRoy and mid-block between LeRoy and Euclid. The frontage of the Davis Hall North Replacement Building will be a continuation of the rustic landscaping in front of Naval Architecture.

5. The introduction of new east-west pedestrian paths will enrich the fundamental College structure and will provide a very significant improvement to internal circulation.
6. In the near term the fundamental academic organization with the common facilities in Bechtel will remain essentially the same.

7. The proposed long range organization of the College core focuses on concentrating common facilities and interdisciplinary space in the center, as exemplified by the new CITRIS II building; this move has the potential to attract a dynamic new stream of campus-wide academic interaction.

8. This organization also proposes to graduate land uses from the highest levels of common usage and accessibility along the Central Glade, to more reclusive and specialized facilities to the north. This will provide focus for undergraduates and users of common and social facilities, and will relieve areas that are less accessible and more focused on research from high levels of congestion.

9. The primary College service access will continue to come from the Hearst Mining Circle, and can be vastly improved when Davis Hall South is rebuilt to serve as a central facility capable of servicing the entire College.

A longer-term future plan anticipates the potential removal of Evans Hall and its replacement in part through intensification of the Bechtel Hall site.
Land Use and Space Plan

*General land use.* Locate the most general uses - those demanding or attracting the greatest participation from the general student population - at the southern edge of the College near the Central Glade or the West Terrace. This supports the College’s policy of outreach to the campus that encourages ever more dynamic, interdisciplinary participation from the widest possible audience. General assignment classrooms, a proposed student center providing improved levels of services and amenities, and a potential library are such uses.
Open Space Armature and Landscape Framework

Campus connections. Create improved connections to the Central Glade. The College is already a dense, urban place, and will become even more so with redevelopment. Long range recovery of the original intent of the Howard plan will restore the College’s frontage on the Central Glade and create a more positive presence on the central campus spine.

Pedestrian paths. Use the expanded web of internal paths to improve access and provide a variety of urban spaces.
- An expanded grid of paths will provide numerous urban spaces that will provide settings for greater social interaction.
- The two north-south terraces will carry large volumes of pedestrian traffic, are open to the sun and, in particular the West Terrace, can become locales of social interaction if supported by common and social amenities (a 24-hour center is proposed to be located on the west side of the West Terrace, and a student center will be located at the Bechtel site).
- Establish a wider pedestrian path on the East Terrace over the proposed central service facility.

The West Terrace. Support the New Century Plan proposal for a Campanile Promenade by developing and landscaping the West Terrace as an extension of the Campanile axis, and establishing an active and urban character to support its role as a primary north-south route and central College open space. Promote accessibility by improving level transitions for pedestrians, and locate a 24-hour center for student amenities and services on its west side.

The Campanile anchors one the most significant north-south cross-axes on campus. The view north from the Campanile is impaired, however, by a large stand of existing trees in the West Terrace of the College. A more urban, rather than picturesque, landscape approach is proposed. The New Century Plan proposes an axial extension from the Campanile to a new oval on the Central Glade, just west of Evans, where it effectively ends. An opportunity to extend the promenade north to the West Terrace should be explored. The design of this junction will depend to a large extent on the resolution of various related New Century Plan proposals for the area, including those for a possible parking structure beneath the Glade, and the decision about whether to remove Evans Hall or to replace it with smaller facilities.
To allow the West Terrace fully to assume its central role in the physical structure of the College, a strong connection to the Central Glade and the proposed University Walk should be made. This may mean modifying the existing stair when the future levels of the proposed oval are set and when the proposed University Walk is implemented. The small plaza at the entrance to McLaughlin should be retained and raised from the present level of the terrace (generally at elevation 331) to approximately level 334 from about the mid-point of present Davis Hall South. This will provide a long forecourt to Naval Architecture, and will help to modify the perception (from the West Terrace) that Hearst Avenue, and therefore also Etcheverry and Soda Hall, are very difficult to reach. Raising the West Terrace will require similar changes to Soulé Road, which connects to the North Gate.

**The East Terrace.** The passage between Cory Hall and the new CITRIS II building should be enhanced as an outdoor space with potential areas of interaction, as compared to its current role as simply a pedestrian passage. Sun penetration will be important, and the views of the Hearst Mining Circle from Hearst Avenue should also be enhanced. Much of the existing conflict between pedestrians and service at the southerly end of this space can be eliminated by broadening the width of the East Terrace to the east of Davis Hall South when a new building is built, allowing pedestrians to pass over the proposed central service facility. This deck will create a small south-facing plaza in an area of the campus that has no current amenities, and will provide shelter to the future truck service area.

When Davis Hall South is replaced, the service facility should be designed to provide a turn-around, thereby eliminating the present truck loop around Hearst in favor of a two-way movement on the north and east side of Hearst Memorial Mining Building. After Davis Hall South has been replaced and service redesigned, and at such time as Bechtel Hall is redeveloped, provide a broader stair at the south end of the east terrace to provide an improved transition to the level of the Central Glade. This improvement can be accomplished without Bechtel's redevelopment.

**Other landscaped plazas and courtyards.** Retain and improve the presently unrealized McCone / McLaughlin plaza, which has the potential to be a handsome south-facing promontory overlooking the Central Glade, and the landscaped area north of Naval Architecture.
Movement and Circulation Framework

**East-west pedestrian circulation.** Establish new east-west connections that link the East and West Terraces. The present lack of connections greatly impairs movement and creates perceptual difficulties for pedestrians. When Davis Hall South is replaced, provide a minimum of 45 feet to the south edge of the CITRIS II building. If or when Bechtel is replaced, provide a minimum of 45 feet to the south edge of New Davis.

**University Walk.** Enhance the setting and built edge of the College as visualized by Howard through the introduction of a long promenade that will define the edge of the central open space for this area of the campus.

The proposed University Walk would begin at an intersection with Sather Road, southwest of McCone Hall, pass south of McLaughlin and the Hearst Memorial Mining Building, and continue east until it reaches Gayley Avenue.

At present the existing constricted passage and grade change between Evans Hall and Bechtel restricts east-west movement, and causes significant cognitive problems for even those familiar with this part of campus. The overbearing presence of Evans and the multiple entrances into Bechtel contribute to the problem.

Short-term solutions are limited, and will require significant re-landscaping of the Central Glade, as well as modifications to the entry into the lower level of Bechtel. Longer-range opportunities will come when the New Century Plan proposals for this area are achieved.
Service Concept

Primary service to much of the College is currently provided by means of a one-way loop around Hearst Mining Building. The route is accessed from the Mining Circle, and descends from the east side of the Hearst Memorial Mining Building to the Davis/CITRIS/Cory/Hearst 'knuckle' via an auto ramp. The return route is along the lower shelf of the east terrace, where it comes into conflict with pedestrians that seek to descend to the lower level from the west entrance to Cory Hall.

Alternative routes, systems, and points of access were examined, and none was found to be superior to the Hearst loop for providing a single area from which each of the buildings in the College can be served. Peripheral service proved to be unfeasible, service via the North Gate is deemed even less desirable than service from the Mining Circle, and service from the Central Glade is filled with improbabilities. Therefore, service should continue to be provided from behind Hearst Memorial Mining, with measures taken to mitigate conflicts between vehicles and pedestrians.

Large-scale deliveries. Relocate liquid nitrogen deliveries to Gayley Avenue, and establish a remote delivery facility alongside Donner Hall; relocate the Materials Testing Lab to RFS.

Hearst service loop. The service loop around Hearst Mining Building should be revamped with the completion of HMMB and the construction of the Davis Hall North loading area. Permit small trucks (DHL, etc.) to access this area to make deliveries. Service access south of the loading area would then be prohibited, and the area would be made into a pedestrian corridor, with emergency vehicle access only.

Long-term service plan. Establish a permanent service facility at a lower level of 'New Davis' after Davis Hall South is redeveloped. This could entail a number of choices as to grade levels and configuration. One option, with primary service from the east at level 330, could provide a service elevator to level 315 and distribution from there to buildings west of the West Terrace. A second option, again with service entering at level 330, could distribute directly at grade from there to buildings west of the West Terrace. A third option could raise the West Terrace to pass over the level 330 service connection.

Service for Phase 1. Establish an improved service facility at the lower level of Davis Hall South when the materials testing lab is relocated to RFS. In that event, this location can be used to serve the entire COE if an access door is provided on the west side of Davis Hall South, to provide temporary service to the Hesse/O'Brien site across the West Terrace. Alternatively, a service elevator may be provided to level 315, and an underground passage built from there to a basement level in a replacement building on the Hesse/O'Brien site.
Phasing Strategies and Development Concepts

Implementation of the College of Engineering master plan is envisioned over a 20-year period, with clusters of projects triggered by specific critical events. The Davis Hall North Replacement Building (CITRIS II) is the first such catalyst. It carries with it implications for the renovation of Naval Architecture, improvement of the West Terrace and the East Terrace, and implementation of Hearst Avenue improvements.

The next significant catalyst is the replacement of Davis South and the need to relocate its occupants. The master plan recommends that CEE, the department that occupies Davis South, be relocated to a new building on the Hesse/O’Brien site. As a result, the center of COE, the new Davis Hall South, will be available for redevelopment as an interdisciplinary research facility. The master plan shows a core at the center of the College that consists primarily of space for growth in interdisciplinary research, and that will include other specialized facilities with a large numbers of users. The core should seek to optimize physical and organizational linkages to the departments on the perimeter of the College. The central core may include some departmental uses and some space that was lost due to the demolition of Hesse/O’Brien and that may not be able to be replaced as part of the CEE replacement project.

The descriptions and recommendations that follow represent a sequence of development and related actions that are designed to anticipate events such as those above. Also identified are strategic and tactical moves that may be necessary to maintain the operations of the College.

Development phases and their respective Project Areas should be considered as packages of related projects, designed and planned concurrently, and implemented within a defined timeframe of three to five years.
Expansion and renovation of Cory Hall
Hearst Avenue streetscape improvements
Davis Hall North Replacement / CITRIS II
Renovation and adaptive re-use of Naval Architecture building
Initial stages of West Terrace improvements
**First Phase: Project Area No. 1**

**Davis Hall North/Naval Architecture/West Terrace**

**Davis Hall North.** Plan the CITRIS II/Davis Hall North Replacement Building as the first phase of a linked central core for the College of Engineering that will provide advanced research facilities, as well as common instructional and support facilities for inter-departmental and campus-wide interdisciplinary research. Accommodate the elements of the CITRIS research program, as well as instructional facilities and a new center for distance learning.

- Provide a new front door to the College from Hearst Avenue.
- Provide access to the Davis Hall South through CITRIS II.
- Provide access to CITRIS II from the West Terrace.
- Provide east-west access from the West Terrace to Cory Hall and Hearst Memorial Mining either through or adjacent to CITRIS II.
- Link CITRIS II to Cory Hall at the proposed upper atrium level of Cory.

**Naval Architecture.** Rehabilitate the Naval Architecture building to meet seismic stability and life safety requirements, and relocate the general administrative functions of the Dean's office to the Naval Architecture building. If feasible and necessary to accommodate the full program, consider adding space to Naval Architecture by linking it to the lower (basement) levels of CITRIS II and adding a new entrance at the building's east side.

**West Terrace.** Begin to develop the West Terrace concept at its upper levels, capitalizing on improvements to Naval Architecture and the construction of the CITRIS II building.

- Establish the new West Terrace as a central place for the College.
- Link the West Terrace to proposed pedestrian crossings along Hearst Avenue. Improve pedestrian routes and handicapped access and integrate these into landscape plans for the Naval Architecture/CITRIS II environs.
- Beginning west of CITRIS II, raise the level of the West Terrace, including Soulé Road, in a series of stepped terraces to approximately level 342.

**Other landscape improvements.** Promote the following critical landscape objectives for the project area:

- Design both sides of the Hearst Avenue frontage from Cory Hall to North Gate as an integrated entry sequence to the College of Engineering.
- Improve the accessibility and character of the two north-south terraces.
- Provide a sympathetic landscape setting for Naval Architecture.
- Use the space between Naval Architecture and CITRIS II to resolve north-south and east-west movement issues at this location and to provide a meaningful open space for the College.

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*The first group of projects is clustered around the Davis Hall North Replacement Building (CITRIS II). This building's interdisciplinary research orientation acts as catalyst for initial development of activities along the West Terrace.*
University Walk improvements

Expansion of Bechtel and connection of West Terrace to University Walk

West Terrace improvements

New CEE building on Hesse/O’Brien site

Renovation and adaptive re-use of McLaughlin Hall

Improvements to McLaughlin/McCone Plaza
Second Phase: Project Area No. 2:
Hesse/O’Brien/McLaughlin

Davis Hall South, the current location of the Civil and Environmental Engineering department, will require significant seismic remediation, and the state has provisionally allocated $49 million for this purpose for use by 2004. COE and CEE currently prefer to replace the existing building. Whether the existing building is remediated or replaced, CEE must be relocated during construction. There are two potential sites for a replacement building for CEE: the current site which poses a challenging surge problem and the Hesse/O’Brien site which has numerous advantages. Building a new facility for CEE at the Hesse/O’Brien location eliminates the need for a temporary home for the CEE and would require only one move for the department and its programs. Relocation of current permanent occupants of Hesse and O’Brien would be required, but this area is much less than that of CEE. By moving CEE to a new building, the new Davis South becomes available for the expansion of interdisciplinary space in the central core of the College.

Civil Engineering Building. Replace Hesse and O’Brien Halls with a new building for the Department of Civil and Environmental Engineering.
- Relocate to Richmond Field Station the existing structural testing bay and any other labs that require large-vehicle service or very large equipment.
- Allow for replacement and growth of all other current CEE facilities and functions.
- Accommodate other space lost due to the demolition of Hesse/O’Brien.

24 Hour Center. Develop the new building on the Hesse/O’Brien site to the maximum capacity so that it can accommodate 24-Hour Center uses and support completion of the west side of the lower West Terrace.
- Provide 24-hour facilities, including student organization offices, undergraduate student services, computer study labs, libraries and reading rooms.
- Orient the 24-Hour Center and other catalysts, such as food service, along the West Terrace with direct access from the public spaces.
- Provide a large (400-500 person) auditorium with direct access from the West Terrace.

West Terrace. Continue improvements to the West Terrace adjacent to the Hesse/O’Brien site. Capitalize on the opportunities to locate active uses in the new CEE Building at ground level with direct access to the West Terrace. Develop a landscape and open space plan for the Terrace that promotes small gatherings and places of interaction.

McLaughlin Hall. Renovate McLaughlin Hall and focus its reuse on general assignment classrooms and common student service uses that benefit from campus access. Utilize the high existing floor-to-floor heights in the building to add a fifth level to McLaughlin within its existing shell.
**McCon/McLaughlin Plaza.** Improve the use of this plaza developing it as an entry from the campus core into the College of Engineering. The space represents a neglected opportunity at present, and improvement of the plaza should be a priority project when the Hesse/O'Brien site is redeveloped. The plaza is at one end of a diagonal pathway that extends from the SW to NE from the low point at the McCon/McLaughlin Plaza through the COE to the high ground along Hearst Avenue at Cory Hall.

**Site integration.** Plan the site as an integrated project and include the following connections:
- Link McLaughlin facilities and service functions to the new CEE Building.
- Link McCon to the new CEE building.
- Link the new CEE Building to the central service facility located at the site of Davis Hall South at level 330. (The link will cross the West Terrace at level 330, under the proposed grade at level 342. If Davis Hall South is replaced, it is recommended that the location of the central service facility be retained in the same location and at the same elevation.)

**Bechtel Hall expansion and improvements to University Walk.** Accommodate the expansion needs of the Kresge Engineering Library in Bechtel Hall and use this project as an opportunity to open up the constricted passage between Bechtel and Evans Hall and to resolve the system of entry into Bechtel from the campus core.
- Replace and redesign the existing exterior stairs and utilize the roof of the Bechtel extension to provide an at-grade transition from the Hearst Mining Circle level to the McLaughlin level.
- Re-landscape the northerly end of Memorial Glade to effect this transition.
- Replace the lost Bechtel classroom and meeting space in the McLaughlin Hall renovation.
- Enhance the College's visual identity as viewed from the campus core.
- Promote improved movement along the edge of the central open space which is also the front entrance of the buildings.
Davis Hall South replacement building

Improvements to Bechtel Terrace
PHASE 3

PROJECTS

Alternative future projects to Phase 3

- Restoration of University Glade to original 1914 John Galen Howard plan intent
- New Bechtel Hall with interdisciplinary and interdepartmental facilities
- Davis Hall South Replacement Building
Third Phase:  Project Area No. 3:  Davis Hall South/Bechtel Replacement

Davis Hall South Replacement.  Plan the Davis Hall South replacement and Bechtel improvements or replacement as an integrated project.  Three possible alternate directions are described:

a) remediation of Davis Hall South and reorganization of Bechtel;

b) replacement of Davis Hall South and reorganization of Bechtel; or

c) replacement of Davis Hall South and replacement of Bechtel.

The two projects abut, and under either a remediation or replacement plan for Davis, opportunities will open for alternative lower level uses in Davis South (or its replacement) with new opportunities to link Davis and Bechtel at these levels. Providing access to new Davis South from the north will enhance its use and role in the COE and provide opportunities as well for co-location of other College functions such as the libraries.

Replacement or remediation of Davis South will also put in place the permanent central service facility.  A central service facility for most of the College’s central campus buildings should be located at the Davis site, and the building should be planned with a full service bay where it meets the Hearst Mining loop. However, service functions will be disrupted during the construction of this building, and alternative service protocols for CITRIS II and the new CEE Building will need to be put in place for the duration of the construction period.

Completion of the West Terrace.  When the recommended east-west promenade along the south edge of the COE is implemented, it, along with the Campanile promenade proposed by the New Century Plan, will raise the current grades at the south end of the West Terrace. This will require creating stairs and platforms to resolve these new level changes.

Completion of the East Terrace.  As with the West Terrace, this project should include decking over the service area. Until Bechtel is redeveloped, other important improvements include redesign of stairs that connect to the proposed University Walk and Hearst Mining Circle.

University Walk.  Complete the implementation of the east-west Central Glade promenade. The preferred solution envisions a broad promenade with a relatively constant and gradual ascent from the McCone/McLaughlin plaza to its intersection with the East Terrace. The final proposal requires the removal of Evans Hall which would broaden the promenade and reveal views of the buildings that flank the central open space, as John Galen Howard envisioned. In the event that Evans Hall is replaced by the pavilions shown in the New Century Plan, this concept provides a handsome and comfortable way to move from east to west along a built edge rather than through the central open space. In the event that Evans is either removed or replaced and the existing Bechtel remains, the promenade can be realized by replacing the

With the completion of the new building on the Hesse/O’Brien site, CEE can vacate Davis South and that site will become available for new development. The new Davis South will provide space for displaced functions from Hesse and O’Brien that are not accommodated in the new CEE building as well as provide expanded opportunities for interdisciplinary research. This project, together with the proposed changes to Bechtel Hall, will also allow completion of an open space and circulation network that ties the College together.
lower level entry to Bechtel from the south with an alternative means of access, as described in Project Area No. 2. In the event that both Evans and present Bechtel remain, the essential idea of the promenade can still be achieved, once again by replacing the lower level entry to Bechtel from the south with an alternative means of access, for example, a broad stair.

Unless Evans Hall is either removed or replaced, there is little urban design reason to replace or significantly enlarge Bechtel. However, if Evans were to be removed, the campus would have an opportunity to restore a setting intended by the Howard plan. The Bechtel site could then be redeveloped to complete the now largely obscured palisade on which McLaughlin and Hearst Mining sit.

Surge Strategies and Move Alternatives

Objectives for phasing development within the 20 year master plan timeframe:
- Minimize the number of moves for each unit
- Optimize the use of available resources within the College for surge.

Space available for surge within the College is limited although some is available. The proximity of Evans Hall to the COE has been useful in surging past projects (notably the Hearst Memorial Mining Building renovation), but its usefulness is limited to office and conventional classroom facilities. It cannot accommodate the specialized labs that comprise several key COE buildings scheduled for replacement or substantial rehabilitation. The construction of light, temporary facilities in adjacent open space (such as was done, for example, for the Powell Library renovation at UCLA) is incompatible with current policies for central campus space. Use of the Richmond Field Station for surge purposes places constraints on College operations. The following phased surge plan outlines one strategy for COE development. Accurate area analyses will be required at the time each project is done to confirm space and equipment requirements and to verify the feasibility of each move.

Using existing resources may require some temporary construction to maximize available space. With the proposed relocation of the structural testing bay to Richmond Field Station, the current high-bay space in the first and second levels of Davis will be unneeded and could renovated for other uses. This space, combined with some lab relocations to Richmond as part of a new research center there, could provide the space for surging functions out of Hesse, O’Brien, or Davis North to ready those sites for construction.
**Phase 1 Surge Plan.** The first phase of work is focused on the construction of the Davis Hall North Replacement Building (CITRIS II), and the rehabilitation and adaptive reuse of Naval Architecture.

The primary functions displaced by this work will be the Mechanical Engineering and Civil and Environmental Engineering labs in Davis North. Occupants of O’Brien will return to Hearst Mining when that is completed, and the O’Brien labs can be reassigned within the COE to provide appropriate space elsewhere in the COE for Davis North labs.
**Phase 2 Surge Plan.** The second phase of work focuses on the construction of a replacement building for Civil and Environmental Engineering on the current site of Hesse and O'Brien Halls. It includes the renovation of McLaughlin Hall for classroom use.

The expanded lower levels of Davis South may be able to accommodate some of the laboratory surge from Hesse/O'Brien. Some laboratory uses may need to be relocated to Richmond. Library functions could be surged to other campus library surge space. Classrooms and offices could be surged to nearby Evans Hall. Core administrative functions in McLaughlin will have been moved to Naval Architecture on completion of its renovation; remaining administrative and non-administrative functions in McLaughlin may be surged to Evans Hall or elsewhere on campus.
**Phase 3 Surge Plan.** The focus of work in the third phase is on the replacement or rehabilitation of Davis Hall South and, depending on its timing and other development decisions that may have been taken in campus-wide planning, the replacement or expansion of Bechtel Hall as well.

With the completion of the O'Brien/Hesse replacement building, CEE will vacate Davis South for its new facilities, thereby making Davis South available for rehabilitation or replacement. Completion of the Davis South replacement projects will allow programs and units surged to Evans and elsewhere on campus to return to the center of the College precinct.