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ABSTRACT

At the request of the California Coordinating Council for Higher Education, a questionnaire on engineering education and technology programs was distributed to all public junior colleges in the state. Responses indicated the number of students who transferred to 4-year engineering programs upon completion of junior college. Four areas wherein difficulties were encountered by transfer students were: (1) meeting requirements at specific 4-year institutions with strong occupational emphasis; (2) determining course equivalents; (3) providing for differences in school calendars; and (4) fulfilling certain lower division requirements. (MS)

TRANSFER OF JUNIOR COLLEGE ENGINEERING STUDENTS TO ENGINEERING PROGRAMS IN SENIOR INSTITUTIONS IN CALIFORNIA

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69-9

A staff report to the
Council for presentation
on July 15, 1969

Coordinating Council
For Higher Education

July 15, 1969

TRANSFER OF JUNIOR COLLEGE ENGINEERING STUDENTS TO ENGINEERING PROGRAMS IN SENIOR INSTITUTIONS IN CALIFORNIA

On February 22, 1966, the Council requested the Director to "initiate a study of engineering education in California with the aid and advice of an advisory committee representing all segments of higher education and representatives of industry."

The Council, on May 23, 1967, authorized the Director to contract for any consultant or other services deemed necessary for the development of a Study of Engineering Manpower and Higher Education in California. Subsequently, Dr. Frederick E. Terman who was Vice President of Stanford University until his retirement in 1965 and had previously been Provost, Dean of Engineering, and Head of the Electrical Engineering Department at Stanford University entered into a contract with the Council for the conduct of the study.

Dr. Terman's report, A Study of Engineering Education in California was presented to the Council on May 20, 1968. The Council unanimously accepted in principle Dr. Terman's report and invited comments on the report from all segments of higher education. Further, the Council requested its staff to "comment on the implications for engineering education, technician and technology programs in California's community colleges of Dr. Terman's report and undertake a study of engineering education as related to the community colleges".

Additional Council actions on the Terman report were taken on October 7-8, 1968 and December 2-3, 1968. All Council resolutions pertaining to the report are reproduced in Attachment A.

SURVEY OF JUNIOR COLLEGES

The Office of the Chancellor of the California Community Colleges designed and distributed a questionnaire on engineering education, engineering technician and technology programs to all public junior colleges in California. The responses of the colleges, due on January 15, 1969, were forwarded to Council staff for the purpose of developing a response to the Council's request. Forty-eight of the eighty-nine Junior Colleges responded to the questionnaire.

The questionnaire contained two parts: Part I, analyzed below, applied to transfer engineering programs, Part II sought information on vocational-technical engineering-related programs.

Data from Part II of the questionnaire are not analyzed in this report because the science and mathematics courses normally offered in the vocational-technical program are not suitable for transfer to an engineering program. In a sense a major portion of a vocational-technical program is "terminal" in nature -- that is, few of the courses are acceptable for transfer to an engineering degree program.

The number of students transferring to engineering programs offered by campuses of the University, the State Colleges and the private institutions for each of the past five years upon completion of two years of community college study are summarized in Table I.

Table I

NUMBER OF JUNIOR COLLEGE STUDENTS TRANSFERRING TO ENGINEERING PROGRAMS OFFERED BY 4-YEAR INSTITUTIONS UPON COMPLETION OF TWO YEARS OF COMMUNITY COLLEGE STUDY

University of California

Campus	1964	1965	1966	1967	1968	Total	% Of Segmental Total	% Of Total Transfers Reported
Berkeley	67	52	40	66	45	270	50.2	17.4
Davis	9	8	15	23	10	65	12.1	4.2
Irvine	--	--	--	2	1	3	.5	.2
Los Angeles	41	37	37	40	34	189	35.1	12.2
Riverside	--	--	--	2	--	2	.4	.1
San Diego	--	--	--	--	--	--	--	--
Santa Barbara	2	1	1	3	2	9	1.7	.6
Santa Cruz	--	--	--	--	--	--	--	--
Total	119	98	93	136	92	538	100.0	34.7

19 Junior Colleges reported data on transfers.
5 Junior Colleges returned blank questionnaires.
23 Junior Colleges reported Data Not Available.

Table I (continued)

California State Colleges

College	1964	1965	1966	1967	1968	Total	% Of Segmental Total	% Of Total Transfers Reported
Kellogg	13	9	9	13	16	60	6.2	3.9
San Luis Obispo	11	18	14	42	35	120	12.4	7.7
Chico	16	7	12	9	9	53	5.5	3.4
Fresno	--	3	3	4	1	11	1.1	.7
Fullerton	--	--	--	--	--	--	--	--
Humboldt	3	--	2	2	4	11	1.1	.7
Long Beach	19	21	28	22	12	102	10.5	6.6
Los Angeles	35	35	41	46	61	218	22.4	14.1
Sacramento	14	15	10	21	5	65	6.7	4.2
San Diego	8	4	3	8	--	23	2.4	1.5
San Fernando	23	24	24	23	23	117	12.0	7.5
San Francisco	1	1	3	4	2	11	1.1	.7
San Jose	35	31	33	53	29	181	18.6	11.7
Total	178	168	182	247	197	972	100.0	62.7

19 Junior Colleges reported data on transfers.
5 Junior Colleges returned blank questionnaires.
23 Junior Colleges reported Data Not Available.

Private Institutions

Institution	1964	1965	1966	1967	1968	Total	% Of Segmental Total	% Of Total Transfers Reported
California Institute of Technology	--	1	--	--	--	1	2.6	.1
Harvey Mudd	--	--	--	--	--	--	--	--
Loyola	--	--	--	--	--	--	--	--
Santa Clara	--	--	--	--	--	--	--	--
University of Southern California	6	6	6	6	5	29	74.4	1.9
Stanford	--	--	1	1	--	2	5.1	.1
University of the Pacific	--	--	--	--	--	--	--	--
Other	--	1	3	--	3	7	17.9	.5
Total	6	8	10	7	8	39	100.0	2.6

19 Junior Colleges reported data on transfers.
5 Junior Colleges returned blank questionnaires.
23 Junior Colleges reported Data Not Available.

These data indicate the following:

For those engineering students transferring to senior institutions upon completion of two years of community college study, approximately,

63% transfer to State Colleges
35% transfer to the University
2.5% transfer to private institutions or others
97% of those transferring to the University go to three campuses -- Berkeley, Davis or Los Angeles
over 50% of those transferring to the University go to Berkeley

Four campuses (Fresno, Humboldt, San Francisco, San Diego) of the State Colleges received a total of less than 6% of the reported transfers.

Over three-fourths of those transferring to private institutions in California go to the University of Southern California.

On occasion, students transfer from a junior college to a senior institution prior to the completion of two years of community college study. Table II indicates the reported numbers of students who transfer to engineering programs offered by campuses of the University, the State Colleges and the private institutions for each of the past five years prior to completion of two years of community college study.

Table II

NUMBER OF JUNIOR COLLEGE STUDENTS TRANSFERRING TO ENGINEERING PROGRAMS OFFERED BY 4-YEAR INSTITUTIONS BEFORE COMPLETION OF TWO YEARS OF COMMUNITY COLLEGE STUDY

University of California

Campus	1964	1965	1966	1967	1968	Total	% of Segmental Total	% of Total Transfers Reported
Berkeley	2	2	1	8	1	14	35.9	4.9
Davis	1	--	--	1	2	4	10.2	1.4
Irvine	--	--	--	1	--	1	2.6	.3
Los Angeles	6	3	3	3	3	18	46.1	6.3
Riverside	--	--	--	--	--	--	--	--
San Diego	--	--	1	--	--	1	2.6	.3
Santa Barbara	--	--	--	1	--	1	2.6	.3
Santa Cruz	--	--	--	--	--	--	--	--
Total	9	5	5	14	6	39	100.0	13.5

17 Junior Colleges reported data on transfers.
9 Junior Colleges returned blank questionnaires.
21 Junior Colleges reported Data Not Available.

Table II (continued)

California State Colleges

College	1964	1965	1966	1967	1968	Total	% Of Segmental Total	% Of Total Transfers Reported
Kellogg	1	--	1	10	3	15	6.4	5.3
San Luis Obispo	1	5	15	10	25	56	23.9	19.6
Chico	3	1	4	6	2	16	6.9	5.6
Fresno	--	--	--	1	--	1	.4	.3
Fullerton	--	--	--	--	--	--	--	--
Humboldt	1	2	--	3	1	7	3.0	2.5
Long Beach	13	11	11	12	14	61	26.1	21.3
Los Angeles	3	5	7	3	5	23	9.8	8.1
Sacramento	7	11	11	8	--	37	15.8	13.0
San Diego	1	1	2	2	1	7	3.0	2.5
San Fernando	4	--	1	1	2	8	3.4	2.8
San Francisco	--	--	--	1	--	1	.4	.3
San Jose	--	--	--	--	2	2	.9	.7
Total	34	36	52	57	55	234	100.0	82.0

17 Junior Colleges reported data on transfers
9 Junior Colleges returned blank questionnaires
21 Junior Colleges reported Data Not Available

Private Institutions

Institution	1964	1965	1966	1967	1968	Total	% Of Segmental Total	% Of Total Transfers Reported
California Institution of Technology	--	--	--	--	--	--	--	--
Harvey Mudd	--	--	--	--	--	--	--	--
Loyola	--	--	--	--	--	--	--	--
Santa Clara	--	--	--	--	--	--	--	--
University of Southern California	1	--	1	--	1	3	23.1	1.0
Stanford	--	--	--	--	--	--	--	--
University of the Pacific	--	--	--	--	--	--	--	--
Other	--	--	--	4	6	10	76.9	3.5
Total	1	--	1	4	7	13	100.0	4.5

17 Junior Colleges reported data on transfers
9 Junior Colleges returned blank questionnaires
21 Junior Colleges reported Data Not Available

These data indicate the following:

For those engineering students transferring to senior institutions before completion of two years of community college study, approximately,

82% transfer to State Colleges
14% transfer to the University
4.0% transfer to private institutions or others
92% of those transferring to the University go to three campuses -- Berkeley, Davis or Los Angeles
over 46% of those transferring to the University go to Los Angeles

Four campuses (Fresno, San Jose, San Francisco, Fullerton) of the State Colleges receive individually less than 1% of the transfers.

The questionnaire distributed by the Community Colleges asked each junior college offering engineering transfer programs to provide descriptive statements indicating where transfer students have experienced difficulties and to state specifically what the difficulties were.

Four of the forty-eight respondents report their programs were new with no transfers reported. Eight respondents indicated no information was available. Thirteen respondents left the space blank which can only be interpreted to mean that information was not available or that no difficulties had been encountered by students when transferring. Eight respondents reported "no problems" with several choosing to provide additional comments such as "engineering transfers usually very smooth", "no difficulties with our transfer engineering program at any of the University or State College campuses", "students indicate that junior college teaching in all areas was adequate and in a few instances superior", "Berkeley and U.C.L.A report better than average grades for upper division work." Only fourteen junior colleges, approximately one out of four, reported students having experienced difficulties in transferring, although some of their comments do not relate directly to transfer. For example, three of the fourteen junior colleges commented that faculty at 4-year institutions are inaccessible, one commented about the lack of financial aids for transfer students, one stated that its own course requirements were difficult for students, five cited problems associated with students who do not complete necessary course sequences (particularly in math and physics) before transferring. Other similar comments cited the larger class sizes at the University and the State Colleges and the depersonalization of learning.

Four difficulties encountered by transfer students were stated which relate directly to the matter of articulation -- each warranting special attention in this report.

1. Six junior colleges mentioned the difficulties associated with students transferring to the California State Polytechnic Colleges, particularly at San Luis Obispo. The occupational emphasis of Cal Poly includes courses with laboratory emphasis in lower division. A student who follows a pattern of courses consistent with those required by Cal Poly will lose time when transferring to another institution. Similarly, a student following the more common pattern of lower division engineering courses will find that it requires more than two years to complete the program if he transfers to Cal Poly. Cal Poly from its very beginning has emphasized the occupational aspects of its engineering programs. Diversity is important to higher education in California and should be protected. The program at Cal Poly is well recognized at state and national levels for its diversity. Although difficulties may be encountered by engineering students transferring to Cal Poly, this aspect of articulation is well recognized and accepted.

2. Six junior colleges also mentioned difficulties associated with transfer of engineering students caused by "poor" transcript evaluation, i.e., difficulties associated with determining course equivalents. Particular citations were made of the calculus sequence at the University and the physics sequence found in most state colleges. Some of the junior colleges reported helpful intervention on the part of individual faculty members and deans of engineering, however, the problem appears frequent enough that appropriate committees within the Articulation Conference should devote attention to the matter.

3. Four junior colleges mentioned the difficulties of determining course equivalents caused by the different academic calendars. Nearly all junior colleges operate on the semester calendar, but all University campuses operate on the quarter calendar, while the calendars for the State Colleges are mixed between semester and quarter operations. The problem will intensify as more state colleges move to the quarter calendar. Problems associated with the junior colleges operating on the semester calendar and the

University and the State Colleges operating on the quarter calendar are general problems of articulation -- not peculiar to engineering. Consequently, it appears that the Articulation Conference through its various liaison committees should examine the matter in detail.

4. Three junior colleges indicated difficulties associated with the design of a sophomore course to meet the lower division requirements at those institutions requiring a course in electrical circuits and devices for transfer students in electrical and mechanical engineering. One of the junior colleges mentioned an agreement of the Engineering Liaison Committee of the Articulation Conference dated March 1968 which solved this particular problem. Apparently the agreement reached on the content of this particular course through the Engineering Liaison Committee needs reemphasis and wider distribution.

In general, the difficulties associated with transfer of junior college engineering students to senior institutions are few in number. Many problems which existed in the past have nearly been eliminated through the communication channels provided within the Engineering Liaison Committee.

THE ENGINEERING LIAISON COMMITTEE

The Engineering Liaison Committee is a tripartite standing committee of the Articulation Conference. At the last meeting of the Committee held March 21, 1969, Henry Mansfield, Jr., Dean of Engineering and Mathematics at El Camino College and Immediate Past Chairman of the Committee, presented a history of the Committee for the benefit of new members and observers. In describing the purpose and objectives of the Committee, Mr. Mansfield stated:

> "The objectives of the Engineering Liaison Committee are to exchange information, to sponsor conferences, and to develop plans and recommendations for action . . . . In addition, the Master Plan goal of a state-wide flow of students from high school to the bachelor's degree without interruption by artificial or capricious barrier to transfer from one segment to another or from institution to institution within a segment must also be an objective . . . . With regard to functions, the Engineering Liaison Committee serves as a body for the exchange of information and the development

of recommendations for action with regard to engineering education in California. It may develop, review, or act on proposals for policy, plans, and procedures which affect engineering education in more than one segment. Its recommendations for actions are made to the Administrative Committee of the Articulation Conference through the minutes and the annual report of the Chairman. Over the years the primary strength of the Committee has been in the commitment of the representatives to finding solutions to all problems of articulation. While recommendations may be made to other groups, the Engineering Liaison Committee is basically a self-disciplining organization whose representatives have genuine understanding, mutual respect, and make honest efforts to work together. One continuing basic conflict exists between the need of the four year institutions to experiment and change which creates diversity where the need of the junior college is for standardization in order to serve the ever increasing number of schools of engineering. This accounts for much discussion each year."

The Engineering Liaison Committee has eighteen members; six from the University of California appointed by the President or the Director of Relations with Schools, six from the State Colleges appointed by the Chancellor of the California State Colleges, and six Junior College representatives appointed by the President of the California Junior College Association. A chairman is elected annually with the chairmanship rotating annually among the three segments. The Committee holds two meetings each year; one in the northern part and one in the southern part of the state. The place of meeting is also rotated among the three segments. Attendance at the meetings is generally about 100 persons.

Prior to the last meeting of the Committee (March 21, 1969) representatives from the Junior Colleges met the previous evening and prepared the following resolution which was presented and adopted by the Committee.

> "Whereas, at a meeting of December 9, 1965, agreement was reached by the state colleges, University representatives as well as the community college representatives that, in generaly, when considering the qualifications of the individual transferring student, rigid course to course and unit to unit matching requirements are not essential. Rather that the prerequisites for future

courses and the total breadth and depth of student preparation before transfer is the essential;

"Therefore be it resolved that the statement of minimum requirements agreed upon at the December 9, 1965 meeting, which deals with the transfer and rank order of additional desirable courses, be placed among the published entrance requirements of all the state college and University campuses which are concerned with engineering."[1]

The minimum lower division requirements for engineering students include basic studies in engineering, physics, mathematics and chemistry. If a lower division student is to complete these requirements he will not be able to complete all of the general education requirements within his first two years. In order to clarify this matter, the Engineering Liaison Committee at its March 21, 1969 meeting adopted the following resolution pertaining to lower division requirements:

WHEREAS at the 'Summit Conference' of 1965, the State Colleges and the branches of the University of California agreed that Community College students should complete their studies in the lower division requirements in engineering, physics, mathematics, and chemistry; and
WHEREAS the minimum number of semester units in these fields agreed upon at this 'Summit Conference' is 50; and
WHEREAS transfer of these students to the four-year colleges with many lower division deficiences in engineering, physics, mathematics and chemistry will result in considerable increase in the time required for completion of the studies for their degree; and
WHEREAS maturity will contribute to a better understanding of many aspects of general education;
THEREFORE, BE IT RESOLVED that Community College engineering students continue to complete at the Community College the lower division studies in engineering, physics, mathematics and chemistry; and further, that rather than attempt to complete a 40 semester unit general education program while in the Community College, a portion of the 40 unit State College requirement be deferred to the upper division.

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[1]Minutes of the so-called "summit" meeting at which a statement of minimum recommendations was developed are presented in Attachment B.

FINDINGS AND CONCLUSIONS

The Council, acting on the findings of Dr. Terman's Report, recommended that the engineering programs of the University at Riverside in Santa Cruz be deferred. The deferment of these programs will have little, if any, effect upon programs in the Junior Colleges. The data provided by the Junior Colleges in response to a questionnaire from the Office of the Chancellor of the California Community Colleges indicates that no Junior College students have transferred to the engineering program at Santa Cruz within the last 5 years. Further, these limited data indicate that only 2 Junior College engineering students have transferred to the engineering program at Riverside within the past 5 years.

The Council further recommended "That the engineering program there (at Humboldt) be phased out as quickly as possible consistent with the best interests of the students and the faculty thereby affected." Further, the Council recommended that the engineering programs at Chico and at San Francisco State Colleges "be continued with annual review by the Council and if there is not sufficient satisfactory growth in 3 years, the program should be phased out beginning in the fall of 1971." During the last 5 years an average of only 2+ Junior College engineering students have transferred to Humboldt State College upon completion of 2 years of Community College study. In addition, an average of 1+ Junior College engineering students have transferred to Humboldt State College before completion of 2 years of Community College study. Corresponding numbers for Chico State College and San Francisco State College are: Chico, an average of 10+ Junior College engineering students transferred after completion of 2 years of Community College study and 3+ Junior College engineering students transferred before completion of 2 years of Community College study. For San Francisco State College, 2+ Junior College engineering students transferred after completion of 2 years Community College study and only 1 Junior College engineering student transferred within the past 5 years before completion of 2 years of Community College study.

The number of Junior College engineering students transferring to the Santa Cruz and Riverside campuses of the University and to Humboldt State College and San Francisco State College are so small that curtailment of these programs would have little impact on Junior College transfer students or programs. The curtailment of the program at Chico State College would have slightly greater impact on Junior College engineering transfers but the number is not sufficient to create problems for other institutions in the event the program is discontinued.

In general the difficulties associated with transfer of Junior College engineering students to senior institutions are minimal. The Engineering Liaison Committee appears to be an excellent channel for resolving transfer problems for engineering students. Based upon responses of the Junior Colleges to a questionnaire on transfer of engineering students, the following obstacles to transfers need further examination and should be referred to the appropriate committees within the Articulation Conference for examination.

Problems relative to the transfer of engineering students from the Junior Colleges to senior institutions which warrant further consideration by the Articulation Conference are:

1. The calculus sequence at the University of California.

2. The physics sequence found in most State Colleges.

3. The semester calendar and course equivalencies in terms of the quarter calendar.

The Articulation Conference is asked to report its findings to the Council in the Spring of 1970.

PROPOSED RESOLUTION

The following resolution is proposed for Council consideration:

WHEREAS, The Council has requested its staff to comment on the implications for engineering education, technician and technology programs in California's community colleges of Dr. Terman's report and to undertake a study of engineering education as related to the community colleges, and

WHEREAS, The Office of the Chancellor of the California Community Colleges designed and distributed a questionaire encompassing the purposes of this study, and

WHEREAS, The responses of the junior colleges to this questionaire demonstrate that difficulties associated with transfer of junior college engineering students to senior institutions appear to be minimal, and

WHEREAS, These responses indicate that the Engineering Liaison Committee of the Articulation Conference provides an excellent channel for resolving transfer problems for engineering students, and

WHEREAS, A few junior colleges point up some difficulties that still exist in the calculus sequence at the University of California, the physics sequence found in most State Colleges, and course equivalencies causes by different academic calendars (semester and quarter calendars), now, therefore, be it

RESOLVED, That the Coordinating Council for Higher Education commends the Engineering Liaison Committee of the Articulation Conference for its effectiveness in minimizing obstacles to transfer of junior college engineering students to senior institutions in California, and be it further

RESOLVED, That the Administrative Committee of the Articulation Conference is requested to seek further improvements in the process of transfer of junior college engineering students through consideration of:

1. The calculus sequence at the University of California,
2. The physics sequence found in most State Colleges, and
3. The semester calendar and course equivalencies in terms of the quarter calendar,

and be it further

RESOLVED, That the Administrative Committee of the Articulation Conference is requested to report its findings to the Council in the Spring of 1970.

Attachment A

Council Resolutions Pertaining To
Engineering Education in California

February 22, 1966

WHEREAS, All segments of higher education contibute to the education of engineers in California; and

WHEREAS, Engineering education is considered a relatively costly program, and the unnecessary duplication of engineering curricula is highly undesirable; and

WHEREAS, Future manpower needs in engineering must be related to the engineering education programs of all segments; now therefore be it

RESOLVED, That the Director of the Coordinating Council for Higher Education be requested to initiate a study of engineering education in California with the aid and advice of an advisory committee representing all segments of higher education and representatives of industry; and be it further

RESOLVED, That the Director be requested to report the findings of such a study to the Council by December 1, 1968.

May 23, 1967

WHEREAS, The Coordinating Council for Higher Education considers that the development of a Study of Engineering Manpower and Higher Education in California is vitally important in order for the Council to discharge its responsibilities under the Donahoe Higher Education Act to develop plans for the orderly growth of public higher education; and

WHEREAS, The Council finds that such a study should also include a determination of costs of engineering programs in the segments of public higher education in California, projected additional capacity needed in California public higher education, possible economies that may be effected without reduction of quality of engineering programs, development of procedures for the Council's examination of requests for additional and expanded engineering public higher education programs, and other related questions; now therefore be it

RESOLVED, That the Council authorizes the Director of the Council to contract for any consultant and other services that may in his judgment be necessary for the development of a Study of Engineering Manpower and Higher Education in California and authorizes the Director to perform any ministerial acts necessary to contract for and develop this study.

May 21, 1968

RESOLVED, That the Coordinating Council for Higher Education accept in principle the Study of Engineering Education in California prepared by Dr. Frederick E. Terman; and be it further

RESOLVED, That the Council invite comments from all segments of higher education on Dr. Terman's report and related Council staff recommendations; that these comments be circulated to members of the Council at the earliest possible date; and that the Council take further action regarding the report at its October meeting; and be it further

RESOLVED, That the Council staff comment on the implications for engineering education, technician, and technology programs in California's community colleges of Dr. Terman's report and undertake a study of engineering education as related to the community colleges.

October 8, 1968

WHEREAS, The Coordinating Council for Higher Education at its May 1968 meeting:

1. Accepted in principle the study of engineering education in California public higher education, relating to the University of California and the California State Colleges, prepared by Dr. Frederick Terman, and

2. Invited comments from these segments of California higher education on the report, and

WHEREAS, The Council has considered all comments and new evidence pertaining to the study which has come before it; now, therefore, be it

RESOLVED, That the Council advises the governing boards of these segments that:

1. With due regard for lead time and growth, no more engineering degree programs* should be approved until all or nearly all present programs are filled up to the minimum desirable level.

2. Minimum engineering degree production guidelines as outlined in the study be adopted as desirable goals toward which to work.

3. All proposals for any engineering degree programs* to be added by these segments, accompanied by sufficient documentation as may be required by the Director, should be submitted to the Council for its review and comment.

4. The State Colleges and the University should be encouraged to discontinue those engineering specialities which are marginal as to size and need, and be it further

RESOLVED, That the Board of Trustees of the California State Colleges are advised that:

1. No more engineering students should be enrolled at Humboldt effective immediately, and that the engineering program there be phased out as quickly as possible consistent with the best interests of the students and the faculty thereby affected.

2. The engineering program at Chico be continued with annual review by the Council and if there is not sufficient satisfactory growth in three years, the program should be phased out beginning in the fall of 1971.

3. That the engineering program at San Francisco State be continued with annual review by the Council and if there is not sufficient satisfactory growth in three years, the program should be phased out beginning in the fall of 1971.

*To be defined in negotiation between the Council staff and the staffs of the University and State Colleges.

4. That the inter-campus cooperation existing among Fullerton, Long Beach, and Cal Poly should be commended, and be it further

RESOLVED, That:

1. The Council approves and concurs with the actions reported in the statement of the President of the University that the engineering programs are being deferred at Riverside and Santa Cruz.

2. The Council advises the Board of Regents that reasonable target figures for the size of engineering programs at Davis, Irvine, San Diego and Santa Barbara be agreed upon by the University of California and the Council staff, and that the University work toward these goals, and be it further

RESOLVED, That the Coordinating Council requests the staff, in accordance with the Donahoe Higher Education Act, to request annually from the segments such data relating to public engineering education which will permit a clearer picture of this aspect of California higher education, and be it further

RESOLVED, That those recommendations appearing in the study and not recognized by resolution here, be commended to the segments for their serious consideration and possible implementation.

Attachment B

UNIVERSITY OF CALIFORNIA
University Dean of Educational Relations
Relations with Schools
Santa Barbara

ENGINEERING LIAISON COMMITTEE
of the
California Public Junior Colleges,
State Colleges, and the University of California

MINUTES OF "SUMMIT" MEETING
Holiday Inn, Los Angeles
December 9, 1965

Attendance List:

Saad H. Amer	Chico State College
Walter J. Arnell	California State College at Long Beach
Carrol M. Beeson	California State College at Los Angeles
Martin Capp	San Diego State College
Albert G. Conrad	UC Santa Barbara
Thomas H. Evans	Fresno State College
Jerome L. Fox	San Francisco State College
Clyne Garland	UC Davis
Norman O. Gunderson	San Jose State College
George T. Harness	San Fernando Valley State College
Harold Hayes	California State Polytechnic College, San Luis Obispo
Harold W. Iversen	UC Berkeley
Elliott B. Johnson	Chico State College
Henry Mansfield, Jr.	El Camino College
Beatrice McGrath	Universitywide Office of Relations with Schools
William D. McIlvaine	California State College at Long Beach
Ralph K. Nair	Universitywide Office of Relations with Schools
Lester Nypan	San Fernando Valley State College
William G. Plumtree	California State College at Los Angeles
Russell L. Riese	Chancellor's Office, The California State Colleges
Harold P. Skamser	California State Polytechnic College, Pomona
Edward H. Taylor	UC Los Angeles
Thomas J. Zilka	San Francisco State College

Following discussion at the October 8, 1965 meeting of the Engineering Liaison Committee, Chairman, T. J. Zilka accepted suggestions that a special meeting be held to find a solution to the articulation problems in engineering curricula which face the junior college transfer student. Although San Jose State College has modified its lower division course requirements and prerequisites for the B.S. degree in Electrical Engineering, recent changes at several other State Colleges and University campuses in lower division engineering course requirements have created additional problems especially for students from the smaller junior colleges.

Representatives of the State College and University of California systems were invited to attend the "Summit" Meeting and Mr. Henry Mansfield, Chairman of the Engineering Liaison Committee's Sub-committee on Lower Division Requirements,

represented the Junior Colleges.

Some of the items of discussion during the day's proceedings were: matching course-to-course and unit-to-unit requirements for the transfer student; the revision of Title 5 of the State Education Code, the requirements of which must be met by the State Colleges; changes made necessary by the move to the quarter plan; length of time required to earn degree; offering of analytical geometry in high schools; variance of unit requirements for graduation at the State College and University campuses; inclusion of engineering courses in the lower division so students will have some contact with the field throughout collegiate career; new programs such as environmental engineering and bioengineering; economical means of communicating trends in engineering education; and, the impact of the ASEE Goals Study.

An agreement was reached by the State College and University representatives and Mr. Mansfield, as representative of the Junior Colleges, that the following requirements for admission to the upper division would, in general, satisfy all institutions:

Minimum Requirements	Semester Units
Mathematics	16
Chemistry	8
Physics	12
Statics	3 (plus 1, Strength of Materials, for SFVSC)
Graphics and Descriptive Geometry	3 (LASC and SJSC require 2 units each of Graphics and Descriptive Geometry)
Electives (Engineering)	8 (approximate)
Other	12 to 16

Rank Order of Additional Desirable Courses

1. Properties of Materials
2. Computer
3. Electrical, Surveying, Manufacturing Processes
4. Strength of Materials
5. Descriptive Geometry
6. Statistics

It was also agreed that in general, when considering the qualifications of an individual transferring student, rigid course-to-course and unit-to-unit matching of requirements is not essential. Rather, the important factors are prerequisites for future courses and total breadth and depth of preparation before transfer.

Mr. Mansfield and his committee were given the task of surveying programs of junior college students to determine the degree of consistency among them and with the minimum requirements list (see above). The committee was also requested to prepare a questionnaire for the purpose of determining from the Junior Colleges the fields of Engineering, Science and Mathematics where it will be most feasible for them to offer courses. In addition, they were asked to devise a questionnaire for the four-year institutions to be used in predicting trends in engineering education, especially in reference to lower division requirements.

The meeting was adjourned at 3:30 p.m.

Note: The next regular session of the Engineering Liaison Committee will be held at the University of California, Davis, March 4, 1966.