



PRELIMINARY FINDINGS OF QUALITATIVE RESEARCH FOR CONSTRUCTION MANAGEMENT PRACTICE UNDERTAKEN AT HDOT, OAHU DISTRICT

Report 1 of 17

Determination of Interrelationships between Organizational System Variables during Implementation of Change

HDOT Contract Award No. 41527

Amarjit Singh, PhD, PEng

Department of Civil Engineering
2540 Dole Street, Holmes Hall 383
University of Hawaii at Manoa
Honolulu, HI 96822

March 18, 1997



Prepared in cooperation with the State of Hawaii
Department of Transportation, Highways Division
and
U.S. Department of Transportation,
Federal Highway Administration

The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of Hawaii, Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

1. Report No. HWY-L-UH-96-01		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Determination of Interrelationships between Organizational System Variables during Implementation of Change: PRELIMINARY FINDINGS OF QUALITATIVE RESEARCH [Report 1 of 17]				5. Report Date March 18, 1997	
				6. Performing Organization Code	
7. Author(s) Amarjit Singh, PhD, PEng				8. Performing Organization Report No. No. 1 of 17	
9. Performing Organization Name and Address University of Hawaii Office of Research Services 2530 Sakamaki Hall, D200 Honolulu, HI 96822				10. Work Unit No. (TRIS)	
				11. Contract or Grant No. Contract No. 41527	
12. Sponsoring Agency Name and Address Hawaii Department of Transportation, Highways Division 869 Punchbowl Street Honolulu, HI 96813				13. Type of Report and Period Covered Associated Findings October 1996 to March 1997	
				14. Sponsoring Agency Code	
15. Supplementary Notes Prepared in cooperation with the U.S. Department of Transportation, Federal Highway Administration					
16. Abstract PRELIMINARY FINDINGS OF QUALITATIVE RESEARCH FOR CONSTRUCTION MANAGEMENT PRACTICE UNDERTAKEN AT HDOT, OAHU DISTRICT Qualitative studies were undertaken by having group discussions and one-on-one interview sessions with all engineers working for the Oahu District. Among the positive findings are that there is adequate team work, engineers are motivated by the nature of work and challenges posed, engineers wish to enhance their knowledge, and job responsibilities were clear. Among the negative findings are that the change order procedure is unduly cumbersome, design-construction coordination and integration is inadequate, and engineers have insufficient knowledge and training in their construction management vocation. Oahu District engineers perceive a complete lack of trust, faith, or support from upper management. There is a lack of formal motivation by HDOT; organization structure is inadequate to respond to tasks; some field offices have serious management and morale problems; and janitorial work is disliked. Whereas the recent induction of computers is a positive change, quite a few engineers were not sure how to use them. Resident engineers reported difficulties with CE III's and inspectors alike. Inspectors reported inexperience and the unwillingness of engineers to do field work as a reason for poor engineering caliber. Among the recommendations are to downsize, increase specialization, increase workload of engineers, delegate more authority to all level of engineers, streamline change order process, create new sub-divisions for planning and scheduling and claims and change orders, increase standards for hiring inspectors, consider making contractor responsible for quality control, and curtail the new hiring at CE III level. The organization structure should be revamped.					
17. Key Words Satisfaction, work challenge, teamwork, self-confidence, coordination, trust, inspectors, superiors, downsize re-organization.			18. Distribution Statement Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161		
19. Security Classif. (of this report) unclassified		20. Security Classif. (of this page) unclassified		21. No. of Pages 41	22. Price

Table Of Contents


	Page
Table of Contents	i
List of Figures	iii
Executive Summary.....	1
1.0 Introduction.....	3
2.0 Nomenclature.....	3
3.0 The Meetings.....	3
4.0 Sample Size and Location for Field office Interviews.....	4
6.0 Nature of Individual Meetings.....	5
7.0 Objectives.....	5
8.0 Scope.....	5
9.0 Nature of 'Qualitative' Studies.....	5
10.0 Listing of Major Positive Findings.....	7
10.1 Discussion of Major Positive Findings.....	7
10.1.1 Work Challenge.....	7
10.1.2 Self Confidence.....	8
10.1.3 Learning.....	8
10.1.4 Satisfaction.....	8
10.1.5 Teamwork.....	9
10.1.6 Job Responsibilities.....	9
10.1.7 No Covert Dealings.....	10
11.0 Listing of Major Negative Findings.....	11
11.1 Discussion of Major Negative Findings.....	11
11.1.1 Change Order Process.....	11
11.1.2 Design-Construction Coordination.....	12
11.1.3 Insufficient Knowledge of Construction Management.....	13
11.1.4 Lack of Trust, Support, and Respect from Upper Management...14	
11.1.5 Superior Relationships.....	15
11.1.6 Low Conceived Level of Independence and Empowerment.....15	
11.1.7 Lack of Formal Motivation by HDOT.....	16
11.1.8 Flaw in Technical Background (Mechanical and Electrical Engineers).....	17
11.1.9 Inadequate Training.....	17
11.1.10 Inspectors Problems.....	18
11.1.11 Organization Structure is Inadequate.....	19
11.1.12 Janitorial Work.....	19
11.1.13 Vehicles.....	20
11.1.14 Lump Sum Contracting.....	20

11.1.15	Quality Control.....	21
12.0	Listing of Dual Findings - Those Having Positive and Negative Characteristics.....	22
12.1	Discussion of Dual Findings.....	22
12.1.1	Superior Subordinate Relationships.....	22
12.1.2	Computer Knowledge and Advancement.....	22
12.1.3	CE III's.....	23
13.0	Preliminary Recommendations.....	24
13.1	Education in CM desirable.....	25
13.2	Downsize.....	25
13.3	Emphasize Specialization.....	26
13.4	Streamline Change Order Process.....	26
13.5	Streamline Engineer Time Sheets.....	26
13.6	Claims and Scheduling Departments.....	27
13.7	Treat with Respect.....	27
13.7.1	Delegation/ Change Order Authority.....	27
13.7.2	Elevate AE's to EM VI positions.....	27
13.7.3	Provide Recognition.....	28
13.7.4	Eliminate Discipline Maintaining Strategies.....	28
13.7.5	Janitorial Contract.....	28
13.8	Leadership Not Aware Of Modern Construction Requirements.....	28
13.9	Inspector Standards.....	28
13.9.1	Redefinition of P.D.'s between HCI V and HCI IV.....	29
13.10	Consider making Contractor Responsible for Quality Control.....	29
13.11	CE III's.....	29
13.12	Contractual Changes of Project Delivery System.....	30
13.12.1	Vehicles.....	30
13.13	Design-Construction Integration.....	30
13.14	Re-organization at Field Offices.....	30
13.15	Re-organization at District Office.....	31
14.0	Conclusions.....	33
15.0	References.....	35
15.1	Note on References Used.....	35

List of Figures

		Page
Figure 1	Field Office Organizational Structure	36
Figure 2	Recommended Reorganization of District Office Organization Structure (Partial)	37

**PROTECTED UNDER INTERNATIONAL COPYRIGHT
ALL RIGHTS RESERVED
NATIONAL TECHNICAL INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE**

Reproduced from
best available copy. 

PRELIMINARY FINDINGS OF QUALITATIVE RESEARCH UNDERTAKEN AT HDOT, OAHU DISTRICT, FOR CONSTRUCTION MANAGEMENT PRACTICE

Executive Summary

Qualitative studies were undertaken by having group discussions and one-on-one interview sessions with all engineers working for the Oahu District. Each resident engineer's field office was done one day at a time. Certain positive, as well as negative findings were made.

Among the positive findings are that there is adequate spirit of team work, engineers are motivated by the nature of work and challenges posed, engineers expressed the desire to enhance their knowledge levels, and that job responsibilities were clear. In the one-on-one settings, engineers reported having obvious confidence in themselves.

Among the negative findings are that the change order procedure is unduly cumbersome, design-construction coordination and integration is thoroughly inadequate, and that engineers have insufficient knowledge and training in their construction management vocation. A particularly disturbing finding was that the Oahu District engineers perceive a complete lack of trust, faith and support from upper management and HDOT leadership. For reasons that go well into the past, field engineers feel 'beaten down' by upper management.

There is definitely a lack of formal motivation by HDOT; inspectors cause difficulties to resident engineers; organization structure is inadequate to respond to tasks; some field offices have serious management and morale problems with shortage of vehicles; and janitorial work is disliked.

Whereas the recent induction of computers is a positive change, quite a few engineers were not sure how to use them; delays in connecting to electronic mail systems are not in the best interests of HDOT. While some CE III level engineers have a good wealth of experience and contribute very well to the work, many CE III's were seen to lack motivation to excel. Resident engineers reported difficulties with CE III's and inspectors alike. Inspectors reported inexperience and the unwillingness of engineers to do field work as a reason for poor engineering caliber.

Among the recommendations to overcome negative trends and enhance positive trends are to downsize, increase specialization, increase workload of engineers, delegate more authority to all level of engineers, streamline change order process, create new sub-divisions for planning and scheduling and claims and change orders, actively show respect to field engineers, increase

standards for hiring inspectors, consider making contractor responsible for quality control, curtail the new hiring at CE III level. The Oahu District and all field offices should be furnished with modified organizational structure charts highlighting modified roles and requirements, modified lines of authority, and modified assignment of personnel to perform contracting tasks.

The challenges facing HDOT are significant as it seeks to modernize its structure for delivering services.

This report is based only on qualitative research (interviews) conducted by the P.I. Other reports are being submitted as part of analysis of questionnaires distributed to engineers at the District Office.

1.0 Introduction

HDOT's Oahu District is subdivided into three areas, with each area having two resident engineer's field offices, for a total of six field offices. The engineers in these offices were interviewed by the UHM research team in group settings and later in one-on-one interviews. Interviews were conducted at the field offices. The respective Resident Engineers and Area Engineers attended these meetings. All interviews and meetings are confidential and participation was voluntary. Prior to these field meetings, meetings were also held in the district office, first with the District Engineer and Construction Engineer and later with all Resident Engineers and Area Engineers together. The research team of UHM approached the study as a neutral party, aiming to look impartially at administrative processes, management methods, and leadership. This report describes major findings of these meetings and interviews.

2.0 Nomenclature

The following nomenclature is used:

PE	-	Project Engineer
RE	-	Resident Engineer
AE	-	Area Engineer
CE	-	Construction Engineer
DE	-	District Engineer
PI	-	Principal Investigator
PD	-	Position Description

3.0 The Meetings

The schedule of meetings was as follows:

<u>Date</u>	<u>Attending from HDOT/ Field Office</u>
10/21/96:	District Engineer and Construction Engineer
11/06/96:	Area Engineers and Resident Engineers (Meeting organized and attended by Construction Engineer at District office)
01/31/97:	Area B field office: H3 (RE: Robert Shin)
02/07/97:	Area B field office: Pearl City (RE: Michael Dineaga)

02/14/97: Area A field office: Mapunapuna
(RE: Sidney Tse)

02/21/97: Area C field office: Kaneohe
(RE: Francis Cheung)

03/08/97 Area C field office: Kaneohe
(RE: Gerald Pang)

03/15/97 Area B field office: H3 and Area C Engineers
(RE: Diana Lee) (RE: Kam Kin Sin)

The interviews were led by Principal Investigator, Dr. Singh

Each field office meeting was attended by their respective resident engineer and area engineer. The CE IV's and CE III engineers were present. At times, attendance was not 100%.

4.0 Sample Size and Location for Field office Interviews

The following numbers of engineers were interviewed overall, though a few other attended the group meetings:

AE's = 3

RE's = 5

PE (CE IV) = 9

PE (CE III) = 19

One inspector, HCI IV was also interviewed, even though the focus was on engineers of the Oahu District.

The meetings were held in either the meeting room of the field office or in a room at the field office in which the entire group could assemble. The group meetings typically lasted 90 to 120 minutes. The individual meetings ranged from 15 minutes to 45 minutes.

5.0 Nature of Group Meetings

Participants of the field office were introduced to the researcher(s). This was followed by a brief explanation of the nature and purpose of the research project. Participants were informed of the voluntary and confidential nature of the research project. Those who did not desire to participate

were free to leave at this time or any time later. A discussion was then led by the PI on administrative matters confronting the engineers. These administrative matters focused on claims and change orders, coordination with design department, planning and scheduling, estimating, inspection and facilities for inspection, public image of HDOT, contractor relationships, computer usage, and other as they arose.

6.0 Nature of Individual Meetings

After the group meetings were over, a ten minute break was given. Participants were scheduled by RE to meet individually with the PI. Individual participants were then asked questions of their impressions on the work place, working conditions, whether they were happy on their job or not, whether they felt empowered to do their job, superior-subordinate relationships from their point of view, degree of work challenge, pressure and stress on the job, team work in the field office, and other. These private discussions, led by the PI, often took their own directions for construction of meaning from the topic.

It is believed that these meetings served to be therapeutic, since engineers were able to discuss freely with a neutral counsel in confidentiality.

7.0 Objectives

The aim of these interviews was to obtain first hand information from the engineers of their perception of management, leadership, administrative processes, working conditions, bottlenecks, work highlights, and special features. Engineers were encouraged to speak candidly in the confidential setting. Their impressions were sought on what they feel should change for the Oahu District, what their foremost priorities and concerns were, and what could be done to improve (through change) HDOT operations and engineer' execution of duties.

8.0 Scope

The findings reported here are based on interviews held as described here. While other instruments and methods are being used by the researchers simultaneously, such as survey questionnaires, the results from those surveys are being reported separately. A formal and complete integration of all qualitative and quantitative research will follow later. However, the findings here do not contradict any finding discovered so far through quantitative research (the questionnaire instruments), but support them. Some corroboration of findings and facts is made with the responses of Questionnaire no. 1.

9.0 Nature of 'Qualitative' Studies

The "qualitative" studies do not, conventionally, provide quantitative answers like 'how many' or 'what percentage'; they also are unable to perform significance studies through statistics. The reason is that qualitative studies focus on dominant viewpoints, consensus opinion, major and minor issues, general perception, salient features, and development of meaning. The emphasis is on the analysis of the subject matter using professional expertise and judgment skills. However, only facts are reported as obtained from the interviews; meanings are constructed to explain trends and opinions (Herndon and Kreps, 1993).

10.0 Listing of Major Positive Findings

The following positive findings were discovered:

1. Engineers experience positive work challenge in their engineering work.
2. Engineers expressed confidence in their own abilities.
3. Engineers expressed the desire and interest to expand and improve their professional competence.
4. All participants reported moderate to good satisfaction with the job.
5. Teamwork exists at the field office levels
6. Job responsibilities are clear
7. No Covert Dealings

10.1 Discussion of Major Positive Findings

10.1.1 Work Challenge

A very significant finding, one which positively affects morale, and is supported by earlier management research in the field, is that engineers feel positively about the work challenges they face on a daily and regular basis. Specifically, it was found that the construction work exposed new challenges each time, and thus engineers feel enthused and excited about it. They approach the work with a positive bent of mind and enjoy the new items they keep learning.

The work challenge keeps the engineers focused on the work. Without this intrinsic challenge, the organization would face serious morale and work execution difficulties.

That work challenge is the most crucial factor in the motivation of people was proven by Frederick Herzberg (1959). Numerous other studies done since then have served to reinforce Herzberg's theories. No known research has disproven the effect of work challenge in motivation.

On Questionnaire no. 1, in reply to the question "what are you most satisfied with in your job," engineers overwhelmingly (70% for RE's/AE's and 42% for PE's) mentioned that it was the nature of work.

It would behoove HDOT to build on this positive finding and provide increased professional and technical opportunities for its engineers.

10.1.2 Self Confidence

To a significant extent, engineers were not seen to exhibit professional depression. Instead, they expressed the confidence and ability to handle work and daily challenges. They ranked themselves high in their capabilities. They were able to discuss their work and duties intelligently with the interviewer(s). The major counter-complaint was that they were inhibited in their work by lack of top management support and stringent, sometimes onerous rules and regulations.

Given a positive work environment and top management support, it is believed that the engineers would want to work with higher productivity.

From Questionnaire no. 1, 60% of RE's/AE's and 73% of PE's feel motivated to do a good job. This motivation is only self-motivation or internal motivation to do a good job. Such internal motivation serves to build self-confidence.

10.1.3 Learning

All engineers, with perhaps only a single exception, felt that they would benefit from training and continuing education. This is a positive sign, in that engineers would not be averse to schemes that promote continuing education. In the modern age of expanding knowledge, they expressed awareness that they could learn new things and techniques of which they have little knowledge.

This finding matches findings from Questionnaire No. 1, where 90% of RE's/AE's and 77% of PE's feel they are only 'somewhat' or 'not much' qualified in engineering management training. 90% of RE's/AE's and 69% of PE's feel they use more management skills than engineering skills.

In the interviews, some CE III engineers were of the opinion that review of payment certificates and claims is an engineering function. Modern literature on these subjects, however, treats such subject matter as a construction management function.

10.1.4 Satisfaction

All engineers reported moderate and better-than-moderate satisfaction with the job. Quite a few reported they were content because they 'had a job.' Pragmatism guides their satisfaction emotions, since it is important to be earning a livelihood. The impression gained was that engineers believe that if they weren't satisfied they would leave HDOT. The very fact they were in the organization and continued to be there, was presented by them as partial reason for their satisfaction.

This by itself signifies there is no serious rebellious tendency among the engineers, even though they would like to see significant reforms. In their technical opinion, however, many existing methods of managing, leading, and administering should change.

The verbal reports by all engineers to the satisfaction issue matched the response in Questionnaire no. 1 "Are you happy in your job?" The questionnaire response also reported that approximately 30% of the engineers are not happy with their salary.

10.1.5 Teamwork

In general, field offices and individuals reported adequate to good team work between the engineers. Complaints, however, centered on inadequate upper management support. Also reported were problems with inspectors, coordination of work by inspectors, and lack of training. Such drawbacks affect the total output. If these were better, then the existing teamwork could provide the necessary synergy to produce high quality output and performance.

Thus there were no serious conflicts reported on sites. Exceptions were reported for normal disagreements over priorities and issues -- discussions that are actually necessary and healthy in every organization. The departures are thus normal.

Disgust was reported in a few cases regarding the qualifications of team mates, but this did not deter from overall team work in the field office. Nevertheless, there was a demoralizing effect on engineers on this account.

From Questionnaire no. 1, 70% of RE's/AE's and 96% of PE's feel they like the group they work with within HDOT.

10.1.6 Job Responsibilities

It was discovered that engineers know their job responsibilities and duties. However, they did not completely agree with the nature of their duties. There were some issues that are mentioned under responsibility and independence under negative findings.

At least the fact that engineers know what they are supposed to do implies there is no ambiguity about their work. This reveals there is uniform and consistent role pressure. The fact that there is no ambiguity is a positive sign, since ambiguity has been considerably related to weak organizations (Wilemon and Cicero, 1970).

However, as is mentioned in this report under the section on 'Inspectors,' there are serious P.D. ambiguities between HCI IV and HCI V.

10.1.7 No Covert Dealings

From the interviews and responses, there were no reports received of any covert dealings, misappropriations, or other hanky-panky in the field offices. This is good, in the sense it reflects good ethical behavior.

11.0 Listing of Major Negative Findings

It was discovered that the following problems were experienced by engineers:

1. The change order procedure is cumbersome
2. There are some serious problems with design-construction coordination and integration.
3. Engineers have insufficient training in construction management. Their professional job knowledge is not enough. Specifically, the following are missing:
 - Planning and scheduling skills are absent.
 - Understanding of claims management and contract law is absent.
4. There is lack of trust, support, and respect to the Oahu District Engineers from upper management. This translates to a lack of upper management leadership.
5. Poor support from supervisor
6. PE's, RE's and AE's have low independence and empowerment
- 7 There is lack of formal motivation by HDOT; engineers are not too proud of HDOT
8. There is a flaw in background expertise (mechanical and electrical engineers are hired for civil engineering jobs).
9. Training and updating of knowledge is inadequate
10. Inspector problems
11. Organization structure is inadequate
12. Janitorial work done by engineers not liked by them.

11.1 Discussion of Major Negative Findings

11.1.1 Change Order Process

It came out abundantly and loudly that the change order approval process needed transformation. Change orders are reported to take too much time, up to 9 months, with a period mostly centering around 3 months. The PE's and RE's are frequently asked to revise their justifications, primarily for poor technical writing skills. This delays the entire approval process which disrupts work, and makes contractors pressurize the field engineers; in the end the field office only gets blamed for site related problems.

The matter of placing blame is, of course, very negative in itself. A nurturing atmosphere has always been known and seen in transactional analysis (TA) to be better.

The change order forms were apparently not structured enough. The existing form has no box for the work justification. Currently, justifications are attached separately.

The authority level for final approval does not rest with the RE or AE, even though they are the decision makers in this respect. It is understood that the approval process is being modified where change orders will follow the following route:

RE --> AE --> CE --> DE --> FHWA

Earlier the route was:

RE --> AE --> CE --> DE --> Hwy C --> FHWA

(Papers were sent to CE for information, but perhaps did not require his signature)

However, it appears as a drawback that RE and AE do not have final authority for certain amounts of money. Currently, they have authority for advance approval, but final approval has still to be given by senior management. Such a system goes against the spirit of delegation, resembles lack of trust, takes away from professional independence and empowerment, betrays lack of support, and extends decision making durations. These issues are discussed again in this section. It would be in the interests of HDOT to consider providing final approval authority of different change order amounts to RE's and AE's. The change order form should also be revisited and improvements sought.

Change orders are closely related to contract law, in which engineers were judged not to have extensive knowledge. In the modern age, it is inconceivable to have people responsible for specialty areas in which they have no specialization.

11.1.2 Design-Construction Coordination

This is another area of serious concern. Whereas at some offices, field engineers reported having a good relationship with design engineers at HDOT, it is still recognized that designers are not perceived to be doing their job. This is manifest in numerous change orders and delayed decisions, not to mention cost overruns to the tax payer.

It is realized that there may be a significant difference in the mind set between designers and field engineers (a subsequent research is planned in this area). However, it is known that constructability reviews or Functional Analysis Concept Design (FACD) are not used in the HDOT design department. These methods are known in the construction science field to enhance productivity, reduce the level of disputes, and improve morale (CII, 1986, Del I'solla,

1982). With any such improved design-construction integration systems missing, there is a serious handicap to the HDOT field office and HDOT in general.

From Questionnaire no. 1, 100% of RE's/AE's and 88% of PE's feel they are dissatisfied in their relations with the HDOT design office.

There are quite a few ways to overcome this design-construction handicap, mentioned again in the recommendations:

1. Conduct cross training between design and field departments. This duration should be of one to two year durations. This process should be commenced immediately. A special charting of duties of those who are engaged in cross training should be drawn up, since neither is the field engineer likely to be conversant with design techniques, nor is the designer expected to be familiar with field practices.

2. Initiate formal constructability review and FACD subdivisions in the design department.

3. Transfer some design functions to the Oahu District office, such as for small maintenance projects.

11.1.3 Insufficient Knowledge of Construction Management

As a neutral party, the research team was particularly alarmed by the obvious and reported lack of knowledge in construction management techniques and principles. The field engineers are engaged in construction management activity, but significantly lack the skills to execute construction management works. The area of construction management is a specialty area of civil engineering that has advanced considerably in the last 20 years. Universities nationwide have increased their teaching of construction management subjects at the undergraduate and graduate levels in high numbers. This was necessitated by the alarming mismanagement of construction projects nationwide.

It is imperative that field engineers should update their skills in construction management and avail of modern knowledge, if they want to be successful in that field. The specialization has become acute. An analogy here is between different specialty areas in medicine, where a different type of training is required to treat the eye from what is required to treat the mind. Family doctors can only be successful for general ailments, not specialty ailments. The same thing goes in civil engineering. The general civil engineer doesn't really exist, because all specialize in one area or another. It is inconceivable to think of a person not well trained in a particular field to be

taking decisions in that field. Would a patient knowingly go to a medical specialist, say in gastroenterology, who did not have formal credentials in that field?

What's happening in the Oahu District is that engineers have for long been engaged in construction practice, with little or ineffective training provided in construction management. Civil engineers fresh out of school with no training in construction subjects are asked to conduct construction execution. Engineers who are mechanical engineers and electrical engineers, or else have specialist degrees in fields other than construction, such as structures or environmental, are hired for construction engineering jobs. The overall observation is that construction engineers and managers have no understanding of important construction management tools, such as planning and scheduling, claims management, estimating, and contract law.

From Questionnaire no. 1, 90% of RE's/AE's and 65% of PE's feel they are moderately or inadequately trained in construction management. In the modern age, in which construction management has become a specialty field, construction engineers should feel they have the necessary amount, and more, of construction management knowledge. Thus, there is a major gap here that HDOT must address immediately.

100% of RE's/AE's feel there is moderate to insufficient managerial proficiency at HDOT. In this age of pursuit of excellence, this is not a good sign.

11.1.4 Lack of Trust, Support, and Respect from Upper Management

An organization that does not support its own kind spirals downwards into a degenerate culture. It is imperative that an organization establish its mission and actively seek to meet those objectives as a cohesive team. Where scapegoating and blame-laying commences, demoralization sets in. It was abundantly evidenced that the Oahu District engineers look at the upper leadership with bitterness, not necessarily with the current administration, but with leadership from Punchbowl the way it has been for many years.

Field engineers feel betrayed by upper management for field decisions taken, for change orders prepared, for handling the public, for managing the contractors. The disharmony is not of moderate or acceptable amounts. There is considerable imbalance and disequilibrium. The field offices and engineers feel abandoned. No progressive work can be achieved in a critical environment. This trend must change.

The reported lack of trust and respect is perhaps more serious. If the engineering staff perceive

disrespect and abuse, then that is bad enough and a sign of a serious underlying problems, even if there is no proven distrust or disrespect. Apparently, field engineers feel beaten down by upper management. They are made to shoulder big responsibilities, but do not get the 'ear' of upper management. Responsibilities are apparently dumped on them without support or assistance provided. Then, decisions taken are not supported. The numbers of such complaints the researchers heard were in plenty. Such a culture amounts to an abusive culture. This is a very negative characteristic.

The same issue was heard in dealings with contractors. While by and large, it was reported by individual engineers that they had no major difficulty dealing with contractors, they often felt let down when upper management did not back them in decisions they felt were justified. At the very least, upper management should explain revised or alternate decisions to field engineers. Modern management believes in participatory management, so talking down to employees or arbitrarily ordering them is not a modern trend for effective management in industrial and production management settings (Likert, 1967). The lower level people must be carried by upper management. Lower management must have faith in upper management for upper management to be successful in their mission. Obviously, over the years, and for many reasons, not all of which could be known to the research team, lower management has lost faith in upper management. From the public's viewpoint, this would translate to a betrayal of the taxpayer, since their dollars are used to pay for transportation services which aren't being delivered with the utmost of efficacy.

From Questionnaire no. 1, a resounding 40% of AE's/RE's say they do not feel part of the decision making process at HDOT.

11.1.5 Superior Relationships

A significant number of RE's/AE's reported that they were disillusioned with superior relationships. This matches the finding from Questionnaire No. 1, where 40% of all RE's and AE's mention 'supervisor' as the item they are most dissatisfied with in their job. Eighty percent of RE's/AE's feel they do not receive good supervisory support, compared to 73% of PE's. Insufficient supervisory support is generally a morale dampener. Also see Section 12.1.1.

11.1.6 Low Conceived Level of Independence and Empowerment

Decisions, such as for change orders, vehicle requirements, hiring/firing, purchase requests, and other items are reported to be handled by either District Office or Punchbowl. Project Engineers have no power over their projects, since the Resident Engineer is the person responsible, even

though project engineers could have many years of experience and talent. Resident Engineers have to deal with a fixed group of engineers and personnel over which they have little or no decision control, since personnel are assigned from head office. RE's have frequently encountered that subordinates don't do the work as required, don't follow instructions, and sometimes are insubordinate. It's like working with ones "hands tied behind one's back." The RE's counterparts in the contractor's organization, the Project Manager, in contrast, has liberties to hire and fire and purchase, etc. Simply stated, it is unconscionable to make people responsible for tasks over which they do not have full control. Then holding them to blame is probably abusive.

Empowerment works in all types of settings. Where empowerment exists, morale is high. With upper management support and empowerment, production and efficiency can be high. The recommendation here is to increase the degree of independence in decision making of project engineers, resident engineers and area engineers. This will provide a feeling of trust, encouragement, and support to all concerned.

11.1.7 Lack of Formal Motivation by HDOT

HDOT is perceived to do nothing to increase the morale and motivation of its district office engineers. Without motivated soldiers, for example, an army stands to lose the war. A similar thing could be happening at HDOT.

Salaries at HDOT are low. While this is tied to bargaining units, the researchers believe that new hires should be automatically hired at high scales to begin with. Of course, altering bargaining unit regulations is possibly beyond the ability of HDOT.

HDOT offers no recognition or award schemes at the district level. The employee or engineer of the year awards are for the entire HDOT. With the district office having about 100 technical employees, awards should exist at the district level.

The lack of trust, respect, and support are serious demoralizers. Engineers are not kept adequately up to date with new knowledge. The training and seminar sessions arranged for engineers are window dressing and do not provide knowledge that can sink in. None of this can motivate engineers in the modern, technological age of expanding knowledge.

While self motivation is also an important concept, it is well realized in management science that organizational leadership should not provide demotivation nor dampen spirits (Maslow, 1968). If anything, it should encourage employees to develop self-motivation characteristics.

Employees can not be expected to do all work without a reciprocal bargain that involves equitable emotional energy.

From Questionnaire no. 1, 30% of PE's and 30% of RE's/AE's feel that the greatest reason of their dissatisfaction is the HDOT organization and reputation.

11.1.8 Flaw in Technical Background (Mechanical and Electrical Engineers)

Quite a few engineers at HDOT are mechanical and electrical engineers. They face the following difficulties:

1. They feel handicapped in a civil engineering environment
2. They find it difficult to obtain the professional license.

Moreover, these electrical and mechanical engineers are not assigned specialty jobs in mechanical or electrical fields. For instance, a mechanical engineer could be asked to specialize in plumbing activities and contracts, while the electrical engineer might be asked to specialize in street lighting, traffic signals, electrical utilities, and the like. In fact, such specialist activities are desirable, and could enhance efficiency, but none of this happens and they are asked to involve themselves in civil engineering activities.

HDOT is primarily a civil engineering organization, and the predominant works of construction management are for civil engineering projects. It is easy to construe it as unethical to have non-specialists perform services in specialty areas. Such a system can be conceived to violate ASCE's code of ethics, where it says that "engineers shall only offer services in the area of their expertise." A gross injustice is being done to the taxpayer and the individual. To the taxpayer -- because services are not being offered by specialists. To the individual -- because it pushes him/her back in obtaining a professional engineer's license. All except one mechanical/electrical engineer are unlicensed.

Let us ask the reader, would you go to an endocrinologist if you had a bone fracture?

11.1.9 Inadequate Training

HDOT's upper management arranges occasional seminars and short training sessions for its engineers. The research team observed the following things on this account:

1. Engineers felt most of such sessions were insufficient.

2. There was no follow-up on the information learned.
3. The information was not disseminated to other members of the group.
4. The information learned was soon forgotten.

It has been experienced over centuries of learning that the type of education that "sinks" in is often imparted in small packages at quick intervals over a prolonged duration. Universities have this system, where each semester course is mostly offered in two lectures per week over a period of 16-17 weeks. Short duration training, such as provided in military establishments for specialist training, is helpful because the officers/soldiers use and follow-up on their training when they return to their unit or station.

All three wings of the U.S. Military send their engineers back to school for advanced degrees in civil engineering. Each officer of the U.S. Navy Corps of Engineers, for instance, requires that every officer be sent back to school for their master's degree. The philosophy there is that the knowledge gained is helpful to the Corps in maintaining a high standard of excellence. Apparently, HDOT does not subscribe to any such scheme.

The outcome is that HDOT field engineers have attended training sessions in computer software, letter writing, and other, but these have not been of long lasting benefit. Clearly, HDOT has to deeply rethink its long term strategy of personnel development and attempt to make monies available for professional development and commitment. It can be understood that monies spent such will result in reduced expenses over the long run.

11.1.10 Inspectors Problems

In quite a few field offices, it was discovered that the responsible engineers were dissatisfied with the level of inspector quality and performance. Inspectors are underpaid, have only a high-school degree, and sometimes provide false or erroneous information.

It was discovered at some field offices that engineers are unaware of P.D.'s of inspectors -- mainly that inspectors have to work under the supervision of engineers. Thus, inspectors were not reporting to engineers, but only to their chief inspector or RE. This is a disciplinary and administrative problem that can be tackled at the District level.

Probably very alarming, was the observation of the reserch team that the P.D. of HCI V and HCI IV are virtually identical. This is an obvious ambiguity that disallows an HCI IV from formally working under the supervision of an HCI V. Specific problems were reported stemming

from this background.

It was reported to the research team by an inspector that engineers are inexperienced, are unwilling to do field work, and would rather spend most of their time in office rather than on the field. It was confirmed in discussions with field engineers that some of them spend as much as 90% time in the office. The Principal Investigator is of the opinion that to develop field expertise, engineers should devote more time to the field. Without adequate field exposure, engineers are hard pressed to make efficient decisions. Inspectors are substantially right when they report that engineers are poor in decision making owing to lack of field exposure.

Note: Field supervision requires physical agility, strength, and a desire to work outdoors. Engineers who prefer office work are generally unsuited to field work. It must be emphasized that a field engineer must devote a necessary amount of time to observing field progress and practice.

11.1.11 Organization Structure is Inadequate

Activities and tasks are undertaken in the field office that are not in sync with the organizational structure and field duties. The organizational structure existing is the traditional, functional, pyramidal structure that is many centuries old. Modern management has developed newer techniques such as departmental project management, matrix structures, and flexible structures. We will be recommending later in this report that the organization structure be revamped and that the matrix structure be utilized. This reorganization will be able to better represent the realities in the field.

11.1.12 Janitorial Work

While engineers are dutifully bearing and performing janitorial tasks around the field office, there was perceived an underlying resentment of such work. While the concept of dignity of labor is well known in the United States (and engineers understand that), it is apparent that engineers perceive janitorial work as not a civil engineering classification. Janitorial work does not take much time for them, therefore they do not speak out openly against it. Moreover, they have been pressurized to perform janitorial tasks over the years, so they have lost the desire to speak up. Nevertheless, they would rather not do such work.

One and only one field office reported they had no objection to janitorial work, did not mind it at all, and would not prefer outside janitors. In factual observation, the research team is compelled to state that that field office was particularly dirty, undusted, and had odors, even though the

offices are relatively new.

Quite a few field offices were seen to be unclean and unkempt. Indoor air quality and indoor environments have become topics of immense concern in the last decade. Employees can not -- should not -- be forced to work in unclean environments. The cleaning of toilets might be done regularly, but the cleaning of offices is not done that regularly or thoroughly by them. Dignity of labor is a good concept, but ill health can contribute to poor morale. This issue is easily something that HDOT can address equitably.

11.1.13 Vehicles

While some field offices have adequate number of vehicles, others don't. It is difficult to imagine how engineers can effectively perform their work if an adequate number of vehicles are not provided. HDOT is reported to complain of finances. However, the complaints of the engineers are conceived by the researchers to be genuine. The number of vehicles by which field offices are possibly short might be only one or two, but that is enough to cause conflicts and acrimony. The emphasis here is that engineers should be treated with the respect due to engineers. If adequate facilities can not be provided, perhaps HDOT should consider alternate methods of cutting back on services and not undertake new work they can't properly handle with dignity to engineers.

A solution to this is to charge vehicles to the contractor and have him furnish vehicles for site use. The argument against this is that expenses increase. The counter argument is that if that doesn't happen, conflicts and unhappiness increase, thereby further wounding the psyche of field engineers and demoralizing them.

11.1.14 Lump Sum Contracting

In project delivery systems, there is always a choice between unit rate, lump sum, cost plus and design-build systems. They each have their specific characteristics, advantages and disadvantages. Lump sum contracts have the advantage that the scope of work is well spelt out (provided the design is adequate). Unit rates have the disadvantage of requiring excessive monitoring to determine work quantities for monthly payments. Fast track projects can be built faster, but run the risks of design complications. Design build projects usually transfer risks to the turnkey contractor, but the final product may not be what the owner wants.

Considering the advantages and disadvantages, it can be proposed that if constructability review and FACD are used, lump sum projects stand to save management time and complications to the HDOT field office teams.

11.1.15 Quality Control

It would also save time for HDOT to transfer quality control responsibilities to the contractor. There was general unhappiness on asking inspectors to perform testing activities. For one, such work is simple and can be done by numerous testing labs. For another, this simple task takes up the precious time of inspectors when RE's are experiencing a shortage of inspectors.

Contractors can easily obtain certifications from testing labs. HDOT could ask for such testing to be done by the contractor at a designated place, such as the Materials and Testing lab or at UHM.

12.0 Listing of Dual Findings - Those Having Positive and Negative Characteristics

The following items were discovered to have both negative and positive characteristics:

1. Superior-subordinate relationships
2. Computer Knowledge and Advancement
3. CE III's

12.1 Discussion of Dual Findings

12.1.1 Superior Subordinate Relationships

There was a mixed bag of information regarding superior-subordinate relationships. There were complaints at both ends. For instance, there was considerable difficulty expressed by RE's in managing and motivating some CE III's and inspectors. This is partially due to the great difficulty of transferring or firing employees. At the other end, there were considerable complaints expressed regarding unhappiness with senior management. A certain level of senior management at the Oahu District were reported to be insensitive, which affects morale and delays decision making. It was reported that some resolutions took many months on decisions that were required yesterday.

Unhappiness with superiors was particularly unpleasant from the reports learned by the research team. The incidence rate was also significant. Forty percent of RE's/AE's reported dissatisfaction with supervisor as a reason that caused them the greatest dissatisfaction on the job. Cross-link to Section 11.1.5.

Satisfaction with certain levels of superiors was also reported in the vast majority.

12.1.2 Computer Knowledge and Advancement

Field engineers have scarcely sufficient amounts of computer software knowledge. While training has been reported to be provided, it is understood that such training has been inadequate. Engineers are still not comfortable with spread sheets, data bases, and presentation software.

While the supply of computers is an outstanding advancement and achievement, this needs to be followed up rapidly with inter-office connections, and e-mail and ftp services, else the momentum can be lost and computers begin to gather dust.

12.1.3 CE III's

While some CE III's are recognized to have considerable wealth of experience and technical knowledge of the field, there was clearly substantial dissatisfaction with other CE III's who have been in the system for many long years and have stopped producing. RE's and CE IV's both reported these findings. RE's reported immense satisfaction and disgust with CE III's.

Nevertheless, many CE IV's lack experience, and this has a negative effect, but can be overcome by education.

13.0 Preliminary Recommendations

PE's, RE's and AE's all significantly mentioned the necessity of reform and change. Their verbal reports match their written response on Questionnaire No.1 "Is it necessary to change the way things are done to improve efficiency at HDOT?" Seventy percent of RE's/AE's have a strong opinion that things should necessarily be changed, with none in opposition. 61% of PE's share the same sentiment, with only 3.8% in opposition. The remaining felt that changes are needed 'somewhat.'

Below are recommendations by the research team on the basis of this qualitative study and early findings. There are more recommendations -- some similar and some dissimilar -- as part of other reports being generated. The genesis of some identical recommendations can also have different roots. Thus one remedy may treat more than one symptom.

The recommendations follow the negative and positive findings discovered and are divided into the following categories:

1. Education in construction management is desirable.
2. Plan to downsize.
3. Plan to specialize.
4. Streamline change order process
5. Streamline engineer time sheets
6. Start claims and planning-scheduling sub-divisions or specialty areas.
7. Treat engineers with greater respect
 - Increase delegation/ Increase change order authority
 - Elevate AE's to EM VI positions
 - Provide more recognition schemes
 - Eliminate discipline maintaining strategies
8. Leadership not aware of modern construction requirements
9. Address inspector standards
 - Redefine P.D.'s between HCI V and HCI IV
10. Consider making contractor responsible for quality control
11. Address CE III's issues of engineering quality
12. Simplify contract delivery systems
13. Enhance design-construction integration
14. Implement re-organized organizational structures
 - at field offices.

- at District Office.

13.1 Education in CM desirable

Education in construction management techniques is absolutely necessary for effective work execution in this specialist engineering field that Oahu district engineers are engaged in. Education is considered here a step beyond training, in that education enters into long lasting memory of the engineer, whereas short duration training seminars and ad hoc meetings do not provide the in-depth understanding necessary.

Special education is necessary in planning and scheduling, claims and change order management, contract law, alternate dispute resolution (ADR), and construction estimating.

Nevertheless, some training in using computer software might be helpful, such as for MS Office Professional, even though there are engineers who have picked up such talents on their own.

While some engineers lack efficient skills in writing, it is not conceived possible to improve such skills with a course or two. Writing talent usually comes with a lifetime of practice. It can only be suggested that new hires be screened for their writing abilities.

Short duration seminars and training sessions can be possibly reduced. It is frequently reported by HDOT and state agencies that money is scarce. Nevertheless, innovative ways must be found for long term education and retraining of engineers.

13.2 Downsize

A trim ship is an effective ship. It is usually better to have a few efficient people than have a large bunch of inefficient people. With the upcoming completion of H-3, it can be recommended that the opportunity should be taken to downsize. Downsizing will have the further benefits as follows:

1. Poor performers can be weeded out, whether slowly or dramatically. (There will likely be some 'bumping' that will go on.) This will raise average standards of talent in the organization, thereby contributing to a revised culture. Morale also stands to increase, since higher professional standards will be expected of those remaining. Poor morale on this account was reported during the interviews.

2. Workload of individual engineers could increase. This is itself a good thing, since it has been considerably reported that current work loads are not heavy. Around the country, the trend

is for people to take heavier loads, since computerization and modern communication systems enable much of the work to be accomplished with less. Increased workloads increase self-confidence and independence. Engineers become more self-reliant and become their own 'work station.' They are pushed to learn more. Doing more will also translate to enhanced responsibilities that are being recommended in this report as good for the cultural transformation. A majority of engineers reported that their workload was moderately heavy. Considering also all the improvements that are possible, it is reasonable to suggest that work load should be increased. But the workload only should not be increased in isolation, without simultaneous implementation of other recommendations. For instance, an increase in workload without increased support from upper management can be disastrous.

3. Costs to HDOT will definitely decrease. This will help HDOT prove that they are spending less per mile of road to what they were spending in earlier years. The monies saved can be used for other necessary improvements, such as step raises in salary, education and training, personnel development, and/or other.

4. Downsizing will serve to increase efficiency. Responsibilities will increase and will result in greater exercise of leadership and innovation skills.

13.3 Specialization

Mechanical and electrical engineers should be assigned tasks in their area of specialty or else should not be hired. The research team believes that hiring of non-civil engineers to perform civil engineering jobs is unethical and a disservice to both that individual engineer and to the department.

A culture of excellence can not be built without investing in professional competence.

13.4 Streamline Change Order Process

The current forms and change order process are cumbersome. It will help to streamline the forms being used and increase delegation to RE's/AE's for this process.

13.5 Streamline Engineer Time Sheets

Engineers are required to fill out time sheets showing how many hours they have worked on each project. That's not all, they are required to fill in the exact hours worked. This can be time-consuming.

In modern cost control practices, there are a few alternate methods of filling out such time sheet information (Slemaker, 1985). Frequently, exact correctness to the last hour is not necessary.

Approximate entries that provide percentages between projects worked on also suffice, especially since the ratio of engineer salaries to total project costs is a small amount. Much depends on the accounting method being used and how power is distributed at HDOT. If the accountant has more power, then the engineer suffers. If the engineer can decide which method to use, the accountant is not hurt. HDOT is, primarily, an engineering organization.

13.6 Claims and Scheduling Departments

For improved efficiency, and in the current context where field engineers do not have adequate scheduling and claims knowledge, separate sections should be created at the District Office to handle these functions. Each of these two sections should be headed by a person of AE rank. This step will, in itself, serve to impart greater professionalism and respect to the functions of the construction engineering management. Also see section on re-organization of organization structure.

13.7 Treat with Respect

Construction engineers can not and should not be treated as grubby, dirty, field workers. They are more than that. The administration of most of HDOT's expenses goes through them. To realize economies in costs and reduce public complaints, more attention has to be paid to these front line engineers.

These engineers do tough jobs. The work that an RE or AE does can often times be more than what their counterparts in private construction companies do. Important decisions are taken by them. They would be served better with support from the leadership and with greater autonomy provided them in their decision making.

13.7.1 Delegation/ Change Order Authority

Increase trust in AE's and RE's. Provide them with greater decision making authority across the board. Have pride in them and they will have pride in HDOT.

Of special consideration here is the granting of final change order authority to these engineers. If paperwork must go to FHWA, consider sending that paperwork directly from the RE and AE depending on the size of the change order.

13.7.2 Elevate AE's to EM VI positions

It is worthwhile considering elevating AE's to EM ranks from CE ranks. AE's are all CE V's. Consider making them EM VI's. This will again impart a sense of support to the Oahu District

engineers. In fact, AE's are already performing EM functions. EM positions should not be held exclusively by top brass. Any one who performs an EM function should be provided an EM rank. To start with, AE's must be elevated to EM ranks. Simultaneously, RE's should be considered for a shift to CE VI.

13.7.3 Provide Recognition

In the same tune, it is worthwhile considering introducing recognition schemes for Oahu District engineers. This is necessary for improved morale. The 'tin man' gained courage merely because he was awarded a medal for courage. Greater attention must be paid to motivation management. (A more detailed study is underway by this research team on motivation analysis.)

13.7.4 Eliminate Discipline Maintaining Strategies

Another way to increase trust and respect is to 'actually trust' them. Administrative items such as writing on a board where the engineer goes during office hours or asking them to submit daily logs of vehicle usage can be abolished. It is understood by the research team that HDOT would like to prevent abuse, which is why they initiated such schemes. However, in the interest of morale and trust, it is believable that any related abuse would be minimal, especially if work focus is increased. It was heard that morale at field offices reduced when writing one's destination on the board was introduced three-four years ago. With radios in the vehicles, engineers can keep in touch with the office. Therefore, life should be simplified for field engineers.

13.7.5 Janitorial Contract

Since the vast majority of engineers do not appreciate doing janitorial work, it is worthwhile considering contracting this work out to an outside cleaning services professional agency. Such a move might cost extra money, but it will save on engineer-hours expended. Besides, professional cleaning will be facilitated, creating a healthy work environment.

13.8 Leadership Not Aware Of Modern Construction Requirements

The engineers' reports point towards upper management being significantly unaware of modern construction management practices and theories. This is a delicate situation. The remedy for this can be for upper management to impement changes and further push for reform with politicians and other state agencies.

13.9 Inspector Standards

To raise the standard of inspectors, consider increasing their qualification levels to that of

Associate Degree. With the amount of writing and reporting they need to do, they need to exhibit more writing skills. Clearly, a person with an associate degree can be expected to have better writing skills than a person with a high school degree.

By raising their standard thus, it will be possible to pay them a higher starting salary as well. Currently, it is somewhat difficult to get good inspectors with knowledge and experience. Though foremen from construction companies have good experience, they generally prefer to stay in private industry owing to higher salaries.

Raising the standards and requirements of inspectors will benefit the instructors and the RE's, who will be able to get inspectors to be more responsive.

CE I's and II's could also be assigned inspection job duties. This will ensure a higher operational standard and skill level. Young ES's can also be assigned inspection tasks. The ES's are typically senior students from UH's civil engineering program and have generally taken a construction course or two. They can be fairly well relied on to perform the inspection function.

13.9.1 Redefinition of P.D.'s between HCI V and HCI IV

The P.D.'s of HCI V's and HCI IV's are virtually identical! Both are allowed to be the chief inspector supervisor on a project. There is nothing in their P.D.'s that says that an HCI IV should report to an HCI V. All the while, the District Office considers the HCI V as the chief inspector, but there is insufficient formal regulation to back that up.

This ambiguity is an obvious recipe for conflict. The HCI V P.D. can be easily modified as can the HCI IV's. Alternatively, if revisions are not desired, HCI V's and HCI IV's should not be placed on the same project, since they have virtually the same P.D.

13.10 Consider making Contractor Responsible for Quality Control

It might be possible to make contractors responsible for quality testing at nominal or no increases to project costs, since contractors nationwide are used to doing this. The advantage of doing this is that quality will be assured while lesser time and effort will need to be spent by HDOT engineers and inspectors. This will also translate into lower administration costs for HDOT.

13.11 CE III's

There is an inherent problem with allowing CE III's to remain at that level indefinitely. For one, they lose motivation. Then they can become a liability to the field office and RE. Growth and

advancement are being emphasized nationwide and in all management circles. The reasons are straightforward: such growth is necessary to be able to cope with the rapid technological advancements worldwide.

However, the CE III level creates a class distinction that many poor performers are content with. This does not create a healthy organizational culture, though. The researchers could sense a distinct difference in personality and standard between licensed engineers and unlicensed CE III's. A revamping of this system is recommended. Some ideas for this are:

1. Place a moratorium, if possible, on the maximum number of years a person can stay as CE III -- say, five years -- after which the individual must obtain a license, else be asked to leave. This will translate into the organization having a higher skill level and qualification standard, both of which will be good for the department.
2. Reduce the number of CE III's, II's or I's taken in.
3. Stop, altogether, the hiring of non-licensed engineers.
4. Apply combinations of ideas 1 to 3 above.

13.12 Contractual Changes of Project Delivery System

The matter of making contractual changes, i.e., of having most, if not all, projects as lump sum has to be decided more thoroughly at Punchbowl. Needless, Oahu District must be consulted before the project is let out as one type or the other. Whereas it might be expedient for some projects to be unit rate, lump sum management is generally considered easier. In combination with constructability review (which is necessary, anyway), and FACD, it is possible to reduce the incidence of design change orders, thereby allowing projects to be ordered as lump sum.

The purpose of making this recommendation is to simplify contract administration wherever possible.

13.12.1 Vehicles

HDOT suffers from a relatively poor public image. Coupled with this, field engineers complain strongly about shortage of vehicles. It is recommended that HDOT study the possibility of having contractors provide vehicles for engineer' use. This can be executed on large and small projects, both. The material symbol will assist engineers in their image. The shortage problem will also be overcome.

13.13 Design-Construction Integration

There is an urgent need to address and improve design-construction integration. This can be done through the following:

1. Installing a constructability review sub division next to the design office.
2. Performing FACD
3. Commencing cross training between design and construction departments.
4. Assigning design engineers to 'stay' with their design once it exits design office.

Designers must feel responsible for design. Therefore, they should be asked to follow-up with the field office on the designs they make.

13.14 Re-organization at Field Offices

The current organization structure at the field offices does not reflect the way work is done. The organization structure should be corrected. The revised approach follows a matrix organization structure. Field office participants must be informed of this revised structure. Each project must be assigned an engineer as project coordinator. The ultimate project responsibility can continue to reside with the RE's. The RE's can be allowed to decide who should be assigned to which project. The inspectors and surveyors on each project report to the project coordinator as well as to their functional department - the chief inspector or head surveyor, as the case may be. The recommended organization structure is provided in Figure 1. Engineering students can be made to work in the field, on inspection jobs, for computer work, or other paperwork as the RE deems fit.

The matrix organizational structures have been highly recommended in recent years for construction management (Kolodny, 1980)

13.15 Re-organization at District Office

A reorganization at the District Office is recommended to conform more closely to modern construction management organizations. Being considered here are requirements for fulfilling the following:

- necessary construction management functions and project requirements.
- span of control.

Necessary CM functions and project requirements include claims and change orders, planning and scheduling, work inspection, quality assurance, processing of payment certificates, design liaison,

traffic coordination, safety control, cost management, acquisition management, among other.

Span of control relates to the number of people a supervisor controls. Supervising too many (generally more than seven) or too few -- such as one or two -- are generally not considered appropriate in management settings.

Considering the above, it became clear to the research team that important functions are not represented appropriately. The recommendation is to have a matrix organization as given in Figure 2.

In the recommended structure, focus is made only to engineering and project requirements. Staff, clerks, and secretaries and purchasers, etc., are not included.

The comprehensive organization structure of the field office will include elements of Figure 1 and 2. Thus the RE will supervise scheduling engineers and claims and change order (C&CO) engineers assigned from the functional departments.

While three AE's and six RE's are shown in Figure 2, their real number is flexible and can be decided by the amount of work and number of projects.

14.0 Conclusions

HDOT's Oahu District faces considerable challenges and hurdles. The solution to many issues and problems it faces are absorbed in difficulties. Some issues are tied to legislative matters, while other issues can be addressed at the departmental level. Nevertheless, so long as HDOT is held responsible for its actions, it is indeed necessary to face up to -- and tackle -- a broad range of issues simultaneously.

While there was relatively good teamwork discovered at the District Office, this is offset by the perceived lack of trust and support from upper management and leadership -- primarily at the Punchbowl office. Punchbowl was perceived to be 'out of touch' with the difficulties and realities faced by field engineers.

Field engineers feel considerably bitter that they do a 'lot of work' but are 'beaten down' by Punchbowl. At the same time, there were considerable concerns discovered where engineers do not have adequate engineering-management knowledge. The remedy for both these problems resides in initiatives that can be taken by the Punchbowl office.

Considerably alarming was the observation that engineers do not have adequate construction management specialty knowledge, such as planning/scheduling, claims management, or productivity management. Redeeming this, however, was the observation that engineers desire more education, knowledge, and training. However, such reeducation should be prolonged in duration. The short seminars were reported by all engineers to be practically inadequate and insufficient, sometime not worth the money spent. This is understandable, since the learning of new knowledge requires formal education.

It is imperative that HDOT improve the working culture and treat its engineers proudly and respectfully. It is only ethical to treat engineers well. The research team feels that field construction engineers are worthy of respect and good treatment. The leadership can do quite a few things to alter current culture and trends.

Recommendations are provided for new organization structures, both at the field and District office. Organization structures should reflect the way work is done or desired to be done. The new organization structures do that.

Position descriptions of HCI IV and V need to be revisited, since the two descriptions are virtually identical and can result in confusion and conflict.

The issue of CE III's affects morale and standards. It is also known that some CE III's have the wealth of experience and are good workers. Attention needs to be paid by upper management to poorly performing CE III's. For this, upper management may have to rethink their entire strategy concerning CE III's.

RE's/AE's need to be given more authority and decision making flexibility to enable them to function with greater effectiveness.

Field engineers should be allowed greater flexibility in their work structure. Specifically, procedures for recording vehicle logs, hours worked per project, and sign-in/sign-out should be eased out. The current procedures consume significant engineer-hours and dampen spirits. Alternative strategies are always available.

Using mechanical and electrical engineers for civil engineering work is an injustice to the taxpayer and the individual engineer. Electrical and mechanical engineers should be asked to focus in their specialty area only.

Good teamwork was discovered among the Oahu district engineers. Any motivation that engineers have is only self-motivation, with none provided by HDOT at all. Engineers are substantially motivated by work challenge. Work inspiration and interest is the major mitigating factor for many negative trends observed.

Design-construction coordination and integration is a major issue that affects the amount of money spent on change orders. Field engineers do not all report good experiences with design office on a formal level, though informal, personal relationships were okay. Constructability review and functional analysis in the design office are recommended for immediate implementation.

The items that need to be immediately addressed are provided under the recommendations and follow the negative and positive findings discovered.

15.0 References

- "Constructability: A Primer," Construction Industry Institute, Publ. 3-1, Austin, TX, 1986.
- Dell'Isola, A., "Value Engineering in the Construction Industry," Van Nostrand Reinhold Co., NY, 1982.
- Herndon, S. and Kreps, G. (eds.), "Qualitative Research: Applications in Organizational Communication," Hampton Press, Inc., NJ, 1993.
- Kolodny, H., "Matrix Organization designs and New Product Success," Research Management, pp 29-33, September, 1980.
- Likert, R., "The Human Organization: its Management and Value," McGraw Hill, 1967.
- Herzberg, F. Mausner, B. and Synderman, B., "The Motivation to Work," John Wiley and Sons, NY, 1959.
- Maslow, A., "Toward a Psychology of Being," Van Nostrand Reinhold Co., NY, 1968.
- Slemaker, C. "The Principles and Practice of Cost-Schedule Control Systems," Petrocelli Books, NJ, 1985.
- Wilemon, D. L. and Cicero, J. P., "The Project Manager: Anomalies and Ambiguities," Academy of Management Journal, pp. 269-282, 1970.

15.1 Notes on References Used

Primarily classic texts and journals have been presented as references in this report.

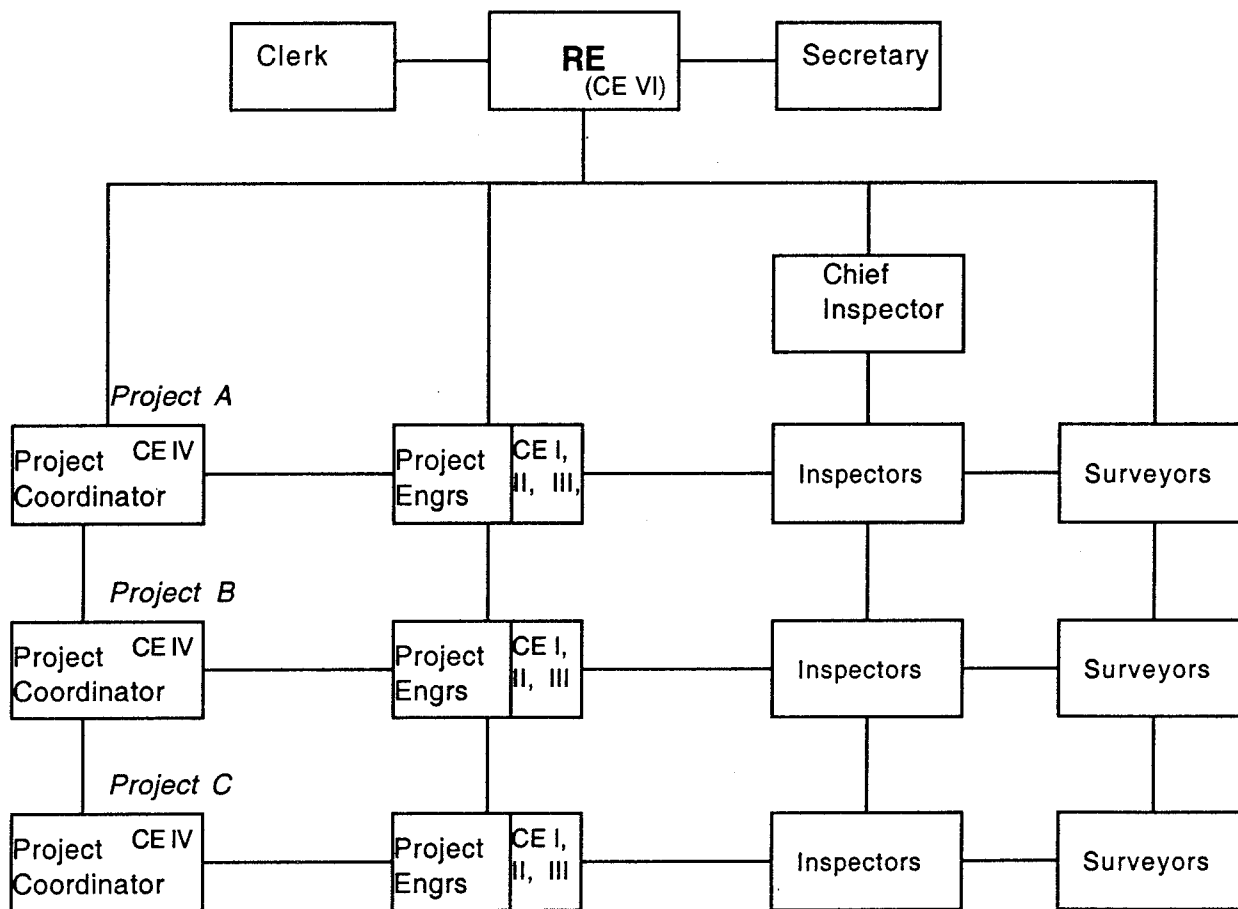


Figure 1: Recommended Field Office Organizational Structure

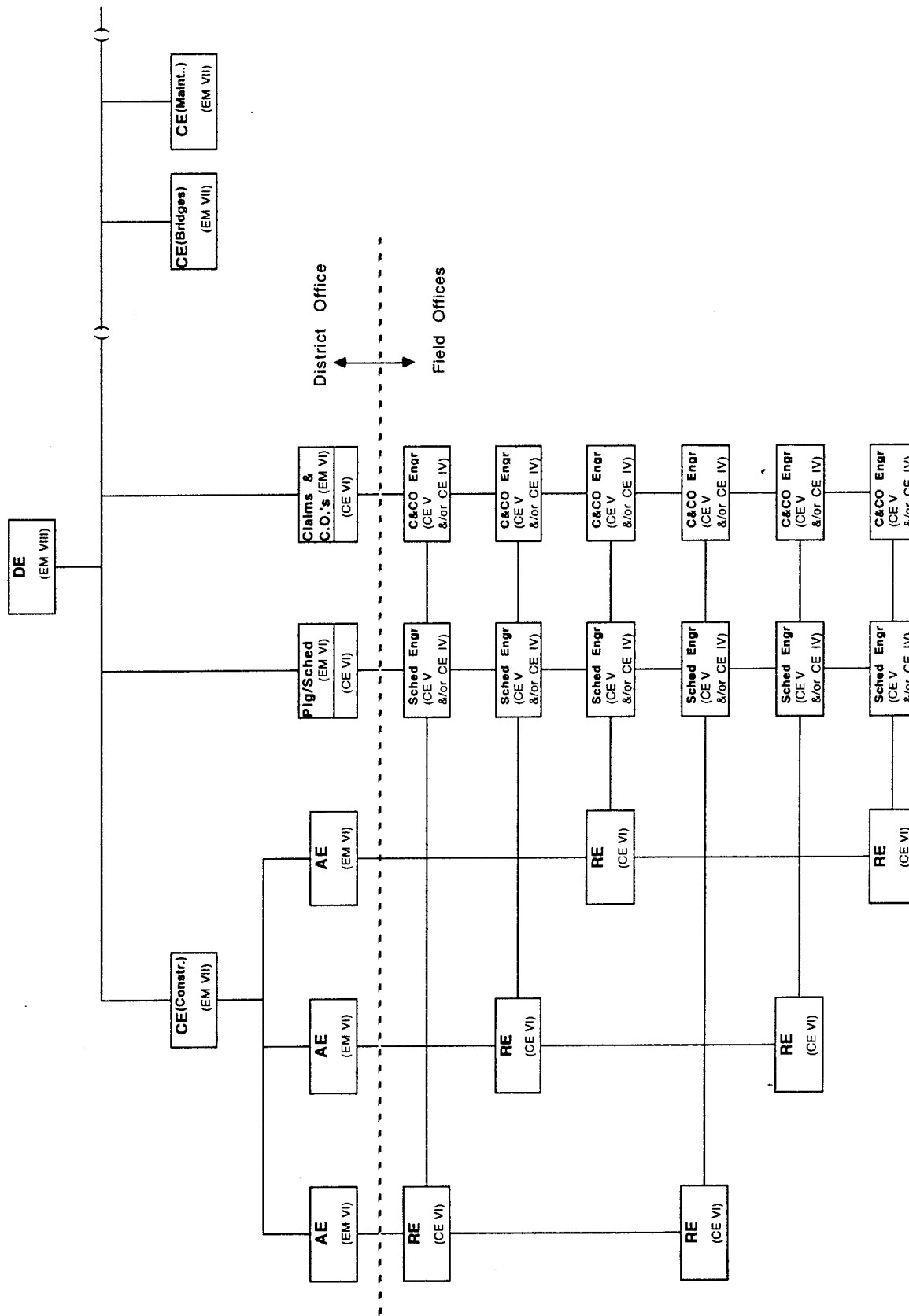


Figure 2: Recommended Reorganization of District Office Organization Structure (Partial)