V The Retrofitting Process: From Contracts to Construction

An analysis of the contracting and construction process not only brings to the forefront the positive and negative components of these processes as such, but also highlights a series of problems deriving from earlier procedures followed in the promotion of the retrofitting program. In this sense, it provides valuable insights as regards the planning and promotion of future programs.

1. The Contracting of the Retrofitting Works.

Table 2 summarizes information on the dates and details of the contracting and construction stages.

TABLE 2

CONTRACTING AND CONSTRUCTION: DATES, COMPANIES AND COSTS

	Date of Public Bidding	Date of Contract Award by Board of Directors	Date of Commencement Retrofitting	Date of Completion Retrofitting
National Childrens Hospital	01-02-88	07-04-88	26-06-88	Feb. 1990
Monseñor Sanabria	12-01-88	07-04-88	01-08-88	July 1991
Mexico	29-09-88	02-03-89	15-05-89	July 1992
Central Offices	19-04-90	not awarded		

	Original Contract Period	Company	Original Contract cost (millions of dollars)
National Childrens Hospital	15 months	COCOSI S.A.	0.830
Monseñor Sanabria	12 months	SAMYP	1.041
Mexico	18 months	WEISLEDER AND COCOSI S.A.	2.205

The public bidding process and contract awards for the Children's, Monseñor Sanabria and Mexico hospitals took place between 1 February 1988 and 2 March 1989. In the case of the Ciudad Neily hospital, the retrofitting works have not been awarded to date, although they are supposedly now budgeted for 1993.

The Central Offices project met with a long series of problems which required nearly a year and a half in order for the retrofitting works to be opened to bids.

The project was not only a retrofitting scheme, but also a scheme for remodelling and expanding the existing building. As such, a feasibility study was required by law in order to justify the increase in space. This process took up a good part of 1989. Budgeting problems at the beginning of 1990 caused further delays, until the public bidding for the works was finally opened up in April of that year.

Three companies presented plans and budgetary specifications for the works. According to early 1990 estimates made by the Engineering and Architecture department at the Caja, these works would cost around 290 million colones (2.8 million dollars approx.). However, the lowest budget received, from Vanderlaat and Jimenez, was for 821 million colones (8 million dollars approx.). The final cost of the works, including previously unbudgeted items such as elevators, and taking into account increased material costs over the construction period, would have turned out to be around 1332 million colones (13 million dollars approx.).

This final price, even taking into account possible cost reducing formula, resulted unpalatable for the CCSS executives and the Board of Directors. The offer was turned down by the Board on the 25th of October, 1990, and the panorama turned back to the

search for a more simple and economically viable retrofitting project. In 1991, a new bidding process was opened up and the contract was awarded, once more, to Bel Engineering. This decision was later appealed by another of the competing companies.

Prior to this award, the overall process, from 1987 through 1991, had cost the Caja nearly 8 million colones in consultancy costs, without considering the sum of the indirect costs incurred.

Between the time that contracts were being awarded for the preparation of structural plans, and the beginning of the bidding process for the construction works, the retrofitting process was given an additional stimulus with the publication of a Presidential Decree ordering all public institutions to revise their installations and take remedial action in those cases where structural deficiencies were found. The Decree was signed on 13 August 1987, and published in the "Gaceta" on 3 September. The initiative for this decree came from the Health Minister, Dr. Edgar Mohs, and the National Emergency Commission. As mentioned earlier, Dr. Mohs had been instrumental in pushing forward the National Childrens Hospital vulnerability studies.

2. The Construction Process: The Final Test.

The construction process, which turned out to be fairly "routine" in the case of the Children's Hospital, was plagued with severe problems in the case of the Monseñor Sanabria and Mexico hospitals. Problems of communication between the social actors involved; inadequate planning and coordination procedures; and shortcomings in the specifications made for the contracting of retrofitting plans and construction works, explain a good number of the problems faced. A number of these can clearly be related to the novelty of the retrofitting program, as such. But, others derived from more basic human problems and errors, lack of foresight, and human and financial resource constraints.

The problems faced gave rise to significant increases in the costs of the works and an extension of the original construction calendars. In the case of the National Children's Hospital the construction process lasted 20 months (as opposed to the contracted 15 months). In the case of the Monseñor Sanabria Hospital the process extended to three years as compared to the originally projected 12 months. And, in the case of the Mexico Hospital, it was three years as opposed to the original 18 months.

The problems faced and the extended time period that the Monseñor Sanabria and Mexico hospitals were being retrofitted, led to severe conflicts and discussions between hospital administrators, building companies and the engineering and architectural staff at the Caja's headquarters. At times a total

breakdown of communications and coordination occurred.

a. The National Children's Hospital.

The construction process in the National Children's Hospital, the first to commence, was the least traumatic of the retrofitting projects.

Preparatory meetings held prior to the commencement of works, between the hospital administrators, Egineering and Achitecture Department staff, the structural engineers, and building company representatives, allowed an early identification of real and potential problems to be faced. The relationship between the building plan and the functional needs of the hospital were discussed during these meetings.

Apart from the positive role played by these early strategic coordination meetings, the construction process was also facilitated by the active presence and concern of the hospital authorities from the very outset of the process; an excellent relationship between the hospital authorities and the structural engineers; the presence of Dr. Edgar Mohs as Minister of Health; the closeness of the hospital to the CCSN headquarters and to the Department of Engineering and Architecture staff charged with the inspection of the construction works; and the efficiency with which the construction company undertook its job.

A limited number of situations occurred which were to be repeated in differing degrees in the other two hospitals. These included:

a. The need to revise the originally conceived building plan. The plan put forward by the construction company would have required the closing down of the hospital during the second stage of the works. Faced with this situation the plan was revised prior to the commencement of works. The new plan required an extension of the building calendar by five months which in itself led to increased administrative costs for the company.

b. Delays in turning over parts of the hospital to the construction company for retrofitting. This occurred with the area of the kitchens and dietary department, due to a delay in gaining authorization from the Comptroller Office to contract these services with the private sector. This delayed the works by one month.

c. The need for a series of construction activities to replace or repair items that had been removed or destroyed in the retrofitting process (walls, windows, floors, paintwork,

electrical systems, etc.). The lack of clear specifications in the building contracts as to who should assume the responsibility for and the cost of these activities led to authorization and budgeting problems. No architectural plans had been drawn up to accompany the structural plans, such that the definition of what constituted an "extra" in the construction works was made more difficult.

d. The need for modifications in the structural plans and new, unplanned retrofitting activities. This occurred with the foundations and support columns in the emergency sector of the hospital. The need for additional retrofitting plans arose as part of the ongoing process, and was not necessarily due to a lack of foresight.

e. Requests made by the hospital authorities for the remodelling or extension of certain of the hospital's functional areas. Taking advantage of the need to retrofit the Emergency Department, the hospital authorities requested that remodelling be undertaken in different areas on the four floors above this. The need to coordinate these works with the ongoing retrofitting process requires agile authorization, contracting and budgetary allocation procedures. This was not always the case with the approved remodelling activities.

The sum of the positive and negative situations faced in the retrofitting process provide important lessons for future activities. Unfortunately, these lessons were not, or were unable to be applied in the construction process undertaken in the other two hospitals.

b. The Monseñor Sanabria and Mexico Hospitals.

The very beginning of retrofitting works in these two hospitals was delayed due to administrative, communications and coordination problems.

In both cases no clear previous communication as regards the planned commencement of construction activities had been transmitted to the hospital authorities by the Engineering and Architecture Department authorities. Neither had they seen copies of the retrofitting plans, or the builder's work plan and calendar of activities, prior to the arrival of the construction companies to commence works. No previous coordination meetings had been organized between the different parts.

In the case of the Monseñor Sanabria hospital the situation was dramatic. On the arrival of the company, the authorities refused to allow the works to commence. A revision of the company's building plan, which proposed simultaneously retrofitting

all sectors of the hospital, revealed that the hospital would have to be closed in order to undertake the work. The negotiation of a solution to this situation lasted a month and a half and the retrofitting process finally commenced on the 1 August 1988. The new plan inevitably required an extension of the retrofitting calendar from the very beginning of the works.

The building plan for the Mexico hospital did not present this problem. This may possibly be attributed to the fact that one of the building companies involved (COCOCISA) had participated in the Children's Hospital project and was able to anticipate this type of problem adjusting the plans accordingly. However, full commencement of works was delayed due to administrative problems in obtaining the Comptroller Office's countersigning of the building contract. Problems with the specifications regarding the company's Deposit of Guarantee, and the lack of adequate budgetary authorizations took over two months to resolve, thus delaying the whole process.

The problems faced at the outset of the construction process were to mark the tone of the process as a whole in these two hospitals. Lack of adequate coordination and programming procedures; problems as regards the agility and timing of inspection procedures; and conflicts between the sectors involved, were further complicated in the case of the Monseñor Sanabria Hospital, by the inefficiency and at times low quality work of the construction company.

Changes in building calendars, severe delays in the completion of works in the different sectors of the hospitals and in the handing over of different sectors for retrofitting by the hospital authorities, combined in a spiralling fashion to increase tensions and construction times and costs. In the Monseñor Sanabria hospital, at one point the company totally ignored the construction plan and was found to be working in all sectors at the same time causing even more severe problems for the functioning of the hospital. Robbery and damage to installations and services were prevalent.

The level of frustration in the Mexico Hospital reached such levels that the authorities broke off conversations with the building company and the CCSN authorities on various occasions. Finally, in 1991, the hospital authorities took the building programming into their own hands.

The problem of "extras" was repeated in these hospitals; and, in the case of the Mexico hospital, requests for remodelling of certain sectors of the hospital again caused authorization and budgeting problems. Sectors of the hospital not included in the original retrofitting program needed to be worked on due to the impact of the March 1990 earthquake in Cobano.

In the case of the Monseñor Sanabria Hospital, the Cobano quake (with its epicenter 40 km away) added new complications to the retrofitting process. The quake caused 25 million colones of nonstructural damages or losses to the hospital. One important factor explaining these losses derives from the fact that the retrofitting process had been completed in differing degrees in the two major sectors of the hospital. Torsion effects were generated leading to nonstructural damage (see Cruz, 1991). New lessons on retrofitting procedures were gained from this experience.

The repairs to the hospital were contracted to the same retrofitting company, leading to further problems between the authorities and the company. And, the retrofitting program was further delayed given that the company diverted its efforts to the repair works. In the end, the hospital took on the repair process on its own account, facing severe financial problems in order to complete the works.

Three key factors (in addition to those noted in the case of the Children's Hospital) explain the unsatisfactory situation experienced in the construction process in these two hospitals.

a. The lack of a participatory planning and programming process promoted by the Caja Central Office authorities. The centralization of basic authorization, decision making, control and inspection tasks clearly contributed to this situation.

b. The lack of anticipatory planning and programming procedures, which could identify future needs in terms of service substitution, and basic functioning.

c. The lack of sufficient human resources at a Central level to adequately plan, program, supervise, and inspect the retrofitting works.

As regards this latter point it is important to note that in 1988, the Caja promoted the most ambitious construction program since its foundation in the 1940s. This included both new buildings (hospitals and clinics) and the retrofitting program as such. This ambitious building program came after seven years of restrictions due to the unfavorable financial situation faced by the institution.

However, at the same time that this ambitious program was being promoted, budgetary allocation problems were also being faced, and the 1988 program finally got under way in the second semester of the year. The 1989 program was to be equally ambitious. Despite these large-scale increases in building activities, the number of professionals working in the Engineering and Architecture Department did not increase commensurately.

The centralization of functions in this group of professionals and the large-scale demand for their services, in all parts of the country, must have put an unbearable strain on their capacity to respond to the coordination, decision making, authorization and inspection needs of the different construction projects. Amongst these, the retrofitting program required the most careful levels of coordination and control due to the highly specialized nature of the process, its novelty, and the need to guarantee an adequate ongoing level of functioning of the hospitals. Three of these projects were simultaneously underway in 1989 and 1990.

Even under these difficult and demanding circumstances, the inspection process for the retrofitting projects was controlled by professionals at the CCSN head offices. The Engineering consultants responsible for preparing the structural plans were contracted on a limited time basis to supervise the works at the Mexico and Children's Hospital.

The severe problems faced at the Mexico hospital finally led to the contracting of the Consultants to both supervise and inspect the works, thus giving greater continuity to these tasks and a permanent on-the-job presence.

Strong arguments exist for promoting this procedure in any future projects, thus taking pressure off the regular CCSN engineers and guaranteeing the presence of highly specialized, on the job professionals.

In sum, other important lessons for future retrofitting programs can be derived from the experiences faced in the Monseñor Sanabria and Mexico Hospitals.

VI Insurance Coverage and the Economic Protection of CCSN Investments.

The scope of the insurance coverage taken by an institution as a protection against seismic risk is clearly an important consideration as regards any decision-making process involving structural solutions to identified levels of vulnerability. It can be argued that the more comprehensive the coverage, less is the pressure to structurally project investments as such. To the extent that the investment protection element is covered, there is greater opportunity for considering other more social or humane criteria in any retrofitting decision. This includes the absolute and relative levels of vulnerability in different installations; the location of the facilities; and the opportunities for rapidly substituting the services they offer in case of serious seismic damage, etc.

The Costa Rican Social Security System has implemented important changes over the last 10 years in the levels of insurance

coverage afforded its installations. The levels of protection given to its investments in infrastructure have increased notably.

Between the late 1970s and 1986 the CCSN basically operated with a philosophy of "self insurance". The number of its installations given formal insurance coverage, and the insured value of the installations (as compared to their real or replacement value) was extremely low.

In 1985, the CCSN only insured 82 of its 150 buildings for a total value of 722 million colones (approximately 13.5 million U.S. dollars). Original construction costs were taken as the basis for insurance coverage as opposed to their real value (actual construction costs less depreciation) or replacement cost. The real value of its installations at that time was estimated to be around 4.8 billion colones (90 million dollars) and the replacement value must have approached or exceeded the 12 billion colones mark (224 million dollars). The inconsistency of the policy can also be seen in the insured values of different buildings. Thus, the large provincial Monseñor Sanabria hospital was insured for 32.6 million, whereas the much smaller but more recent, Ciudad Neily Hospital was insured for 33.5 millions colones.

The impact of this policy was vividly illustrated in the case of the Escalante Pradilla Hospital, damaged by the 1983 San Isidro quake. Here, the Caja only recovered one sixth of the total cost of damages, due to the very low level of insurance coverage afforded the installation at that moment (31.9 million colones as opposed to its real value of 140 million).

This event, as we have pointed out in Section II of this report, had an important effect in terms of promoting a more adequate insurance coverage for the institution and in the creation of an Insurance Department at the CCSN Central Offices in early 1984.

During 1984, and the first semester of 1985, the Insurance Department and the Director of Engineering and Architecture put together a new insurance plan taking into account the real, updated value of buildings. This plan and the different options it presented were analyzed by the Board of Directors in early September 1985, and on 26 September the Board approved the subscribing of a new policy with the National Insurance Institute (NII) to cover all buildings with a value of 200,000 colones or above. The yearly premium for total coverage would cost 15.6 million colones (292,000 dollars approx, at the ongoing 1985 exchange rate).

The consolidation of this scheme was to take over a year, due to delays in calculating the real value of installations and long drawn out negotiations between the CCSN and NII, without the intermediation of an insurance agent. The policy was finally issued

on the 1 October 1986, covering 151 buildings (including the country's 31 hospitals). The insured value (80% coinsurance) summed to 3.9 billion colones (67 million dollars approx.) at a premium cost of 13 million colones per year (222.000 dollars approx.).

Between 1986 and early 1989, the same policy was maintained applying annual increases to the insured colon value. Thus, in 1988, the CCSN had an 80% coverage for its buildings, for a total insured value of 5.3 billion colones (67 million dollars). The annual premium summed to 15 million colones (190.000 dollars approx.).

On 26 January 1989, the Board of Directors approved a new contract with updated real property values to substitute the 1988 coverage. In this policy an 80% coverage was taken on 284 buildings, with a total insured value of 8.2 billion colones (98 million dollars approx.). The annual premium summed to 23 million colones (274.000 dollar, approx.).

At this time, the NII was offering a new type of insurance policy which would allow a coverage for "replacement value" as opposed to real value. This policy alternative was presented to a number of Caja executives in early 1989. However, it was not until the latter part of 1990, six months after the Cobano earthquake, that the idea of an insurance cover for replacement value started to take hold in the institution.

In November, 1990, the Insurance Department made its first request for calculations to be made of the replacement value of the CCSN buildings. This process would take nearly five months to be satisfactorily completed and approved. Methodological problems, lack of adequate systematized updated information and certain indefinitions as regards the inclusion of furniture, machinery, equipment etc. in the calculated values explained this prolonged process. Following this, a further five months were consumed in negotiations as regards the premium to be charged and in completing the information required by the NII in order to be able to issue a new contract.

Finally, after a whole year of calculations, negotiations discrepancies and other delays, the new insurance policy was issued on 1 December 1991.

This policy covers 183 buildings (including, for the first time, buildings under construction), for an insured value of 21.6 billion colones (172 million dollars approx.). The tariff rate was finally fixed at 0.30%, as opposed to the previous 0.35%, and the annual premium at 64.6 million colones (517,00 dollars approx.).

During the long year of calculations and negotiations the country was seriously affected by the Alajuela, December 1990, and Limon, April, earthquakes which caused serious damage to hospital

infrastructure in different parts of the country. The insurance claim for these damages was based on the old 1990 policy. As such, the quake gave an important lesson as regards the virtues of updated and comprehensive insurance policies and rapid calculation and negotiation procedures.

Thus, for example, the La Fortuna Clinic in the River Estrella Valley was totally destroyed. The insurance cover for the building was for a total of 9.4 million colones; the Caja received 7.2 million colones in indemnization; and the estimated construction costs for the new clinic were calculated to be 60 million colones, in mid 1991! A conservative overall calculation shows that the CCSN received over 300 million colones less in indemnization following the Alajuela and Limon quakes as would have been the case if the new policy had been in effect. This is equivalent to five years payment of the new annual policy premium, 24 years payment of the amount saved by the long drawn out negotiations on the new premium rate, and the cost of retrofitting three medium size hospitals!.

But, one clear conclusion can be drawn from an examination of the changing policy context in the institution. The major changes instrumented in 1985-86 and 1990-91 were in fact stimulated by the San Isidro and Cobano earthquakes. The Alajuela quake reinforced the latest policy change decision.

In 1992, the institution now has a fully comprehensive risk insurance coverage (fire, volcanos, flooding, earthquake, etc.) and a reasonably high level of financial protection.

Finally, a number of interesting questions arise from an analysis of the National Insurance Institute's seismic protection schemes and tariff structures. Thus, for example, the Institute does not discriminate between the cost and coverage of insurance for seismically sound and structurally unsound buildings. The tariff structure is exactly the same. Arguments exist for a change in this policy thus stimulating retrofitting activities. Moreover, thought should possibly be given to the idea that state national insurance companies and international reinsurers design low interest loan schemes for public building retrofitting schemes in developing countries. Financial limitations are, after all, a stumbling block to this type of activity.

VII EPILOGUE

The retrofitting of the Mexico Hospital was completed by mid 1992, thus bringing to an end the first stage of the 1986 program. The new Central Offices and old Ciudad Neily projects are still awaiting financing. And, various buildings of the San Juan de Dios Hospital were included in study plans for 1991-1992.

The series of high intensity quakes suffered in Costa Rica between March 1990 and April 1991 put a break on any proposed short term continuation of the preventive retrofitting program. The damages caused to medical installations in the country and their repairs; and the need for post earthquake retrofitting of various installations (at the Tony Facio Hospital in Limon, in particular) interrupted the preventive program. But, according to CCSN authorities, this program will be continued.

At an organizational, planning and programming level, the CCSN has implemented various changes over the last two years related to its Engineering, Architecture and Maintenance functions. The discussion of the problems faced over the last few years have been a major factor in these changes. Engineering and Architecture are now separated into two distinct Directorates within a newly created Operations Division. Their previous direct hierarchical link to the Medical Services Division has thus been severed.

The whole construction program of the institution is now discussed, conceived and coordinated by a new Constructions Committee, made up of representatives from the Operations Division, Engineering, Architecture, the Medical Division and the Executive Presidency. Planning (on a proposed 5 year basis), coordination and budgeting procedures have been given a greater emphasis. Decentralization has become a manifest policy of the institution.

VIII CONCLUSIONS AND RECOMMENDATIONS

1 Consciousness, Decision Making and Hospital Retrofitting.

a. The lessons to be learnt from the 1983 San Isidro quake, and its impact on hospital infrastructure, did not establish a move from consciousness to action. The prevailing adverse financial situation faced by the CCSS at that moment, a lack of any really understanding of the seismic hazards faced by the country, and a tendency to consider San Isidro to have been an isolated and atypical event explain this situation.

b. Between 1983 and 1985 the principle incentives given to seismic prevention and mitigation activities were to come from the financial authorities at the CCSS. Earlier pressures for a more comprehensive insurance coverage for medical installations were spurred by the San Isidro quake and the opening of an Insurance Department at the Head Offices was finally agreed to in early 1984.

c. Prior to 1986, the only hospital vulnerability analyses to be promoted were the result of the interest of engineering staff at the University of Costa Rica (U.C.R.). They received the moral support of the CCSS authorities but no real tangible financial or material incentives.

d. The Mexico 1985 earthquake, despite it's impact on a general level, did not stimulate any general policy as regards hospital retrofitting amongst the CCSS decision makers. Persisting financial difficulties and the tendency to see this event as another 'special' case explain this context. The Mexico quake was instrumental, however, in stimulating the authorities at the National Childrens Hospital to push for a vulnerability study of their installations. This was achieved not only because of the importance of the hospital but also because of the reputation of the structural engineer who preferred a first early diagnosis, and the political clout of the hospital's Director who was very soon to be named Minister of Health for Costa Rica.

e. The National Children's hospital vulnerability study and a newly commenced independently sponsored UCR study of the Mexico hospital were the immediate precursors of the future retrofitting program.

f. The San Salvador, October 1986, earthquake offered the missing link in the final decision to implement a retrofitting program at the CCSS. The impact of this Central American event on hospital infrastructure constituted a third successive reminder as to hospital vulnerability. But, this factor alone

is not sufficient to explain the rapidly changing policy context that occurred during the last two and half months of the year. Other very important components of the process were i) the clear evidence on hospital vulnerability to be drawn from the Children's and Mexico hospital studies; ii) the increased presence and persuasiveness of certain structural engineers; iii) an improved financial situation at the CCSS and the move towards the reanimation of the institution's building programs; iv) the determination, commitment and, foresight of certain CCSS executives; v) the recent approval of a new and more demanding Seismic Code for the country.

g. The final decision to promote a retrofitting program was, thus, the result of a series of necessary conjunctural circumstances occurring at the end of a relatively protracted period of consciousness raising. The real availability of financial resources is a clear requisite for decision making as regards retrofitting programs. Moreover, the human and political commitment to such a program are also indispensable prerequisites.

h. By December 1986, the retrofitting program had become official CCSS policy, and Board of Directors authorization had been given for the contracting of vulnerability studies.

2. Selecting Installations for the First Stage of the Program

a. The selection process was ad hoc and a priori. No overall evaluation and selection process took place using a preestablished range of objective criteria. Preexisting knowledge of the different installations combined with the implicit criteria of size, height and importance were determining factors in the 'selection' process. The exclusion of other installations was based on various unwritten criteria including: location in 'low risk' seismic zones; recency of construction; low rise or one story buildings; the existence of plans for the replacement or substantial remodelling of certain facilities.

b. The selection process basically took place in November 1986, and was the product of a small group of persons in the Engineering and Architectural Department and the Executive Presidency of the institution. The retrofitting program would be controlled by these same persons during the next three and a half years.

c. The rapidity with which the units were selected typified the urgency with which the program was now being put together. This urgency and commitment to promoting the program would turn out to be both it's best ally and worst enemy. The lack

of adequate administrative, programming, planning and coordination procedures would cause numerous operative problems at a later date.

3. *The Contracting of Structural Plans and Technical Specifications*

a. The plans for the National Children's, Monseñor Sanabria and C. Neily hospitals and the Central Office building were contracted directly with preselected consultancy groups. The arguments in favor of this non competitive process were the urgency to get things going and the ethics and efficacy of contracting the original designers of the buildings. This procedure, authorized by the Comptroller Office, was to cause problems in the case of the Ciudad Neily contract given this had not been previously authorized. The Mexico hospital contract was awarded as a result of a normal competitive bidding process, but after consultations with the original Mexican designers.

b. The confection of plans for the five installations was completed between December 1986 and September 1988. Only in the case of the Central Office building was there a need for any major change of plans. Here the original plan for a 'simple' retrofitting exercise was replaced by a more expensive retrofitting and building expansion plan which would add nearly 6000 square meters of space to the existing building.

c. The structural plans for the buildings were not accompanied by the drawing up of architectural plans detailing changed aspects of the building resulting from future construction works. This omission was to cause problems later on.

d. The structural plans for the Monseñor Sanabria and C. Neily hospitals and for the Central Offices were not preceded by a separately contracted vulnerability analysis of the buildings, as had been the case with the Children's Hospital. This procedure would seem to reflect the urgency with which the program was being pushed forward. However, strong arguments exist for following a more sequenced procedure. The existence of a preliminary vulnerability analysis and the prior identification and discussion of possible retrofitting options could avoid future problems, such as those faced in the case of the Central Office project. Early estimates of possible building costs could also be established.

4. The Contracting of Retrofitting Works and the Retrofitting Process.

a. The contracts for the National Children's, Monseñor Sanabria and Mexico hospitals were awarded between April 1988 and February 1989. The Ciudad Neily contract has not been offered to date. The Central Office contract was finally opened up for bids in early 1990. Due to the final calculated cost of construction (nearly 1.4 billion colones) the contract was never offered. This final end to a four year process raises serious questions as to the budgetary estimation procedures used as a basis for originally promoting the works (CCSS estimates put the price at around 300 million colones).

b. The construction process in the Monseñor Sanabria and Mexico hospitals was plagued with serious problems of planning, programming, coordination and communication, which led to a considerable increase in the construction calendars and costs. The process followed in the National Children's Hospital was considerably less problematic. This can be explained by the coordination and programming procedures implemented; the more aggressive and predictive stance taken by the hospital authorities; and human factors such as the levels of confidence and respect existing between the social actors involved in the process.

   Many of the problems faced can be explained by the lack of sufficient human resources available to control and organize the process within a system which is highly centralized in terms of decision making, authorization, inspection and supervision procedures. The unwieldy work load faced by CCSS engineers seems to have prevented an adequate control of the process.

c. The experiences of the construction process as such highlighted the 'spontaneous' nature of the whole retrofitting program and errors (many unforeseeable due to the novelty of the experience) committed in earlier stages of the process. The major lessons learnt are the following.

   i. The need for hospital authorities to be incorporated in the process from the very beginning (vulnerability analyses and drawing up of structural plans). This is particularly so at the moment when construction plans and programs are being conceived, in order to guarantee that the planning and programming of works is consonant with the functional needs of the hospital. The adequate and negotiated programming of the retrofitting projects would guarantee an adequate planning of service substitution aspects at the hospital level.

ii. The convenience of considering the needs for hospital remodelling and modernization schemes jointly with the retrofitting process. Many requests for such activities arose as a result of the ongoing retrofitting projects and gave rise to planning and budgeting problems which could be avoided by a predictive planning process and more integral approaches.

iii. The need for structural plans to be accompanied by architectural plans which clearly identify the changes in the physiognomy of the buildings and the need for replacing or rebuilding existing elements (floors, walls, windows, paintwork, etc.).

iv. The need to carefully consider the human resource requirements as regards the control and inspection of works. To the extent that these are not available at a Central level, these tasks should be subcontracted to specialized consultancy firms as part of the overall retrofitting project and be budgeted accordingly.

v. A strengthening of the technical and decision making capacities at a decentralized level (regional and hospital) would seem to offer enormous benefits as regards project promotion and implementation.

d. In addition to the specific needs of each retrofitting project, a program perspective is also required.

The coordinated promotion of different schemes is clearly necessary. In a context where a number of retrofitting projects are ongoing at the same time, these works should be planned from a program perspective in order to guarantee service substitution options, satisfactory human resource requirements and adequate budgetary allocations. In Costa Rica, the fact that three of the country's major specialized hospitals were being retrofitted simultaneously required a more thorough programming and planning process than seems to have been achieved. This is even more so given that the retrofitting program was being undertaken at the same time as the promotion of a very ambitious new construction program. Enthusiasm, commitment and urgency are not substitutes for well thought out programming and planning principles and adequate resource allocation procedures.

5. *Seismic Insurance Policy.*

a. Between 1982 and 1991 the CCSS insurance policy evolved from a low coverage, low value scheme (1982-86) based on original

building cost calculations; through a real, updated building value scheme (replacement costs minus accumulated depreciation) between 1986 and 1991; to a total replacement value coverage from the beginning of 1992 onwards.

b. The transition from one scheme to another was clearly stimulated by the impact of the San Isidro quake in 1983 and the Cobano and Alajuela quakes in 1990.

c. The transition process and the final signing of new insurance policies were overly prolonged due to various problems related to the information base available, cost calculation methodologies, negotiating procedures, and the lack of clear and concise specifications as regards the information required for drawing up new contracts. These aspects need to be given careful consideration in the future.

d. The comprehensive policy now followed offers an important seismic (and risk) mitigation measure, affording the institution adequate economic protection against potential natural or technological disasters.

e. This coverage has been accompanied by an increasing commitment to the promotion of disaster preparedness training amongst medical personnel and emergency management procedures.

f. Given the present homogeneous tariff and insurance coverage offered, regardless of the levels of seismic security of buildings, and the financial problem faced in stimulating retrofitting schemes some thought should be given to the introduction of discriminatory tariff rates accompanied by low interest loan schemes by insurance companies or international development banks for seismic retrofitting of public sector buildings in developing countries.

The sum of the measures taken by the CCSS over the last ten years comprise very important steps in the promotion of structural, economic and organizational seismic prevention and mitigation protection schemes.

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