

1. Sand casting and salt water damage to paddies created by the tidal surge:

Following the cyclone, many agencies and government officials expressed concern that the tidal wave had brought large amounts of salt water into the rice paddies, and that this salt water had damaged the paddies and the soil to such an extent that the immediate planting of a new crop would be extremely difficult. Several agencies talked about the problem of trying to find salt-resistant strains of rice to introduce to the area. Others said that the paddies should remain fallow for a short time. Still others felt that certain types of fertilizer should be brought in which would neutralize the effects of the salt in the soil. Due to lack of information about the situation, very few of the agencies are taking any type of action in the field of agriculture at this time.

A team of rice experts (including a soils engineer, an agronomist and a soils testing expert) from one of the local universities visited each of the areas affected by the tidal wave to determine the level of salt water damage to the soil and the rice crop. They reported that salt water damage is being greatly overestimated. The tidal wave or tidal bore generated by a cyclone normally comes at the end of the rice season, at a time when most of the rice has already been cultivated and is ready for harvest. Due to the cultivation process, large amounts of water are standing in the fields; and the soils, even though they may not be currently flooded, are super-saturated with water, and therefore unable to absorb other large amounts of water. When the tidal bore came inland it did bring massive amounts of salt water. However, there are three factors to consider. First, the tidal wave came in very rapidly and receded very rapidly, not standing in the paddies much longer than several hours. Second, after the tidal bore had receded, the water which was still standing was a mixture of water from the flooded, swollen rivers nearby plus the rain which accompanied the storm. Therefore, the salt water which was still standing was diluted. Third, the super-saturation of the soil meant that much of the water that entered the paddies began to percolate downward through the soil, but did not actually enter the soil itself; it continued down as a solution into the ground water table. The salt water will remain at the level of the water table until such time as the moisture within the soil is dissipated through evaporation, and then it will tend to be drawn back upward from the water table to replace the water which is being evaporated by the sun.

Thus, over a period of one or two months, the salt water in the water table will begin to rise, and then the damage will be done. The salts will begin to rise towards the surface as soon as the fields have dried out. But if water can be pumped into the fields from fresh water sources, the salt water will be kept at the level of the water table and within several months it will eventually percolate out through the flow of the water toward the ocean. Continuous flushing of the paddies from the top will ensure that the salts will be kept down and will not rise to the surface.

Engineers estimate that it will take two-to-four flushes of fresh water before a new crop can be planted. Once the new crop has been planted, the normal cultivation of the paddies and the flooding necessary for that cultivation will serve to continue the flushing process and the suppression of the salts and salt water; this will enable the farmers to protect their soil.

Therefore, what is necessary as an immediate objective is the provision of a means of opening the water canals to enable the irrigation of the fields in order to begin the flushing process. Most of the major canals can be opened very quickly. Existing blockages are primarily in the small secondary canals, and there are numerous breaches caused by the rapid flow of the wave in and out of the region. In addition, there have been other breaches caused by the collapse of dikes, and also a number of blockages caused by heavy debris which has floated into the smaller channels, clogging them at key points.

Very few of the agencies working in Andhra Pradesh understand the dynamics of the process described here. Many are being encouraged either to provide salt-resistant strains of rice or to purchase large amounts of fertilizer which will stabilize or counteract the influence of the salts. This appears to be the easier choice for the agencies -- to purchase something and provide it, rather than to address the problem of how they are going to cultivate with salt-resistant rice or fertilizer if the channels remain closed.

A number of agencies have been urging the government to organize massive schemes to re-open the canals and smaller channels. However, to date neither the equipment nor the manpower has been committed by any one agency. CARE has been talking about using its food-for-work to open the canals; but due to some of the politics of the situation, they must receive an official request from the government. As of this time, they have not received a request.

## 2. Timing of housing reconstruction activities:

At this time, all the agencies are concentrating on provision of housing and village reconstruction programs immediately. For those agencies who are contemplating the building of permanent structures of what is known here as RCC construction (reinforced concrete and cement) or pucca houses, this will mean involving large numbers of people in training programs on how to build with concrete, steel, cement, brick, etc., and will take a tremendous amount of time, thereby continuing to divert people from the number one priority: agriculture.

Most of the work going on in the area now is devoted to salvaging what is left of the rice crop. Hence, there is a shortage of labor in the region for non-agricultural activities. With the emphasis that the agencies are placing on housing, there is a concern on our part that, when cash wages or food-for-work programs are used to encourage people to build houses, agriculture will be forgotten. In talking with the people, we have determined that agriculture is the number one priority. And in order to get the agriculture going, they must open the canals. However, the massive amounts of money which are going to be spent on housing and community shelters may detract from the re-opening of the canal system and the activities necessary to get a crop going now. Thus, the emphasis on housing may have the effect of diverting attention from the number one problem -- that is, the keeping of the salt water in the water table so it will not rise and damage the soils. The agricultural team which investigated the area has indicated that, within about two months after the tidal wave came in, the salts will be back at the surface unless certain steps are taken immediately to prevent it.

In discussions with the villagers and the Village Reconstruction Organization (which has been working in the field of housing in this area since 1969), we have discovered that the normal building time is between the end of February and the end of May. This is the period when the people have the materials, the time and the money to undertake construction. The primary reason why construction is not undertaken before this time is because extensive actions need to be taken to harvest the crop, to plant, cultivate and harvest the second winter crop, and get it off to market. There is a period of time between the harvesting of the winter crop and the planting of the summer crop which enables the people to concentrate on housing activities. That is also the time when the materials that are normally used in housing (wood, bamboo, etc.) are best used for making the traditional structures. The people normally acquire these materials earlier and then cure them for several weeks before beginning to build with them.

We have become concerned that the emphasis placed on housing now will affect the production of the second crop -- a crop which is very necessary in order to prevent salinization of the lands inundated by the tidal wave. At present, only a small portion of the crop which was struck by the tidal wave can be salvaged, and the majority of the people in the area are currently working to cut that crop and salvage what they can. However, the harvesting, threshing and selling of that crop will be finished about the time that the agencies being moving on housing. And with the massive number of units that are planned to be constructed, it is estimated that as much as one-third of the work force which is available will be employed in the construction of the housing in the area. One of the things which people need most now is cash in

order to buy rice and other foods which are being brought in from the outside, and the relief agencies will undoubtedly have to pay many people in order to get their housing programs completed. It is our feeling that housing activities should be delayed for several months and the people should rather be employed in opening the canal systems in order to get water into the fields so that the winter crop can be planted and harvested. Then, first, they would have the capital to buy building materials and other supplies; and, second, they would be able to help prevent the continued salinization of paddy lands.

We have been encouraging agencies not to consider housing the number one priority, but rather agriculture, and to plan now for housing activities which will begin in the building season. It remains to be seen whether many of the agencies will take this advice.

Comments at the end of January:

Our worries about diversion of attention from agricultural activities have proven right on some accounts and wrong on others. The agencies by and large did continue to ignore the salt water problem and the lands continue to get more saline each week. Additionally, the drinking water has begun to be unpalatable due to the salts. Only a few agencies have organized channel clearing projects. Drinking water for humans is being trucked in to the mainland areas and carried by boat to the islands. Cattle and buffalo must be driven to fresh water.

The housing programs have taken longer to organize than most agencies contemplated. Those agencies building with local materials (bamboo, wood, palm) all waited until supplies were available and cured, and will begin during the building season. The agencies who are building with RCC construction are importing their labor from other parts of the country (a problem itself). But in either case, the salvaging of the existing rice crop has been unaffected by the agencies' actions.



### 3. Protection from the tidal wave or tidal bore:

One of the primary concerns of the Indian government at this time is the protection of people from future tidal surges. The government has proposed that large community centers be built in each village. They will be one or two stories high, depending on the level of the ground and on whether a large plinth or fill can be constructed in order to build a one-story community shelter. Each of the community shelters would be flat on top with a small wall around the edge of the roof and a stair or some kind of ladder leading from the ground to the top of the building. It is not clear now whether the stair or ladder would be from the inside of the structure or from the outside. The idea is that, when a cyclone comes, people will be able to go from the village to the shelter and can either get inside or climb on top of the shelter, depending upon whether protection is needed from high winds or from flooding.

There appear to be several major problems to this concept. First, no one can predict the exact height of a tidal wave. Theoretically, it is estimated that a tidal wave could be as high as sixty feet or more. The wave which struck Andhra Pradesh was approximately 18-20 feet high and swept inland to a distance of approximately 15 miles before petering out. The government wishes to build these cyclone shelters throughout this affected area. They have seen examples of buildings which withstood the wave and are trying to design the shelters similar to these. However, while it is true that many of the buildings did stand, in many of the big structures (churches, temples, community centers, hospitals, etc.) large numbers of people crowded into the centers and were drowned when the tidal wave passed over. While the buildings withstood the wave, the people did not. In many buildings, more than one hundred bodies were found after the waters receded.

The demand for large-scale community shelters is based on a lack of information about the dynamics of a tidal wave. People do not understand that it is not a true wave; that in fact it is a large surge or high tide which has a leading edge in the form of a wave. People who are trapped in a building will be under water for as much as seven to ten minutes, depending upon the speed at which the wave is moving and how far they are from the coast.

In general, we have tried to dissuade the government from encouraging the development and construction of community shelters. Our reasoning is as follows:

- A. The shelters will attract large numbers of people to an area in which they cannot all be housed. Even if the government can build the shelters in all the communities, they will be unable to properly estimate the total number of people who will need a shelter when disaster strikes. In all probability, the shelters would not be able to house everyone adequately. Thus, in a cyclone everyone would be attracted to the community shelter and those that could get in might survive; however, the vast majority would not be able to get on top and would be swept away in the attempt to climb up. If they were able to get inside the shelter, they would probably drown.

- B. We feel that the money can best be spent in building good, strong, permanent structures in areas that are known to be above the predicted surge level. Money to be devoted to community shelters could be better utilized by providing it to individual families to enable them to build strong, wind-resistant structures in the safer areas.
- C. We feel that the community shelters give a false sense of security to people who live in marginal areas. Community shelters would encourage settlement of these areas and increase the vulnerability of the people to flooding and tidal surges.
- D. We have pointed out several times to the government that other countries which have attempted the same type of program have had little success. We have used the example of the shelter construction program in Bangladesh (financed by the World Bank) and have pointed out the many problems that occurred there. However, more information on this is necessary, and we have considered asking the government to form a committee to go to Bangladesh and talk with the people involved in the project there.

Comments from the end of January:

As a part of our attempts to persuade the government to abandon their shelter plans, we developed a white paper outlining several alternatives. Our strongest recommendation was a long-term program for developing an extensive elevated road network which:

- A. Would serve as all-weather roads for the area;
- B. Would provide high ground for escape from local flooding as well as from tidal waves;
- C. Would provide windbreaks for normal cyclones;
- D. Would contain future tidal waves and reduce the area of inundation. They would also cause the wave to crash sooner, thus dissipating much of the destructive force.

We have proposed that this road system be progressively elevated a few feet each year in a program designed to provide work for the local villagers during non-agricultural periods. Thus, money would be injected into the community annually, the roads will themselves enhance the economic development of the region, and a greater degree of safety would be provided for all the people in low-lying areas.

4. Different aid levels in different affected areas:

In the area affected by the cyclone, there were two distinct types of resulting damage. The first was the damage caused by the effects of the wind alone. The cyclone came ashore with winds up to 170 miles per hour, destroying large numbers of traditional houses and doing considerable damage to pucca (brick) structures which had synthetic materials for roofing, especially those with asbestos cement sheets. Many commercial structures (particularly tobacco barns, cotton storage warehouses, and various other large structures made of industrialized materials) were also damaged, especially at the roof level. Most wind damage occurred in the district of Guntur.

To the north of the Guntur district lies the Krishna district. Two of the sub-districts of Krishna -- Divi and Bandar -- were also affected by the wind, but more importantly they were struck by a large tidal wave which came in at the mouth of the Krishna River and swept approximately 15 miles inland. Within the area affected by the wave, there was virtually 98% destruction of housing and other buildings. Some villages lost as much as 90% of their population. 100% of the agriculture and fishing was affected, with as much as 80% loss of fishing boats and an unknown high percentage of loss, probably as much as 90%, to crops (predominantly rice with a small percentage of sugar cane).

Because the two affected areas received distinctly different types of damage -- one caused by wind and the other caused by wave action -- there has been a tendency on the part of the government and relief organizations to consider two separate types of reconstruction programs for the area. In the area affected by the wave, the government and relief organizations are planning to build reinforced concrete and brick structures. In the area affected only by the wind, the agencies working there have indicated that they will provide a lower level of assistance in housing, concentrating on provision of better materials for improvements to traditional structures.

While we concur that the best approach is to improve traditional structures, we feel that treatment of the two areas as separate and distinct, and provision of a high level of assistance to the area affected by the flood, will only serve as an encouragement to the people to move into the flood-prone region, thus increasing the population which is vulnerable to future tidal waves. In looking at the topographic charts of the area, it is clear that the area which was struck by the wave this time is the most vulnerable within the immediate region and will probably be the area which is most affected if another tidal wave is generated by a cyclone. Located at the mouth of the river, it is the lowest land in the immediate area and therefore will be the most subject to flooding. We feel that the government should adopt and encourage uniform relief policies and housing types in order to keep the population distributed evenly throughout the region, and should adopt policies which will discourage settlement in the most vulnerable areas along the coast.

5. Adoption of standard or uniform relief policies:

In the aftermath of the cyclone, almost 100 different organizations (primarily local groups or new groups which have formed to meet the situation) have rushed aid and relief into the disaster-affected region. The vast majority of organizations are concentrating their efforts in the Divi taluk which is the area most affected by the tidal wave. Each of these organizations is capable of providing a different level of assistance. Each has decided to adopt a village or villages, and this practice has been encouraged by the government. Depending on the level of resources of the particular voluntary agency assisting a village, some villages have received massive assistance while others have received virtually none. Distribution to date is primarily along the main roads, with the remote villages receiving only minimal assistance in the form of basic necessities. Already the relief organizations are concentrating on rebuilding these villages in their own image. There are hundreds of plans for housing going around, including many which are extremely inappropriate culturally, and many which are far beyond the range of either the relief agencies or the people to afford.

The different levels of assistance and the inequity of distribution are already causing hard feelings between donors and recipients, and many complaints are being levied against the government. At the present time, the government has no definite policies nor plans for reconstruction of housing. It is using its money to assist the voluntary agencies in their actions by providing matching funds. To date they have announced that they will provide a 50% subsidy (or matching funds) to construction operations, to enable the relief agencies' funds to go further, but only if the agency builds RCC structures.

It is our concern that the government adopt uniform relief policies in order to minimize the inequity in distribution. We have recommended that a minimum level of safety be adopted and that the relief agencies be encouraged to meet this minimum standard, using local materials for housing construction and concentrating on distributing assistance widely rather than on limiting massive assistance to a few. To date the government has not acted on this proposal. Furthermore, because most of the agencies are concentrating on Divi taluk, we feel that, when the housing programs begin in earnest, many people will move into this region in order to take advantage of the massive aid which is being provided to a few, and the relief organizations will be unable to cope with the demand. Therefore, the number of people who are subject to inundation in another tidal wave will be increased, and alienation of the people from the government will become a future problem.



6. Health problems following the cyclone:

Immediately after the cyclone, there were numerous reports of large outbreaks of cholera in the areas affected by the tidal wave and wind. Many of the major international magazines claimed that an epidemic had broken out and that it would take massive amounts of medicine and many doctors from outside in order to solve the problems.

In a recent address to the press, officers of the National Cholera Control Program announced that there were only eighteen suspected cases of cholera, of which only eight proved to be actual cases. This is approximately the same number of cholera-affected persons normally found within the community. There is no evidence that the cholera, or other major waterborne diseases, became more prevalent as a result of the cyclone.

Within one month after the cyclone, most of the relief organizations had ceased their medical operations. By the first of the year, those who remained reported that they were only treating such disorders as extreme diarrhea, sickness caused by drinking salt water, and gastroenteritis.

7. Reoccupation of tidal wave-affected areas:

In many places in the wave-affected area, the people are going into the fields by day and returning to the larger villages and towns by night. This is due to several factors. First, the stink of rotting carcasses makes the area very unpleasant. Second, there are still many bodies which have not been recovered or disposed of, and the people are reluctant to spend the night in the area. Probably most important, in many of the villages so many of the people have been killed that there are no services or other activities being carried on in the villages, and therefore they are simply ghost towns.

Hence one of the major strategies being undertaken by the agencies, as well as the government, is to build housing and temporary shelters in these areas now to encourage people to move back and re-establish many of the villages. The government is especially concerned that population increases in the towns be discouraged. Otherwise, other people will move in to take the jobs when agriculture is restored and they will have overcrowding situations in each of the towns along the line which marks the extent to which the tidal wave came inland. The government is very concerned that it will not be able to provide services once the agencies which are providing them now leave, and that there will be a tremendous demand on the government to continue feeding programs, medical services, etc., which they are not capable of carrying out.

8. Clearing of irrigation channel system:

When the tidal wave swept ashore, it breached and destroyed many of the dikes and embankments of the canal system which provides the water for the paddy lands. The canal system, especially at the lower reaches, is open only in the major channels, and many of the secondary canals and laterals need to be cleared of debris and silting in order for the water to be able to reach all the areas. At present, the government estimates that it will take approximately three to six months to get heavy equipment into the area and clean out these canals. However, we estimate that there is enough manpower in the area which could be mobilized as soon as the current threshing activities are completed to open the majority of the smaller canals. In those areas where the canals cannot be opened, large pumps could be installed which could bypass blockages or breaches and get water into the remaining areas.

We have recommended to the government that they ask the relief agencies to delay housing activities and concentrate on using all the resources at hand to open the channels under the supervision of the Irrigation Department. To date, no action has been taken. The government indicates that it will still rely on the heavy equipment rather than on manpower to open the canals.

Comments at the end of January:

The government has agreed to undertake a channel-clearing project, using hand labor to clear all the major channels by the end of March. They will open only the main channels that are normally under the authority of the Irrigation Department. They will not provide assistance to efforts to clear the laterals and other secondary and tertiary channels. They asked the voluntary agencies to do this. As of January 15th, only OXFAM, the Salvation Army and several individual landowners have provided funds for such operations.

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