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ISSUES TO FLOODPROOF RETROFITTING

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This Issue Paper is an excerpt from Chapter 7 of a soon to be published book entitled Floodproof Retrofitting. Dr. Shirley Laska, of the University of New Orleans, Department of Sociology, is the prime author with others, such as myself, contributing one chapter. The book will be published by the Natural Hazards Research and Applications Information Center at the University of Colorado, under a grant from the Federal Emergency Management Agency. This excerpt is printed with the permission of the Natural Hazards Research and Applications Information Center. Further, the opinions expressed here are solely those of the chapter author and do not necessarily represent those of the sponsoring organizations, the Association of State Floodplain Managers or the Michigan Department of Natural Resources.

Many of the issues identified in this paper resulted from the meeting of the Association of State Floodplain Managers' Floodproofing/Retrofitting Committee, on May 22, 1989, in Scottsdale, Arizona. The Committee members provided a great deal of thought and input to these issues and were the prime force behind this paper.

Readers of this Issue Paper are strongly encouraged to obtain the book Floodproof Retrofitting. It will approach floodproof retrofitting from a sociological view in the initial chapters, looking at retrofitting behavior or the public. Subsequent chapters focus on the implications of government action, assessing retrofitting's role in the overall floodplain management picture, experiences gained from past program implementations and an analysis of floodproof retrofitting's cost effectiveness at all effected levels from the individual to the Federal level.
ISSUES TO FLOODPROOF RETROFITTING

The National Flood Insurance Program (NFIP) is probably the single-most important factor to bring awareness of flooding and flood mitigation efforts to the National attention. The 1968 Flood Insurance Act has been very successful, but twenty-plus years of experience with the program has brought some problem areas to light.

Probably the largest problem with the NFIP lies in addressing "repetitive loss" structures, i.e., those structures that suffer flood losses on a recurring basis. Recent estimates from the Federal Insurance Administration indicate that since 1978, approximately two percent of all properties ever insured account for 40 percent of the claims dollars paid from the National Flood Insurance Program (U.S. General Accounting Office, 1988). There appears to be ample opportunity to affect repetitive flood losses through floodproof retrofitting. Due to the potential role of floodproof retrofitting to reduce such recurring loss, the role of the Federal Emergency Management Agency in assisting in floodproof retrofitting individual structures is currently being assessed.

Some very specific questions seem to be frequently asked by floodplain managers and government administrators on a country-wide basis in regard to floodproof retrofitting activities. Why is there not more floodproof retrofitting being done? Why is there not more emphasis being placed on repetitive loss structures? Why is there not a bigger effort on the part of the National Flood Insurance Program and its administrative agency to purchase and remove floodprone structures? Obviously, the answers to most of these questions could be addressed neatly with unlimited budgets at all levels of government. Since this appears to be an unrealistic expectation, identification and discussion of some of the issues that impact floodproof retrofitting as seen from the perspective of state and local officials is relevant. But before discussing these issues, let me emphasize that the Federal Emergency Management Agency (FEMA) has begun to address some of the issues here. FEMA has initiated a study and response to an Association of State Floodplain Managers' (ASFPM) resolution on repetitive loss structures of October 1989. FEMA administrators recognize these problems exist, but must insure that they develop procedures, statute amendments and rules that are well thought out and not simply knee-jerk reactions to controversy. To their credit, this is what I see occurring.

1. Funding Sources

Excuses for not floodproof retrofitting are easily found. "I don't think it will help!" "The floods won't happen again!" But, the most often heard excuse is that it would cost too much. In some cases, this may be true. Structural modifications to a residence to provide any degree of safety from flooding are
expensive. In the case of repetitive loss structures in particular, there is an excellent opportunity to realize public as well as private gains in a short period of time. An investment in flood damage reduction measures should be strongly considered by the Federal government.

Congress should examine closely the potential for establishing a Hazard Mitigation Fund. An initial amount adequate to initiate the program should be appropriated and credited to the Mitigation Fund. Subsequent funding should be continued through re-appropriations, utilizing a set percentage of disaster relief funds and/or designating a percentage of premiums received from the sale of flood insurance. Any interest, earnings or donations received should be credited in order to further strengthen the program. Unencumbered balances at the close of each fiscal year should also remain in the Fund. Monies from the Hazard Mitigation Fund should be used for grants and/or loan subsidies to individuals for any approved floodproof retrofitting measures, or any other approved retrofitting measure that would reduce losses resulting from a natural hazard. The fund should also be used for purchase of severely threatened or damaged flood prone properties, currently accomplished under Section 1362 of the NFIP.

A recent amendment to the Disaster Relief Act has created the beginnings of a Hazard Mitigation Fund. The Public Assistance Fund allows up to ten percent of a disaster relief grant to be used for mitigation purposes. However, the retrofitting measures employed must be on the currently quite restrictive list of approved measures. Further, the Public Assistance Fund grant requires a 50/50 match from the local government. At this point in time, the Public Assistance Fund has had one applicant approved for a grant; establishing a greenway below a Utah dam following its failure.

Some state funding legislation has also been put into place. During periods of extreme high water on the Great Lakes from 1985 through 1987, Michigan initiated an Emergency Home Flood Prevention Program. The program reduced the interest charges on loans by 3 percent, when the loans were used for elevating or moving homes above flood heights. The maximum loan amount was set at $25,000. Initiated at the urging of the governor, the program was administered by the Michigan Department of Natural Resources and elevated 44 homes, reducing total interest payments by $81,000. Overall, this program was a disappointment. Most people simply wanted a hand out and were not that interested in a loan program. There was another inherent drawback to the program that was at least partially responsible for the less than enthusiastic response. To obtain a loan subsidy, the applicant must first qualify for a loan through a commercial lending institution. Many of the people that really needed the assistance were unable to qualify for any loan, therefore they were unable to participate in the program. The same problem would exist with the loan subsidy program discussed above as part of the Hazard Mitigation Fund. Of course, loan subsidies would be only one part of a many faceted
program. Those persons unable to qualify for loans should be qualified for grants under other aspects of the program.

Similarly, a state loan program for floodproof retrofitting initiated after the 1987 floods in suburban Chicago communities proved disappointing in the small number of participants. This program too, had a built-in problem similar to Michigan's, but from the opposite point of view. In the Chicago area, to qualify for the program, the household income could not exceed $35,000. Because the area is populated by what may be loosely described as middle-class families, relatively few had income levels less than the program cap, and consequently could not qualify. Further, about a year's time elapsed following the flood before the mechanics of the program were in place and loans could be issued. Communities first had to develop mitigation plans before individuals could participate. Advertising of the program was essentially left to each separate community. Only one community did what could be described as a good job in promoting the program and, not surprisingly, had the best citizen participation.

2. Recognition of Floodproof Retrofitting for Reduction of Flood Insurance Premiums

There are many methods that can be employed to floodproof retrofit a residence. Certainly, relocation to a flood-free site is effective. It is, however, not always feasible. Elevation of the residence on piles, higher foundation walls or fill is probably the second best technique. Again, this is not always a realistic option due to the nature of flooding, type of construction or other site specific constraints. Yet, elevation of the structure or relocation out of the floodplain are the only options the NFIP recognizes, through reductions in flood insurance premiums.

The administrators of the National Flood Insurance Act, the Federal Insurance Administration (FIA), should assure that they, their engineering contractors and the program itself stay current with the state-of-the-art in floodproof retrofitting. Many new products and techniques have appeared over the last few years. An evaluation program is needed to assure that products and techniques perform as advertised. Credit on insurance premiums should be given owners who floodproof retrofit using these recognized, accepted measures. Elevation of a structure should not be the sole basis for credit consideration.

It would be anticipated that the Federal Insurance Administration may have concerns in granting credit for the use of some systems or products for floodproof retrofitting. Should a product or system be improperly installed, it may be ineffective or worse, exacerbate the condition. FIA must be assured that such measures will work and have been installed according to the manufacturer's specifications. Therefore, such systems or products should be installed only under the supervision of an appropriate licensed professional, such as an engineer or
architect. Certifications of installation should be required of the professional by FIA, before premium credits are granted.

3. Improve Local Record Maintenance

Floodplain management—from the engineering analyses done to establish flood elevations and enforce local ordinances on the one hand to the ability to target floodproof retrofitting structures which are repeatedly flooded—is dependent upon good, reliable, up-to-date data. Collecting and maintaining such information is most surely the responsibility of the Federal floodplain managers who administer the NFIP as much as it is the state and local officials.

As previously discussed, the lack of data on flood losses experienced, particularly on repetitive loss structures, is a serious deficiency in more effectively administering or improving the National Flood Insurance Act. An excellent source of these data would be from local communities following flood events. Records of specific structures experiencing flooding, flood heights, types of damage caused, and estimated damage costs should be maintained by all units of government participating in the NFIP. This information should then be passed on to FEMA in a nationally consistent format for their use in establishing a useable data base on flooding. Once this data base has been assimilated from all available sources, it can be used by a floodplain manager to more effectively address future flood potential and to recommend and implement mitigation measures including floodproof retrofitting.

4. Repetitive Loss Structures

Recent estimates, as stated earlier, indicate that since 1978, approximately two percent of the properties ever insured account for 40 percent of claims dollars paid from the National Flood Insurance Program. If we assume these figures are reasonably accurate, they represent an opportunity of singular importance that must be addressed. Unfortunately, there is a significant lack of data on existing buildings, the total potential policy base, the degree of flood damage to which these buildings are exposed, and similar information that would facilitate the development and implementation of a complete and appropriate response to the repetitive loss problem.

The Federal Insurance Administration has collected claims data since its inception. However, these data have never been compiled in a useable, computerized system that would enable the ready indentification of repetitive loss structures or other program problem areas. In the defense of FIA, budget reductions have made it very difficult, if not impossible to accomplish this task, as much as it is needed. Congress must restore this funding to FIA. The long-range benefits created by breaking the flood-rebuild cycle will far outweigh the initial expenses in supporting this portion of the program.
Upon filling the void created by the lack of data, the National Flood Insurance Act should be reviewed to assess the feasibility of it being amended to create an adequate and flexible source of financial assistance to owners of existing floodprone properties. Flood mitigation and protection measures employed beyond elevation, acquisition and relocation by individual homeowners insured under the NFIP should qualify for financial assistance.

5. Proactive Approach to Floodproof Retrofitting

Obviously, the biggest interest in and emphasis on floodproof retrofitting occurs immediately following a flood disaster. Flooding is on everyone's mind; people are busy trying to clean up, governments are assessing ways to keep it from recurring, and the newspapers and television are analyzing it from every possible perspective. Unfortunately, most disaster response programs are aimed only at returning flooded structures and people to a pre-flood condition. Reacting only to the current disaster continues the inevitable flood-rebuild, flood-rebuild cycle. Programs and policies emphasizing a proactive approach to retrofitting to break the cycle are sorely needed.

The Upton-Jones Amendment to the Housing and Community Development Act of 1987, is one of the first steps to a proactive approach. This act provides funds for the demolition or relocation of homes with NFIP insurance which are in imminent danger of collapse due to erosion or undermining. A comprehensive inventory of flood-prone structures and specific repetitive loss structures would greatly assist promoting initiatives formulated to address the lack of other proactive programs. Incentives to floodproof retrofit should be attractive to the home owner and to local government. The Community Rating System (CRS), a new concept currently being examined by the Federal Emergency Management Agency, may provide some of these incentives. Through local programs for flood hazard mitigation, such as floodproof retrofitting, the community may request an evaluation and rating under the CRS. If the mitigation activities are judged creditable, insurance premium reductions may be given to policy holders within that community. As stated earlier, these activities, i.e., systems and/or products, must be acceptable and installed in accordance with manufacturer's specifications and under appropriate supervision.

There are two major components or criteria to establishing a proactive floodproof retrofitting program: incentive and knowledge. Incentives, other than the personal desire to protect one's property, need to be in the form of a monetary value to be effective. If an incentive program can answer affirmatively at least two or three of the following questions, it has a chance of being effective: "Will my property be less prone to flood damage?" "Will my property increase in value?" "Can I afford the initial investment, if any?" "Is my property worth more than
the cost of retrofitting?" "Will my property still look like it 'belongs' in the area and not be an ugly duckling?"

Knowledge is the second component. If citizens have no knowledge of a retrofitting program or even how to attempt the construction of a retrofitting project, there is no chance for success. It cannot be expected that every property owner will be informed and educated on programs, methods and site-specific constraints. However, state administrators, local units of government, and local building officials should be informed and educated in all of these aspects.

6. Testing of Floodproof Retrofitting Measures and Disseminating Information on Methods and Products

In order for accurate information on floodproof retrofitting to be disseminated, research on methods and products for floodproof retrofitting must continue. New and old products are advertised continually in trade magazines and newspapers, promoting the products' abilities to stop infiltration, block water flow and floodproof the home or basement. Depending upon the specific conditions found at each individual site, some work as advertised and others do not appear to come close (U.S. Army Corps of Engineers, 1988). Currently, the U.S. Army Corps of Engineers conducts some testing and researches new methods at the Waterways Experiment Station in Vicksburg, Mississippi. Their findings are published by the Corps' National Flood Proofing Committee1.

Two examples of recent products which have shown positive results highlight some of the issues in the need for testing. Experience with a basement floodproofing system in the Greater Chicago area has shown some very positive results. The system consists of a valve in the sewer line, a sump pump and a monitoring system to alert the owner to system malfunctions. According to literature, newspaper articles and testimony of experts, the system has maintained totally dry basements during heavy flood conditions while adjacent unprotected homes have experienced heavy damage. Official testing of the method would give added security to those considering adopting it.

Testing on flood shields that pull up from storage areas around the circumference of the house has also been shown to be effective. The Corps of Engineers' National Flood Proofing Committee had tests conducted on actual houses equipped with these devices in Arizona and Oklahoma (U.S. Army Corps of Engineers, 1988). Effectiveness was limited by the depth of water on the side of the building and to the care exercised in underlaying the shield into the soil to prevent seepage.

1. "Flood Proofing Tests; Tests of Materials and Systems for Flood Proofing Structures" is available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA. 22161.
Private companies with products on the market or intending to market products must also continue to research improvements and new technology. Further, a method of certifying these products as effective should be established by the Federal government through contracts with certified testing laboratories. As yet, very little research on floodproof retrofitting techniques is being conducted at the many engineering universities. The opportunities for masters and doctoral research are many. Assistantships and grants to universities should be established by the Federal government to research floodproofing.

Published findings of research and testing are a must. Otherwise there is virtually no means of getting new information into the hands of the practitioner and the consumer. Professional organizations such as the Association of State Floodplain Managers, the American Society of Civil Engineers, the American Institute of Architects, and the National Association of Home Builders are only a few of the many sources of published information.

The Association of State Floodplain Managers has recently established a Floodplain Management Resource Center at the University of Colorado's Natural Hazards Research and Applications Information Center (NHC) in Boulder. The Association's first priority was to collect all available information on floodproof retrofitting. This has been accomplished and is readily accessible to an interested user through a simple telephone call. The Corps of Engineers' National Flood Proofing Committee has also recently amassed and published their annotated Flood Proofing Bibliography. All of these publications are housed in the Chief of Engineers' library in Washington, D.C. and are available through the Corps District Offices or through local libraries utilizing the Inter-library Loan System in conjunction with the Chief of Engineers Library.

Another excellent means of transferring information is through seminars and conferences. There has never been a national conference directed at floodproof retrofitting. The first is scheduled for late November 1990, in Illinois. Professional

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1. Natural Hazards Center can be accessed by telephone at 303/492-6818 weekdays between 9:00 a.m. and 4:00 p.m., MST, or by writing Natural Hazards Research and Applications Information Center, IBS #5, Campus Box 482, Boulder, CO. 80309-0482, Attn: Floodplain Management Resource Center.

2. "Flood Proofing Bibliography" copies can be obtained by writing to the Chief of Engineers Library, U.S. Army Corps of Engineers, 20 Massachusetts Avenue, N.W., Washington, D.C. 20314.
organizations such as those previously mentioned should seize this opportunity for a specialty conference as soon as practical. It should be geared toward consulting engineers and architects, state and local floodplain managers, and building officials. These persons can then bring the newly learned methods back to their areas of practice to expand the breadth of the technical knowledge.

Training programs at the state and federal level are also necessary to assist in disseminating floodproof retrofitting technology. Once state floodplain managers have the required technical expertise and knowledge, local training sessions for county and community building inspectors and building contractors should be held. These efforts should be recognized as part of the Federal Emergency Management Agency's Community Assistance Program and receive appropriate funding through that program.

A new and exciting training aid has recently been completed in a cooperative effort between the National Association of Home Builders and FEMA. The "Best Build" video shows proper construction techniques in areas subject to coastal flooding. Another in the series, "Best Build" addresses riverine flooding. Yet to be produced, but in the planning stage, is a video dealing with floodproof retrofitting. These are very high quality products suitable for use in any training session or on Public Broadcast System Television.

7. Retrofitting of Public Properties

Private losses due to flooding are not the only losses to be considered. Millions of dollars of damage to public facilities occurs annually. The majority of wastewater treatment plants are sited adjacent to rivers and streams and in the lower parts of communities. Obviously, this location lends itself to the gravity flow of sewage and to the ease of discharging treated waters back into the river system. On distressingly frequent intervals, these plants are flooded to the extent that they are inoperable, suffer extensive damage to equipment and buildings and, worse, discharge untreated sewage to the stream. In too many cases, publicly-owned buildings, park facilities, roads, bridges and utilities are not exempt from flood damage.

New public facilities, of course, should be designed and constructed with flood potential in mind. In fact, those communities, including state agencies, participating in the National Flood Insurance Program are required to insure that new

1. "Best Build" video copies may be purchased from the National Association of Home Builders, Environmental Affairs Department, 15th and M Streets, N.W., Washington, D.C. 20005, Attn: Best Build Video; or telephone 800/368-5242, Ext. 484.
facilities are designed and constructed to take flooding into account. But what of the existing flood-prone facilities? The significance of federal tax generated funds expended for disaster assistance for flood-damaged facilities mandates that every possible and feasible alternative be investigated to floodproof retrofit these structures. Further, if a governmental agency is going to promote floodproofing to its citizens, they first must be willing to provide a positive example through their own actions. The Hazard Mitigation Fund would be an excellent source of funding for communities to tap to mitigate flood losses to their facilities.

The incentive to local government to floodproof retrofit exists. Flood insurance is required by the Disaster Relief Act on public structures. Without it, loss of disaster assistance funds will result if flooding occurs. Communities will have to compare the cost of insuring their flood-prone facilities to the cost of floodproof retrofitting them.

8. Assessing the Benefits of Retrofitting

When assessing whether floodproof retrofitting is a feasible, worthwhile solution to an individual flooding problem, certainly economics is a very important factor to be considered. The formula used to calculate the benefit/cost ratio by the U.S. Army Corps of Engineers on their civil works projects is a good method to estimate the appropriateness of a project. If the total cost of the project divided into the worth of all of the benefits realized by the project results in a number greater than 1.0, then the project is probably cost effective. The greater the number is than 1.0, the more cost effective is the project. If the number is less than 1.0, then most likely the project cannot be justified economically.

Economic factors, however, sometimes do not tell the complete story. In many areas, the same residences may flood on a very frequent basis. The flooding may not be so severe that it totally ruins the structures, but significant property damage is realized. In some instances, people simply do not want to change the area in which they live. The residence may have been in the family for many years and changes or structural modifications are simply not acceptable to the owner. Elderly persons are sometimes very reluctant to affect such a change in their lives as some forms of structural modifications may entail. To many people in low-lying residential areas, flooding is simply a way of life to them. This is not to say they enjoy or look forward to being flooded. The alternatives that have been offered, or of which they have been made aware, are simply more of a problem than dealing with the flooding. They have become used to the flooding and know what to expect and how to deal with it.

The proponent of floodproof retrofitting will have a tough selling job in some of these cases. If the physical properties of the site or area are conducive to methods other than
physical changes to the structures themselves, then these methods should be thoroughly investigated. The floodplain manager must keep in mind that even though economics are a very important consideration, they are not, in many cases, the factor upon which an owner may base his or her decision to floodproof retrofit. Some of these factors may be so personal or intrinsic to the individual themselves and the property that the manager may never know what they are or even that they exist.

9. Adverse Impacts

Not all structures are ideal candidates for floodproof retrofitting. For one reason or another, some should either be left as they are or be demolished or moved and the site returned to open space.

Many buildings have been flooded so often or are so old that they are structurally unsound. The expense of reinforcing the building and/or replacing many structural components before it could be elevated or relocated are too great for the benefits that may be realized. Every effort should be employed to purchase such buildings through Section 1362 of the NFIP or through grants administered by the state or local governments. These areas should then be returned to open space or park lands held in ownership by the local unit of government.

Some methods of retrofitting involve raising the structure on fill. The additional height combined with fill side slopes that should not be steeper than one foot vertical to four feet horizontal, may encroach on critical adjacent areas. This additional encroachment may involve filling of valuable wetland areas or it may extend into floodway portions of a riverine floodplain, creating increased flood heights and velocities. The fill in the floodway will also be subjected to potential erosive velocities placing its integrity in jeopardy.

The Design Manual for Retrofitting Flood-prone Residential Structures (FEMA, 1986) published by FEMA, provides an excellent discussion of various retrofitting techniques and description of when to use these techniques based on site-specific conditions\(^1\). It cannot be overstated how important consideration of the constraints of any one technique is during the selection process. While elevating a structure by the addition of a few layers of concrete blocks to its foundation may be very appropriate to afford protection from one to two feet of flooding, extending the foundation higher to attempt protection from higher levels of flooding may lead to a catastrophic failure of the structure.

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\(^1\) Copies of the manual may be ordered from the Federal Emergency Management Agency, P. O. Box 70274, Washington, D. C. 20024.
Such flood protection methods as dikes or flood walls often are very effective in controlling flood waters. Again, care must be taken in their siting, design and construction to enable them to be effective and do the work for which they were intended. While the dike or flood wall may appear to be an answer to an individual, thought must be given to what may happen if it is overtopped. This situation usually creates conditions that are more damaging than if the dike or wall were not built in the first place. Dikes placed in floodways will tend to increase flood stages on upstream or adjacent properties. Further, diking of large, low areas may lead owners into a truly false sense of security, thinking that they are fully protected from future floods. Floods higher than anticipated will often occur and are well documented.

Floodplain managers, local officials and property owners would do well to remember the statement of an old hydrologist, "It has never rained as hard as it is going to!" Structural failure of improperly designed or constructed flood protection works also occur all too often. Protection of low lands by these or any other method is generally ill advised. It essentially promotes the development of land that is best left in its natural state.

Arguments against an open space, natural area policy are sure to be voiced. Rightly so, if the land continues to be taxed as residential or commercial property. All levels of government must act in concert to effect a means of providing for equitable taxing of flood prone lands. This land should be listed on the tax roles as non-developable and taxed at the minimum level to assist owners in the retention of the land as open space.

Conclusion

Floodproof retrofitting can be an effective means of reducing the vast expenditure of funds due to flood damages. Its use must be carried out with careful planning and consideration of all of the potential problems with which it is associated. With all levels of government working together to effect appropriate integrated changes in the National Flood Insurance Act, the Disaster Relief Act, and state and local floodplain management statutes to provide recognition, assistance and credit for floodproof retrofitting, the impacts of its use can become even greater.
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