

Organizational Coordination, Transportation Planning, and Hazard Mitigation: A View from the North Carolina Coast

PATRICIA J. MCGUIRE

Organizational coordination has long been recognized as an essential element of effective planning. Coordination is particularly important in sensitive coastal areas, where maintaining a balance between development and conservation is critical. Considered both irreplaceable environmental and valuable economic resources, coastal areas are subject to state and federal regulations concerning proper management and the minimization of risks associated with the high potential for natural hazards. Mandates have resulted in inter- and intragovernmental consistency requirements, however, which are often subsumed by the divergent goals and policies of the agencies involved. This problem was examined in the context of three transportation projects in coastal North Carolina, a bridge replacement at Sunset Beach, planning for a new bridge to Currituck Banks, and ongoing maintenance, relocation and long-range planning for the Outer Banks' primary road, NC 12. Case studies based on an evaluation of land use and transportation plans and interviews with highway engineers, emergency managers, and planners were developed for each of the projects. An assessment of the link between transportation improvements and coastal development, as well as an overview of the state and federal policy context for these activities, was prepared. Three policy issues were identified as inhibiting effective planning in coastal areas: the lack of an overarching mandate concerning the appropriateness and necessity of development in these areas, inattention to the powerful role played by infrastructure improvements in undermining hazard mitigation objectives, and the absence of requirements for cooperation among the government agencies that play primary roles in coastal management and development.

But all these separate instances of planning suffer from two things: a lack of understanding of the social meaning of the plan, and a failure to achieve coordination with other organizations by dovetailing, under a common authority, into a broader scheme for regional and inter-regional planning. (1)

Lewis Mumford's perceptiveness and foresight into the dilemma of planning are as cogent today as they were 57 years ago. These two issues raised by Mumford, the understanding of social meaning and organizational coordination, remain today only peripheral elements of modern planning. Despite several decades of directives for public participation and the expanded consideration of social and environmental impacts, planning still suffers from a lack of attention to, and effective integration of, the social impacts of planning activities. The focus of this paper is Mumford's second point, the coordination of planning organizations. This problem is examined in the context of transportation planning in coastal areas of North Carolina, which have high potential for natural hazards.

Coastal areas are irreplaceable environmental and valuable economic resources, and the need for coordination among business interests and environmental concerns is clear (2-5). The lack of coordination among public development activities has serious implications for the effectiveness of hazard mitigation efforts and leads to several questions. Should roadway needs in coastal areas be planned in the same manner as in any other area of the state? Are mandates for the movement of people and goods of greater importance than those developed to provide for public safety and environmental protection? Three factors make these questions particularly important:

1. Development in coastal areas of North Carolina is increasing. Population projections for counties in this area indicate an average increase in population of 13 percent between 1990 and 2010, with some counties experiencing growth rates higher than 35 percent. The rate of growth for the state is expected to be 10 percent for the same period.
2. Some natural hazards are predictable; all are inevitable. As population expands in areas of high risk, "disasters"—the confluence of human activities and natural hazards—are increasing in both frequency and severity. Since 1990, \$31 million has been spent for emergency sand removal, beach nourishment, and sandbagging in numerous attempts to keep open the only highway between Nags Head and Hatteras on North Carolina's Outer Banks. Since 1974, \$18 million has been spent on regular maintenance for the road.
3. Mandates for consistency of inter- and intragovernmental activities, rather than for comprehensive planning undermine hazard mitigation objectives. Resulting fragmentation prohibits serious consideration of questions concerning the appropriateness of development in hazard-prone areas and of the government's responsibility for its role in increasing people and property at risk.

Two state agencies play primary roles in coastal development and the implementation of hazard mitigation objectives, the North Carolina Department of Transportation (NCDOT) and the Department of Environment, Health, and Natural Resources' Division of Coastal Management (DCM). A third agency, the Department of Crime Control and Public Safety's Division of Emergency Management (DEM), although directly charged to reduce losses due to disaster events, plays a minor role in the process.

While NCDOT does not have a formal policy for transportation planning in hazard-prone areas, this study concludes that a number of economic, political, and governmental-structure factors, requirements of the Highway Trust Fund, the Official Map Acts, and plans

for the state's intrastate system (6–8) serve to establish a de facto policy to increase road construction in coastal areas. If the proposed schedule for the intrastate system is met, four-lane highways will be in reach of 96 percent of the state's population within a decade (9). These policies support increased development in coastal areas with high potential for natural hazards despite the hazard mitigation and coastal management mandates that are in place.

Unlike NCDOT, DCM has a clear mandate to facilitate the balanced development of coastal areas. As the staff to the Coastal Resources Commission, DCM implements North Carolina's Coastal Areas Management Act by conducting environmental research, setting guidelines, and overseeing the preparation of local land use plans. The agency is also responsible for reviewing permit applications for consistency with local land use plans. Despite its clear mandate to "provide a management system capable of preserving and managing the natural and ecological conditions of the estuarine system . . . and perpetuate their natural productivity and their biological, economic, and esthetic values" (10), DCM serves primarily in a "supporting capacity" to local governments and consequently has no power to enforce its guidelines (11). In the realm of transportation, the Coastal Areas Management Act (CAMA) directs DCM to "establish policies, guidelines and standards for . . . transportation and circulation patterns . . . including major thoroughfares [and] transportation routes" (12). In actuality, many jurisdictions rely on thoroughfare plans prepared by NCDOT for the transportation components of their local land use plans. As a result, DCM's responsibility for developing a coastal management program that balances development and conservation must often yield to the interests of other agencies.

These thumbnail sketches illustrate a lack of philosophical alignment within and between the state agencies that play the largest public roles in coastal development. A discussion of hazard mitigation and the role transportation improvements play in coastal development further details these interagency contradictions. These issues are examined through case studies of three transportation projects in coastal North Carolina, a bridge replacement at Sunset Beach, the proposed construction of a new bridge across Currituck Sound to Corolla, and ongoing maintenance of the Outer Banks portion of NC 12 (Figure 1). The complexities and difficulties of these projects clearly illustrate the lack of concurrency with imperatives to reduce risk of loss from natural hazards and the inadequate coordination between emergency managers, coastal managers, and transportation policy makers. A long-range, interagency planning process recently initiated for the Outer Banks' primary north-south road, NC 12, is presented as a possible solution to the lack of coordination.

TRANSPORTATION AND HAZARD MITIGATION: POLICIES IN CONTEXT

Hazard Mitigation and Coastal Areas

In many ways, urban growth in coastal areas of the United States is under the spell of a fatal attraction in which the "areas most attractive to new development are often those most dangerous to life and property" (2). Policy makers are caught in the middle, bound by the responsibility of protecting people and property from natural hazards without too severely limiting the private development market. "Great storms . . . are, in the grand scale of time, normal events, recurring again and again, more or less regularly" (13), yet they are perceived as catastrophes by human observers whose collective memory is, by comparison, short. Short memories of hazardous

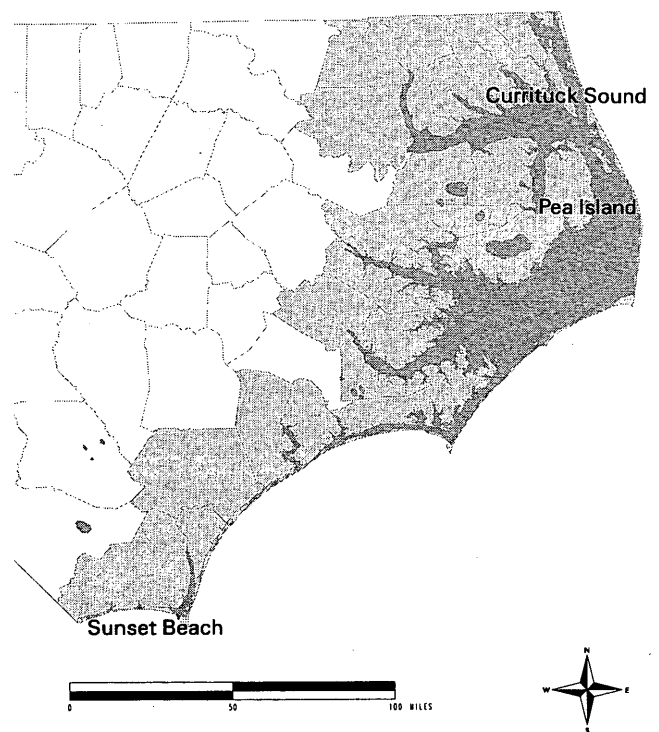


FIGURE 1 Location of three case study transportation projects in eastern North Carolina.

events and large investments in high-risk areas have resulted in the repeated reconstruction of destroyed public utilities—an outcome that has been widely recognized as costly and inefficient (4,14). In 1976 the United States federal government modified the disaster determination process administered by the Federal Emergency Management Agency (FEMA) to include the preparation of mitigation plans for future events (15). The concept of hazard mitigation is not new. Humans have always adapted construction techniques to high winds, battened down in the face of hurricanes, or evacuated in the path of volcanic eruptions. In spite of recent initiatives, the cycle of "build, destroy, rebuild" (2) is supported at tremendous cost, much of it directly subsidized (and largely hidden) through disaster assistance and flood insurance, or indirectly through tax breaks for second-home buyers and funds for a variety of public facilities improvements.

A common criticism of the mitigation planning process is that there are few requirements for the coordination of efforts. Emergency managers are typically responsible for preparing plans for responding to disasters. Their work primarily addresses the preparedness (events preceding the emergency) and response (short-term emergency aid and assistance) stages of the disaster response process (2). The scope of transportation in hazard mitigation planning is usually limited to discussions of evacuation routes and techniques. In the aftermath of hazardous events, planning activities are fragmented rather than linked. Reconstruction and relocation decisions are assigned to highway engineers. Land use policies concerning the type and amount of development are left to local planners. While consistency requirements are in place, the unequal levels of government, planning resources, and organizational goals from which these plans are developed undermine the joint efforts that are necessary under the unique characteristics of high-risk areas. Coordination of the goals, objectives, and policies of the relevant governmental agencies must increase if two elements of haz-

ard mitigation, decreased vulnerability and reduced exposure, are to ever be effectively realized.

Role of Roads and Bridges in the Coastal Development Process

Infrastructure and transportation systems play a vital role in the development of coastal areas—barrier islands are largely inaccessible without bridges, causeways, or ferry services, yet these improvements, and the development they support, inhibit the natural maintenance processes of these islands. Like most barrier islands, the narrow chain of sand that buffers the North Carolina mainland from Atlantic winds and tides is in a state of “dynamic equilibrium” (13). The islands, from sea to sound and beach to marsh, are in motion, rolling over on themselves with the wind and waves reshaping shorelines in response to long winter storms or brief, powerful hurricanes (13,16). Infrastructure investments introduce an element of permanence alien to these environments. Concomitant growth in seasonal and year-round residents increases the sense of permanence, and additional improvements become necessary to protect the health and safety of coastal immigrants. The combined effects of purpose (infrastructure to improve access to the coast) and need (investments to provide adequate evacuation capacity) bring into sharp relief the critical nature of transportation in coastal areas.

Transportation networks play two roles in the coastal development process. First, roads and bridges increase accessibility to barrier islands by expanding the transportation system from intermittent boat or automobile-carrying ferry services to roadways open around the clock. Second, these road networks are vital to the evacuation of the increasingly large number of people who are drawn to vacation opportunities at the shore. While there is an extensive literature on the relationship between land use and transportation (17–20), the strength and direction of the relationship is far from clear. Land use and transportation planners have found it difficult to develop models that account for the many variables that come into play in decisions regarding individual relocation or improvements to the transportation system. In the case of the islands that make up North Carolina’s coastal areas, the cause-effect relationship is clearer, and most believe that “highways bring development” (16). Schoenbaum (16) presents a sketch of the manner in which access improvements lead to a never-ending cycle of transportation-related construction:

... before the construction of bridges and roads, there was very little development on North Carolina’s barrier islands. Nags Head was a small resort town on Albemarle Sound until the bridges and roads were constructed in the 1930s. Other islands “benefited” from the military roads and bridges constructed during World War II. Highway access has increased the value of property on the island tremendously. . . . This is why the pressure for roads and bridges comes not so much from the people who *live* in the area but from those who want to *develop* it.

Schoenbaum’s views on the role of transportation improvements in promoting development is echoed in much of the literature on transportation in coastal areas. In *Transportation Access over Currituck Sound*, Howard Needles Tammen and Bergendoff describe the construction of a bridge connecting the Outer Banks to Nags Head in 1928 as the “prime mover for the beginning of development of the northern outer banks” and conclude that “adequate vehicular access proved to be the catalyst for accelerated development of the Dare county segment of the outer banks from Nags Head to Duck” (21). The point was driven home in a 1990 trial concerning the inad-

equacy of an environmental assessment completed for a bridge replacement in Sunset Beach, North Carolina. U.S. District Judge, W. Earl Britt ruled that the NCDOT’s and the Federal Highway Administration’s argument that it is zoning changes that will cause increased development, and not the bridge, completely ignores the regulatory definition of “indirect effects” that they are required to abide by: indirect effects are those caused later in time and may include growth inducing effects (22).

The consequence of increased development of coastal areas is that, at some point, road and bridge improvements are necessary to move large numbers of people out of harm’s way. Evacuation is only one component of a hazard-mitigation program, but this critical element is completely dependent on the capacity of the transportation network. As Godschalk and others have noted, “for most built-urban areas in threatened locations, there is no other apparent alternative to protecting the population from storm forces” (2). Local land use plans have begun to utilize a “carrying-capacity” approach to analyzing their transportation systems for determining appropriate levels of development (11). Transportation was listed as the first Emergency Support Function (ESF) of FEMA’s recently developed Federal Response Plan (FRP) for disasters (23). The need for a clearly defined and coordinated transportation policy with regard to coastal development and the hazard mitigation process is evident.

CASE STUDIES OF TRANSPORTATION PROJECTS IN COASTAL NORTH CAROLINA

Planning for three transportation projects in coastal North Carolina is currently under way: the replacement of a bridge over the Intra-coastal Waterway to Sunset Beach, the proposed construction of a new bridge across Currituck Sound to Corolla, and long-range planning for a troublesome stretch of NC 12. The complexities of these projects clearly illustrate the lack of concurrency with imperatives to reduce risk of loss from natural hazards and the inadequate coordination between emergency managers, coastal managers, and transportation policy makers.

Sunset Beach Bridge Replacement

Sunset Beach is located in Brunswick County at the southernmost tip of North Carolina’s Outer Banks. The town’s recently completed land use plan calls for Sunset Beach to remain a “family beach.” Residential development of the island dates to the early 1950s when a single-lane, barge-supported swing bridge was constructed over the inland waterway to connect the island with the mainland. Soon after, the name of the island was changed from Bald Beach to Sunset Beach. Residential development, primarily for seasonal, recreational uses, continued. Recreational development of the mainland has occurred as well, and the area now boasts a score of golf course communities and the highest property valuations in Brunswick County. Both the mainland and the island have seen increasing rates of growth in the past 10 years and are estimated to be 60 percent built-out. The remaining capacity is expected to be reached in about 10 years, and the town is currently requesting funds to develop water and sewer treatment facilities to meet current and future needs without any further environmental impacts.

The bridge was privately maintained and operated until 1960 when the state agreed to take over these functions. Following a number of initial structural alterations and repairs, the state has maintained and operated the bridge since the early 1960s. By the

early 1980s, time and use had taken their toll, and NCDOT initiated a planning process to determine what should be done with the bridge. In light of the increase in development on Sunset Beach and the design capacity and condition of the bridge, NCDOT developed a number of alternatives for replacing the structure. The initial environmental assessment process, which included assessment of consistency with the CAMA, was conducted. The favored alternative, replacement of the single-lane, pontoon bridge with a double-lane, high-rise, fixed-span bridge was identified. As required under NEPA, an Environmental Assessment was prepared, circulated, and approved prior to the "Finding of No Significant Impact" (FONSI).

There had been some concern expressed by residents of Sunset Beach over the selection of the high-rise option at NCDOT's public informational meetings and at the public hearing when the preferred alternative was presented. Approximately 25 people attended each of the two public meetings and 80 people attended the public hearing (24). Written comments were received from 147 citizens, 75 of whom were opposed to the project (25,26). Several reviewing agencies were also concerned with the potential impacts associated with the bridge replacement. NCDOT did not consider these comments to represent a serious objection. The town council was very much in favor of the project and adopted a resolution on October 11, 1982, calling for NCDOT to either renovate the structure or facilitate other measures that would improve its safety. The citizen and review agency comments did raise some concern, however, and the bridge-replacement project was placed "on hold" shortly thereafter (22). While some objections were raised during the public hearings, no opposition was recorded during DCM's review of NCDOT's permit request. A Coastal Resources Commission permit was issued in early 1985.

In 1985, the project was revived and 200 people turned out for the public hearing at which five alternatives were presented, with the high-rise option still the preferred bridge replacement option. Written (54 pro and 82 con) and verbal (11 pro and 30 con) comments were offered (24). In spite of the opposition, NCDOT decided to proceed with its preferred alternative and the Sunset Beach Town Council adopted a resolution of unanimous support for replacement or improvement of the existing bridge. NCDOT's second FONSI addressed some of the concerns of citizens and reviewing agencies, but in early 1986 the project was still on hold as a "direct result of the strong opposition [residents] and others have expressed" and the fact that much-needed repairs had extended the projected service life of the bridge to 1994 (22). During the next 2 years, the CAMA and CZMA consistency requirements were met, a bridge was designed, and the right-of-way was acquired. The bid notice was released and a contractor selected. As the contractor began to mobilize and prepare the site, opposition coalesced. Members of the Sunset Beach Taxpayers Association filed suit against NCDOT for failing to complete an Environmental Impact Study (EIS) for the project. Critics claimed that the new bridge would drastically increase development pressures in the Sunset Beach community, threaten wildlife species, and destroy the link between the mainland and island portions of the community. The suit was successful and a court order was issued making all of NCDOT's actions null and void and directing the agency to comply with the environmental impact assessment requirements of NEPA as it had failed to do.

As part of the EIS, NCDOT has hired consultants to determine the impacts of the existing bridge on the water and road traffic and to assess the direct and induced land use impacts and the economic, visual, and water-quality impacts of three "reasonable and feasible"

bridge alternatives. The three alternative designs include a 15-ft drawbridge (low-rise), a 30-ft drawbridge (mid-rise), and the 65-ft, fixed-span (high-rise) bridge (24). Land use and economic impacts have been evaluated through a case study of "the historical impacts of bridge replacements on two neighboring islands, Holden Beach and Ocean Isle Beach" (24). This case study indicates that the impacts of high-rise bridges have been minor. While several large projects have been constructed, the rate of development in both communities has slowed since the bridge openings, perhaps in response to changes in federal tax laws or the downswing in the national economy (24). In spite of this, both communities have seen an increase in day visitors. The report states that "more dependable bridge access did enable business owners to consider locations which previously had been too inconvenient" (24). Sunset Beach has actually had a higher rate of residential development than the neighboring towns, leading NCDOT's consultants to conclude that the "character and pace of development is more attributed to the Town's attitude toward growth and the impact of the national economy, rather than the existence of high-level bridge structures" (24). The study does not yet consider the possibility that the continued growth in Sunset Beach may be the result of a unique, small-town character associated with the limited access to the island afforded by the swing bridge.

Traffic impacts associated with the various replacement alternatives are being assessed. A vessel-height survey was conducted to determine the height and frequency of watercraft passing through the existing drawbridge, and vehicular traffic counts were under way in 1994 (25). Travel patterns for vehicles and vessels in coastal areas are markedly different, particularly for larger vessels. Peak vehicular traffic occurs in the summer, but vessel traffic peaks occur in the spring and fall because many yachts and sailboats follow seasonal weather patterns. The study revealed that during the peak tourist season daylight hours the low-, mid-, and high-rise structures would allow unrestricted passage of 37 percent, 67 percent, and 100 percent, respectively, of the vessels.

Social impacts are also being considered. Peggy Hayes, one of the consultants working with NCDOT on the EIS, believes that development trends and land use policies are the strongest forces affecting development on the Outer Banks. As part of the land use plan update process in 1992, Hayes prepared a questionnaire addressing a number of issues that had been identified during a public meeting. The survey was mailed to a sample of property owners from the town and extra-territorial area. Of the 200 questionnaires sent out, 124 were completed and returned. However, the voluntary nature of the response may bias its representativeness. Two questions addressed the bridge replacement issue. The first question was "What is your preference for a bridge to the island?" Fifty-seven respondents (48 percent of the total) indicated support for maintaining the one-lane bridge. Overall, 73 percent of the residents who responded to the survey were in favor of maintaining the current bridge or replacing it with a mid-rise structure. To a more general question concerning "the most important issue facing Sunset Beach," two residents indicated "no high-rise bridge" (26). Fourteen others responded that a new bridge was needed, and only one resident felt that the most important issue facing Sunset Beach was that the existing bridge did not allow safe evacuation from the island.

In 1992 Sunset Beach prepared its land use plan update. The plan was officially adopted by the town council on March 13, 1993, and was certified by the Coastal Resources Commission 13 days later. Unlike those of several neighboring communities, the plan con-

tained specific statements concerning transportation. The first statement called for improved bridge access through renovation or other measures. The second expressed concern over the safety and evacuation capacity of the swing bridge and called for "more reliable" access (26).

By the time the update was prepared, the issue of the bridge was growing in intensity. Although there appears to be a feeling among certain residents that the elected officials do not represent the collective interest of the community, the policy statements in the land use plan are not specific as to the type of bridge that should serve the community. As a further assurance of good faith, "the town has enacted a 35-foot building height requirement . . . which can only be changed by public referendum" (24).

Mid-Currituck Bridge

From the late 1970s to the early 1980s, Currituck Banks was the least-developed of North Carolina's string of barrier islands. Speculative purchases and subdivision had been raging for nearly three decades, but northeastern North Carolina was a rural, agricultural area and the Outer Banks had never seen more than limited development for lighthouse operations or hunting lodges (13). Growth in the Norfolk, Virginia, area began to exert pressure on Currituck in the early 1970s and NCDOT road building and expansion were increased. For many years, environmental and development interests engaged in heated debates over the appropriateness and necessity of developing the entire Outer Banks. A key issue in this debate was the construction of a road connecting the outer banks of Virginia to Currituck Banks. Although long discussed and oft-planned, the road has never been constructed (13). Following several years of debate, NC 12 was extended to Corolla, a community that could only be reached by a sand road for some time. Development has boomed in the interim, and over 270 residential structures have been constructed in the beach communities north of Corolla. Currituck County's 1990 *Land Use Plan* (12) identifies the lack of access to these residences as the most controversial and complex transportation issue facing the community. Residents of a number of unincorporated areas drive north along the beach to reach their homes. Development is increasing despite this inconvenience, which suggests that the state's firm policy that "no road would be built north of Corolla" (13) may one day be breached.

In spite of legal barriers and the existence of public and private wildlife refuges north of Corolla, the no-road policy is particularly vulnerable at the present time. Because of increasing development on Currituck, traffic along NC 12 is rapidly increasing. Poplar Branch Township, which encompasses the lower portion of the Currituck Outer Bank and part of the mainland, is the fastest growing of Currituck County's four townships (12). The distance to the closest soundcrossing bridge, Wright Memorial from Southern Shores to Point Harbor, is 20 mi. Currituck County officials claim that a mid-sound bridge is needed to increase access to service-needy residents on Currituck Banks. First proposed in 1978 (27), a feasibility study was completed in 1989, and, using the provisions of the Official Corridor Map Act, a corridor was preserved for a landing site of the bridge near Corolla. Revenue bond, federal, and state financing alternatives were examined in the study. Subsequent attempts to obtain federal funds were unsuccessful, but the project, with construction scheduled for 2003, was included in the 1991-1997 Transportation Improvement Program (TIP) (28). The provision of emergency medical services and hurricane evacuation

are the two primary arguments presented in the 1991 Currituck County land use plan in support of a bridge, but the state's 1993 TIP identifies a different purpose—that the bridge will "enhance the accessibility of the Outer Banks and benefit the important tourism interests" (28).

In its latest iteration, the project is only in its early planning stages. Despite the potential impacts and need for coordination, permits staff at DCM learned from newspaper articles that the project was being revived. While this may seem irregular, it is not entirely so. Scoping meetings are held with a variety of agencies to identify potential areas of impact that should be addressed in the environmental impact assessment process. However, the EA or EIS process allows official review and comment only at the draft report stage. Many alternatives or impacts have already been dismissed by this point in the process and the boundaries of analysis have been set by NCDOT. In accordance with the schedule outlined in the 1993 TIP, a contractor was selected in March 1994 to begin an EA. While a landing location at Corolla has been reserved since 1991, three alternative takeoff points have been identified, all linked to existing corridors in an effort to minimize the environmental and economic costs associated with cutting through the large swamp that borders Currituck Sound on the mainland side.

Both bridge and nonbridge alternatives are being considered in the EA, and the impacts to be addressed range from land suitability to archaeology. Like many projects of this magnitude, the momentum associated with a conservative estimate of \$48 million for planning and construction seems to favor a build alternative. The time costs of vacationers must be weighed against those of schoolchildren commuting to the mainland, and the revenue associated with increased development must be weighed against the costs of disaster relief. These questions are of importance when any expensive public investment is considered but are critical when a project of this scope is proposed. The link between land use changes and development is not always clear. A bridge has provided access to the northern Outer Banks since 1928, when a toll bridge was constructed to connect Manteo and Nags Head (21). Subsequent transportation improvements were followed by other development, but no public road served Currituck County's portion of the Outer Banks until 1984. The justification for incorporating the private road that ran from Duck to Corolla into the state system at that time was access—access to the beach by vacationers, access to community services on the mainland by taxpaying residents, and access to the island community by government employees. In the past decade, development has increased despite only limited improvements in access, and has led some to conclude that "some portion of the growing number of . . . residents seek, or at least accept, the seclusion afforded by this access restriction" (21). If suboptimal access does not prevent development, the county has identified a condition that may—limited potable water supply in the northern portion of the county. This condition has led to a call for comprehensive studies of potable water supplies in advance of constructing a new bridge (12).

The strong link between access improvements and development emphasized here and NCDOT's policy concerning NC 12 are contradicted on two points by the resumption of planning for a mid-Currituck bridge. First, neither the need nor the purpose for a bridge has been clearly established. The county land use plan belies itself, both supporting the bridge's inclusion in the TIP and recommending caution because of potential impacts of increased development on the water supply, and the TIP emphasizes the tourism and economic development benefits of this "critical" structure. Second,

selection of a Corolla landing site is incomprehensible if this is to remain the northernmost town with full public road access. Development pressure would substantially increase in Corolla as would development in the northern beach communities. Some residents of these communities are already calling for the state to provide improved access to their holdings. An increase in the number of people at risk would necessitate road construction and open up more areas for development.

Long-Range Planning for NC 12

Maintenance and upgrading of the Outer Banks' main artery is a continuing sore point between NCDOT and most of the agencies charged with determining the negative impacts of publicly funded projects. By their very nature, barrier islands are in motion. Wind-driven sand, wave overwash, and downstream currents move these islands landward and southward. As is obvious, the mobile nature of barrier islands is somewhat at odds with the stable requirements of roadways (at least when asphalt, concrete, and lots of time and money are required in their construction and maintenance). NC 12 is regularly in need of repair.

Because of a lack of long-range planning and accounting methods that separate maintenance activities from emergency cleanup, most of these repairs have been carried out as stopgap measures. A prime example is the 6-mi stretch of roadway south of Oregon Inlet. In recent years, over 0.5 million yd³ of sand have been pumped from the sound to lengthen the beach, and sandbags have been installed to further protect the road from overwash. Following Hurricane Emily in September 1993, a portion of NC 12 north of Buxton was washed out, and NCDOT requested permission from the Coastal Resources Commission (CRC) to lengthen the beach with sand from Pamlico Sound. In 1992, NCDOT had initiated a study of long-range alternatives for this section of roadway, but the consideration of impacts on the nearby National Park and National Wildlife Refuge were complicating the analysis and no specific solutions had been identified. The CRC was reluctant to grant permission, calling instead for NCDOT to develop a more permanent solution to the problem of overwash in this area. When the project was delayed, local landowners appealed to the governor's office. Soon after, a declaration of emergency was issued on the grounds that the road condition severely limited access to residences in Buxton and Hatteras, and the beach nourishment permit for the project was issued by the CRC. Clearly, something had to be done. Over 20,000 structures are located on Hatteras Island and, according to NCDOT Assistant Branch Manager Barney O'Quinn, unofficial state policy is to quickly correct deficiencies in the transportation system and prevent or minimize damage to the tourism industry.

Conflicts such as these with the state's policy toward coastal management have led to the initiation of a long-range planning process for the approximately 80 mi of roadway between Oregon Inlet and Ocracoke. Seven federal and state agencies are involved in the "Interagency Task Force on the Transportation System for the Outer Banks" (29). Using a "partnering process" combining staff and funds from the participating agencies, the task force is to develop a unified approach to the planning process. Three objectives identified for the process, to be reached over 5 years at a cost of \$7.8 million, include protecting and maintaining the transportation system for the Cape Hatteras National Seashore and the Pea Island National Wildlife Refuge, providing background studies and

a scientific basis for making sound decisions on transportation system improvements, and ensuring that the natural barrier island system on the Outer Banks is preserved and subjected to minimal environmental impact (29).

NCDOT initiated this process in response to criticism that it was not considering the cumulative impacts of road maintenance on this vulnerable stretch of the Outer Banks. Since most land and water projects on the Outer Banks could affect the entire area, the process is also an attempt to coordinate the efforts of many agencies and maximize the effectiveness of their sand management, channel dredging, and hurricane-evacuation efforts. Included in the scope of work is a comprehensive assessment of transportation alternatives, including bridges, causeways, ferries, and even a buyout of all private property. The agency has already committed \$1.5 million to the process and is anxious for it to succeed. Scarcely past the embryonic stage of development, the partnering process may hold part of the key to successful integration and coordination of the many mandates that affect public involvement in coastal development.

IMPLICATIONS OF THIS ANALYSIS

The analysis of the collective policies and actions of NCDOT and DCM has clearly shown that the state of North Carolina does not have a coherent policy concerning the provision or upgrading of transportation infrastructure in coastal areas with high potential for loss from natural hazards. NCDOT does not have a specific policy for coastal areas. Rather, certain mandates (eg., the Highway Trust Fund or unofficial policy concerning the tourism industry) direct increased roadway development along the coast without regard for the potential hazards of such development. Clearly, political and economic factors play an important role in transportation policy throughout the state, and well they should. The Highway Trust Fund was devised to formalize some of these interests and to equalize highway spending around the state. Its effect in coastal areas has been to facilitate construction of roads and bridges that both encourage development and support evacuation. Unfortunately, the impacts of such transportation investments on fragile and unique barrier island ecosystems are not adequately addressed.

Local land use planning is considered an effective means of mitigating hazards through development management, such as density and height restrictions and public facilities requirements. Both the CZMA and the CAMA stress local land use planning but do not explicitly require that the type or capacity of transportation systems be considered or determined by the communities. Further, a significant element in this process, the transportation network, is managed at a different level of government. The impacts of a transportation improvement on local residents may be considered secondary to its benefit to the entire state. The converse is true as well. A transportation improvement that enhances access and developability of a certain area may also increase the responsibility of the entire state for facilitating the increased loss of life or property. What are the costs of allowing and supporting development of high-hazard areas? How much risk, and therefore responsibility, does the state accept? The ensuing contradiction is evident. "We are caught in a dilemma" laments Barney O'Quinn, Assistant Branch Manager for the Planning and Environmental Branch of the Division of Highways. "Where is DOT inducing development and where is it supplying to meet a need?"

What appears to be an oversight by policy makers in North Carolina in establishing an overarching policy and process for coordi-

nating these activities results from the complexity of problems facing the state concerning the rapid development of coastal areas and the difficulty of balancing the benefits of coastal development and the costs of loss from natural hazards. By allowing policy to be developed in separate governmental areas, each acting as a distinct entity, the resulting competition of interests and lack of comprehensive planning disables the effective implementation of federal and state mandates to reduce the loss of property and life and to protect this fragile environment. These compromises ensure that larger questions are never addressed. The role of transportation policy in this process is not clear. In most cases, transportation improvements are seen as accompanying development trends. Transportation is a key element of the developability of coastal areas. As a result, where the political and social will is for development, transportation improvements are accepted as givens and rarely discussed. Only in the case of the CBRA has government, at any level, recognized the strength of this relationship and attempted to manage coastal areas through the prohibition of federally funded infrastructure improvements.

The long-range planning process recently undertaken by NCDOT is a step toward the organizational coordination and regional planning Mumford was calling for nearly 60 years ago. This process may even allow for the parties involved to look beyond their particular needs and consider the larger, difficult questions concerning the appropriateness and necessity of development in hazardous areas and the benefits of a cooperative, comprehensive process of planning and environmental management.

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