Basic Emergency Planning Awareness for Acadia National Park Rock Climbing Enthusiasts – Otter Cliffs Climbing Area

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1. Introduction

Since the 1880s, the natural beauty of Mount Desert Island (MDI) in Maine has made it a popular destination for people from all walks of life. Amongst the most notable of these was George B. Dorr, a strong believer in conservation who spent more than forty years seeking to preserve land on MDI. In 1919, he witnessed the establishment of Lafayette National Park on MDI by President Wilson. This was the first national park east of the Mississippi River, and Door was appointed its first superintendent. In 1929, the name was changed to Acadia National Park (ACAD) with a present day total of 47,000 protected acres (Reams 2006).

ACAD lies within Hancock County and is divided into three sections: MDI, the Schoodic Peninsula mainland, and parts of Isle au Haut Island. Through the initial efforts of Dorr, it has become a well-established recreational area for hiking, biking, paddling, and rock climbing enthusiasts. The purpose of this study is to develop basic emergency planning awareness for the rock climbing enthusiasts. ACAD has five commonly used climbing areas on MDI, of which Otter Cliffs is designated the preliminary study area (Fig 1). The analytical objective is to provide driving distance/time from each emergency service location on MDI to the Otter Cliffs area.

2. Methods

2.1 Data

GIS datasets were collected from publicly available sources on the World Wide Web. One exception was climbing area locations for which an ACAD GIS Specialist was contacted (Table 1). The official ACAD map was also obtained to assist with orientation of the national park and datasets. Analysis was conducted via ArcMap, ESRI software, using the proper ACAD geographic projection: NAD_1983_UTM_Zone _19N.

2.2 Preliminary Analysis

The study was limited to emergency services located on MDI, which includes nine fire stations, one hospital, and three law enforcement departments. Metadata and attribute tables were utilized to further focus the datasets into certain emergency service

specifications resulting in three fire stations, one hospital, and three law enforcement departments (Table 2). To assist with initial visualization of emergency service proximity to Otter Cliffs, the *buffer wizard* was used to display one mile intervals (Fig 2).

2.3 Route Analysis

Route analysis was based on the entire MDI road network with slight dataset modification. Within ACAD is the Park Loop Road, a scenic 27-mile drive (Reams 2009), in which a section is one-way only. To accommodate, the "jurisdiction abbreviation" field attributes, which assign the roads to the responsible entity--in this case "reservation"--were modified. *RESV* represents the two-way section, while the one-way section was changed to *RESV1*.

Using the *spatial analyst* extension, the road dataset was converted from a feature to a grid via "jurisdiction abbreviation." Reclassification of the roads followed, taking into consideration possible inaccessibility of the one-way section where Otter Cliffs is located. Therefore, *RESV1* received a higher weighting than the other roads (Table 3). Step three involved computing a cost distance grid, which took into consideration the reclassification, also known as a cost surface grid, to show the cost from each point in the grid (emergency services) to a particular location (Otter Cliffs). A direction grid was simultaneously created and applied in the final step to determine the least cost path from all seven emergency services in the direction of Otter Cliffs (Fig 3).

2.4 Driving Distance/Times Analysis

Using the least cost path as a reference, the approximate driving distances/times were calculated from all seven emergency services in the direction of Otter Cliffs: (1) Speed limits were acquired from the MDI road dataset. (2) The length per road segment was calculated in the attribute table via *calculate geometry* into meters, converted into miles using *raster calculator*, and then the sum of each road length based on the speed limit and entity responsible was calculated via *statistics*. (3) Average driving times were then derived using the following equation: $\text{Travel Time}_{(\text{minutes})} = \text{Distance}_{(\text{miles})} / (\text{Speed}_{\text{mph}}) * 60_{(\text{minutes})}$. The longest route is shown in Fig 4a and the shortest in Fig 4b.

2.5 Analytical Considerations

During the analytical process, the presence of MDI vehicle bridges was of concern: more specifically, two overpasses located along the least cost path. After consulting the official ACAD map, it was determined that these overpasses carried Route 3 over the one-way section of Park Loop Road. According to the least cost path, Route 3 was included in the end result, which validated the analysis.

Another analytical consideration was removing the one-way section of Park Loop Road to take into consideration probable inaccessibility at the entry point. At the same time, it was also considered that large volumes of visitor vehicles might hinder ease of accessibility for emergency vehicles to pass through to their destination, especially during the summer months. Even though the one-

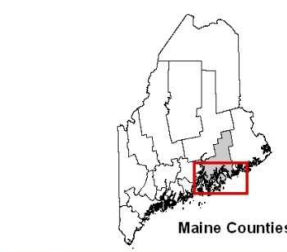
way section was assigned a high weight during reclassification, the least cost path seemed to break the rules and extend 0.263 miles onto the one-way section of Park Loop Road terminating at Otter Cliffs. Upon closer review of the ACAD gates dataset in ArcMap, there is an access gate that dissects the Park Loop Road and Otter Cliff Road. No further information was available regarding the usage of this gate. Therefore, for the purpose of this study, it was assumed that if a real emergency occurred, access to Otter Cliffs, which is located on the one-way section of Park Loop Road, would be granted.

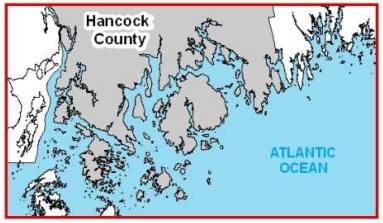
3. Conclusion

Keep in mind that this study did not take into consideration emergency services not adhering to the posted speed limit when dispatched. However, there is a general consensus that as the distance from the Otter Cliffs climbing area to emergency service increases, so does the driving distance/time from the emergency service locations toward Otter Cliffs. This poses advantages and disadvantages for the rock climbing enthusiast in an emergency situation.

The town of Bar Harbor is relatively close to Otter Cliffs, roughly six miles in ten minutes travel time, with three emergency services available. Mount Desert Island Hospital, the only hospital on MDI, provides general medical and surgical services. Bar Harbor Ambulance, a fire station down the road from the hospital, provides both vehicular and air ambulance services. Bar Harbor Police Dept is right next door to the fire station and can provide initial response. The remaining emergency services on MDI are between ten and twenty-one miles from Otter Cliffs. Only two seem relevant: Bar Harbor Ambulance – Town Hill Station provides services similar to those of Bar Harbor Ambulance; and Mount Desert Fire Dept. Station 1 in Northeast Harbor only provides vehicular ambulance service (Fig 5).

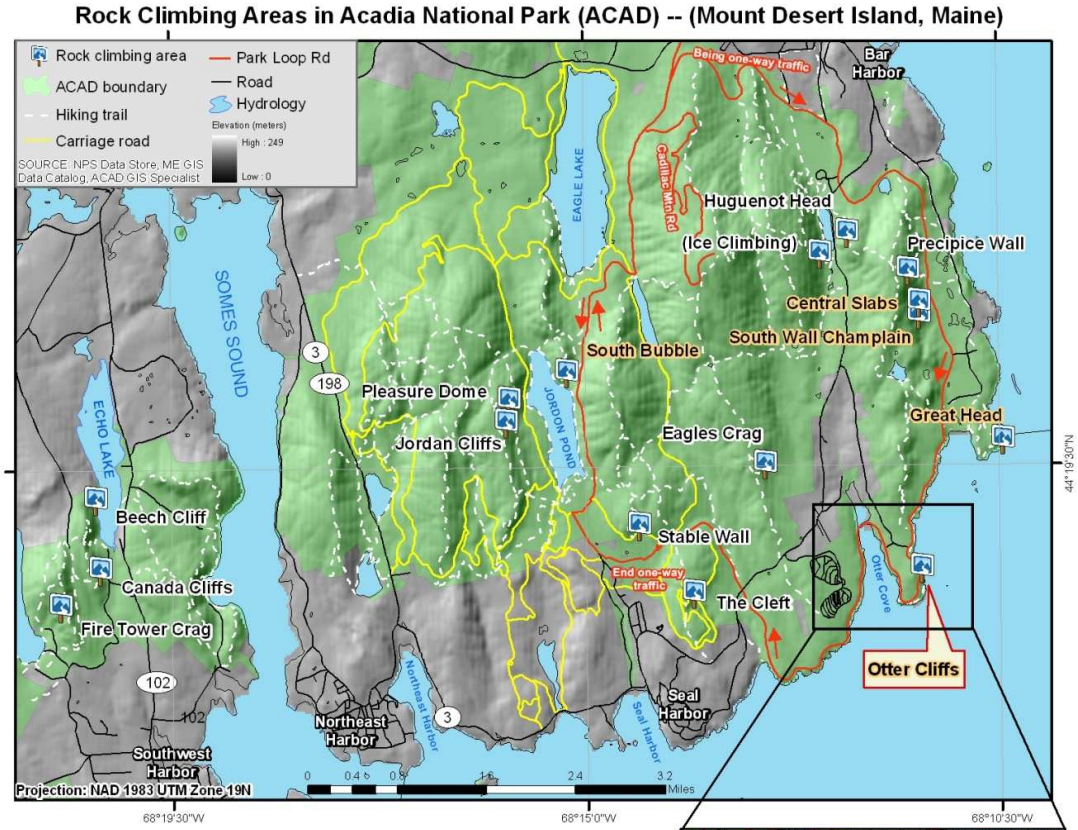
Even though this study focused on one of the climbing areas within ACAD, one must remember that the remaining fifteen are just as critical for basic emergency planning awareness. For example, Bar Harbor Ambulance – Town Hill Station can provide ambulance services to three climbing areas located west of Somes Sound (Fig 1) as they are closer than Bar Harbor Ambulance. As a result, this study can be expanded to include emergency scenarios for all sixteen climbing areas and be made available to out-of-state visitors.





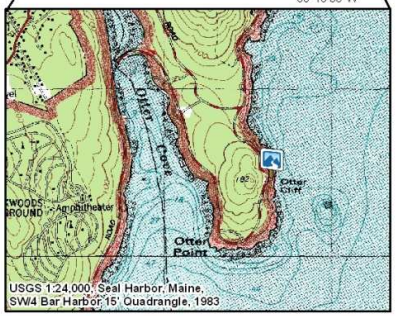
Three sections of ACAD: MDI, Isle au Haut, and Schoodic Peninsula.
http://www.nps.gov/acad/planyourvisit/upload/ACADmap2005.pdf

"George B. Dorr overlooking the land he loved."
http://www.nps.gov/acad/historyculture/george-b-dorr.htm



COMMONLY USED CLIMBING AREAS	
Otter Cliffs	60' sea cliffs, crack and face climbing, rappel access, routes up to 5.12
South Wall (Champlain)	3-pitch routes to 5.12, good corners and thin cracks
Central Slabs	1-pitch routes, some good beginner routes, routes to 5.10
South Bubble	1- to 3-pitch routes, some friction climbing, good beginner routes
Great Head	high-grade sea cliff climbing, rappel access, know tides and weather

http://www.nps.gov/acad/planyourvisit/climbing.htm



Topography of the Otter Cliffs climbing area.

Figure 1. Orientation of ACAD and the five commonly used rock climbing areas on MDI, including Otter Cliffs.

Dataset Name	Category	Source
ACAD_ClimbingAreas_PT	ACAD climbing area	Contacted ACAD GIS Specialist -- 23 Feb 2010
ParkBoundary_Poly_ CARTO_200901	ACAD boundary	NPS Data Store (http://science.nature.nps.gov/nrdata) last accessed 21 Feb 2010
CarriageRds.gdb	ACAD carriage road	
HikingTrails2009	ACAD trails	
ParkGatesALL_ 20090324	ACAD gates	
acad_dem	ACAD DEM	
Hyd24p	Mount Desert Eastern Highlands watershed	ME GIS Data Catalog (http://megis.maine.gov/catalog/) last accessed 21 Feb 2010
medotpubrds	Maine roads	
brdgs	Maine road bridges	
fire	Maine fire stations	
police	Maine law enforcement	
hospital	Maine hospitals	
cnty42p	Maine state and county boundaries	
o44068c2.tif	ACDA park and buildings (1:24000 topo maps)	Libre Map Project (http://libremap.org) last accessed 22 Feb 2010

Table 1. Publicly available GIS data on the World Wide Web as well as an initiated phone call with an ACAD GIS Specialist for rock climbing area datasets that were utilized for this study.

Emergency Service	Primary Functions (listed in attribute table)	Final Count
Fire station	"ambulance services, air or ground"	2
	"ambulance and fire service combined"	1
*Hospital	"general medical and surgical"	1
**Law enforcement depts.	Not listed, metadata consulted.	3

** Clinics were not considered as this study focused on major injuries.*
*** According to the metadata for law enforcement, park police was included in the dataset. Based on online research, the mission statements per department did not exclude "parks" and was included in the study.*

Table 2. The "primary functions" field in fire, police, and hospital dataset attributes tables were utilized to further focus the datasets into certain emergency service specifications.

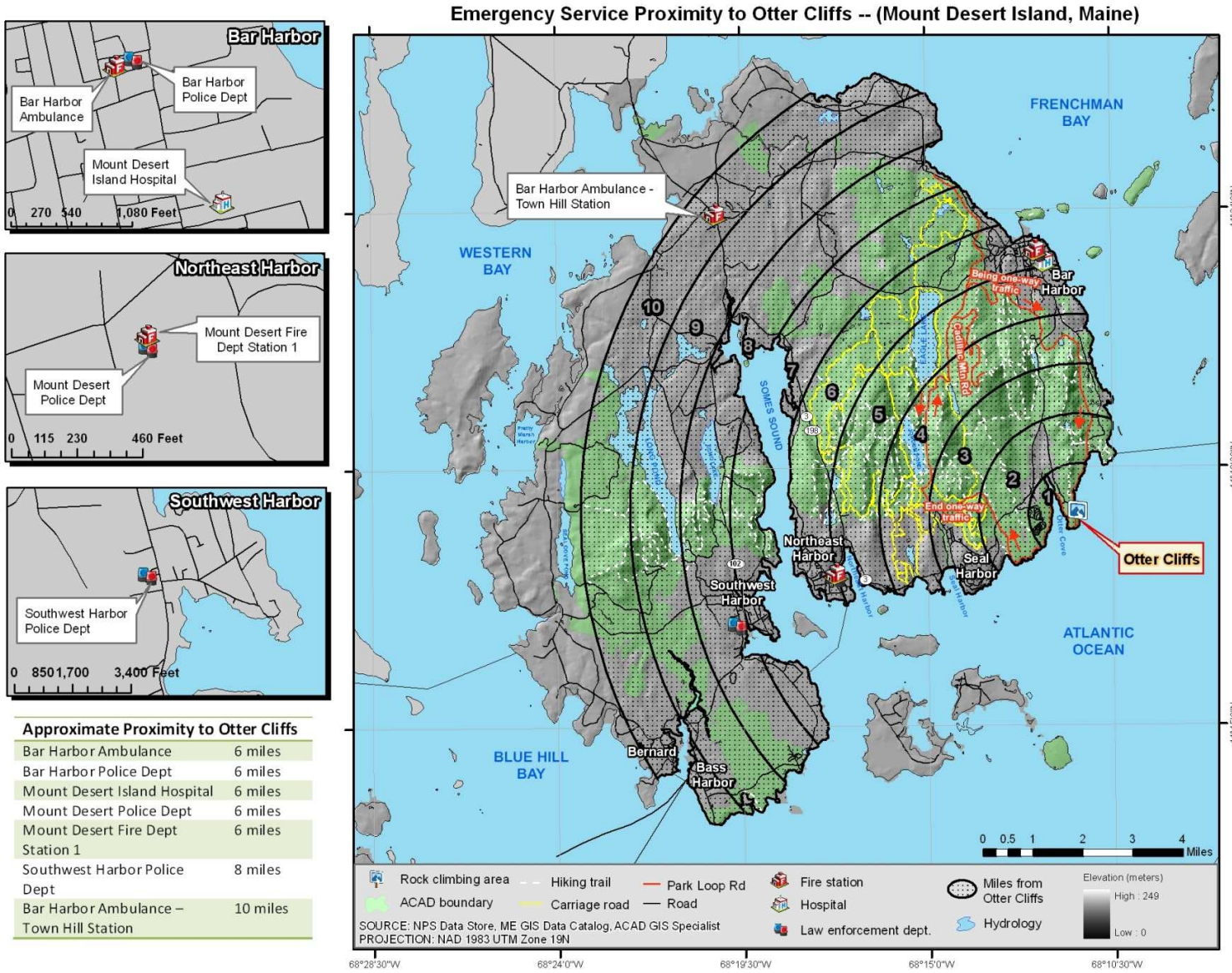


Figure 2. Emergency service proximity to Otter Cliffs using *buffer wizard* in ArcMap.

JURISDICTI	JURIS_ABBR	Weight
State aid	STAI	2
State hwy	STHW	1
Tnwy summer	TNWS	5
Townway	TNWY	4
Reservation	RESV	3
* *"Reservation1"*	*"RESV1"*	6
** NoData	n/a	9999

** Data modification to accommodate the one-way section of the Park Loop Road.*
*** NoData was a value during the reclassification process and represents "other" in which a large number was assigned.*

Table 3. Reclassification of the MDI road dataset after grid conversion.

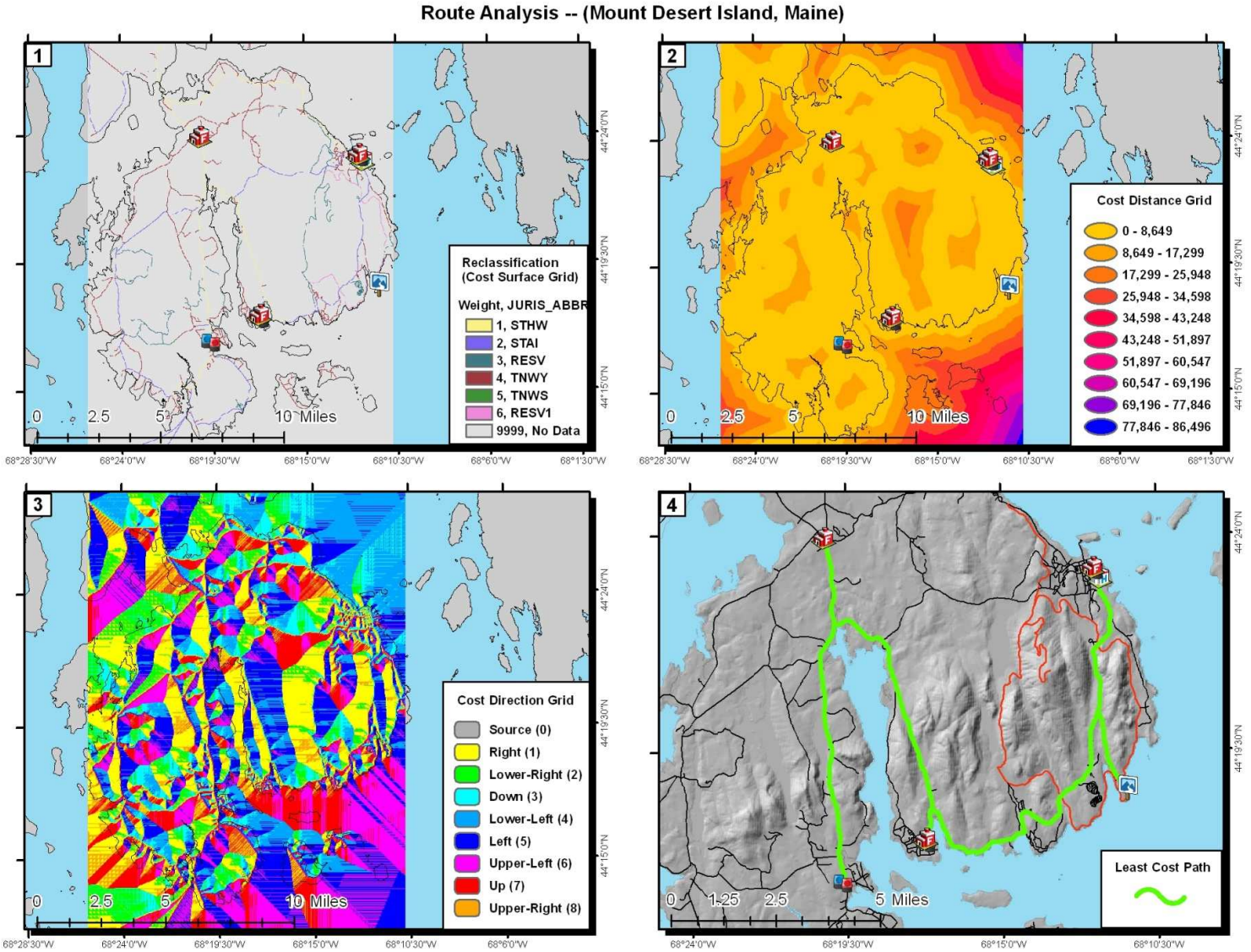


Figure 3: Step-by-step route analysis of the MDI road dataset and Otter Cliffs point data.

Approximate Driving Distance/Time from Southwest Harbor Police Dept to Otter Cliffs -- (Mount Desert Island, Maine)

*Route	**MPH	Length	***Time
-- Leave Southwest Harbor Police Dept --			
Townway	45	0.081	0.108
State hwy	25	0.575	1.380
State hwy	40	0.895	1.342
State hwy	50	3.746	4.496
State hwy	35	0.161	0.277
State hwy	25	0.769	1.847
State hwy	35	5.118	8.774
State hwy	25	0.626	1.504
State hwy	30	0.610	1.221
State hwy	40	0.823	1.236
State hwy	35	0.052	0.089
State aid	35	1.471	2.523
State aid	25	0.877	2.105
State aid	40	1.709	2.564
State aid	25	0.863	2.072
State aid	40	0.592	0.889
State aid	50	0.337	0.404
Townway	35	1.225	2.100
Townway	45	0.092	0.123
Reservation	45	0.515	0.687
-- Arrive ACAD access gate to Park Loop Road--			
Reservation	45	0.263	0.351
-- Arrive at Otter Cliffs --			
	37 mph	**21.409 miles**	**36.09 minutes**

* Refers to entities responsible.
** Posted speed limit.
*** Does not take into account red lights, stop signs, etc. as emergency vehicles have the right of way when dispatched to an incident.

Speed Limit, Entity responsible

- 15, Townway
- 25, State aid
- 25, State hwy
- 30, State hwy
- 35, State hwy
- 35, Townway
- 35, State aid
- 40, State hwy
- 40, State aid
- 45, Townway
- 45, Reservation
- 45, State hwy
- 50, State hwy
- 50, State aid

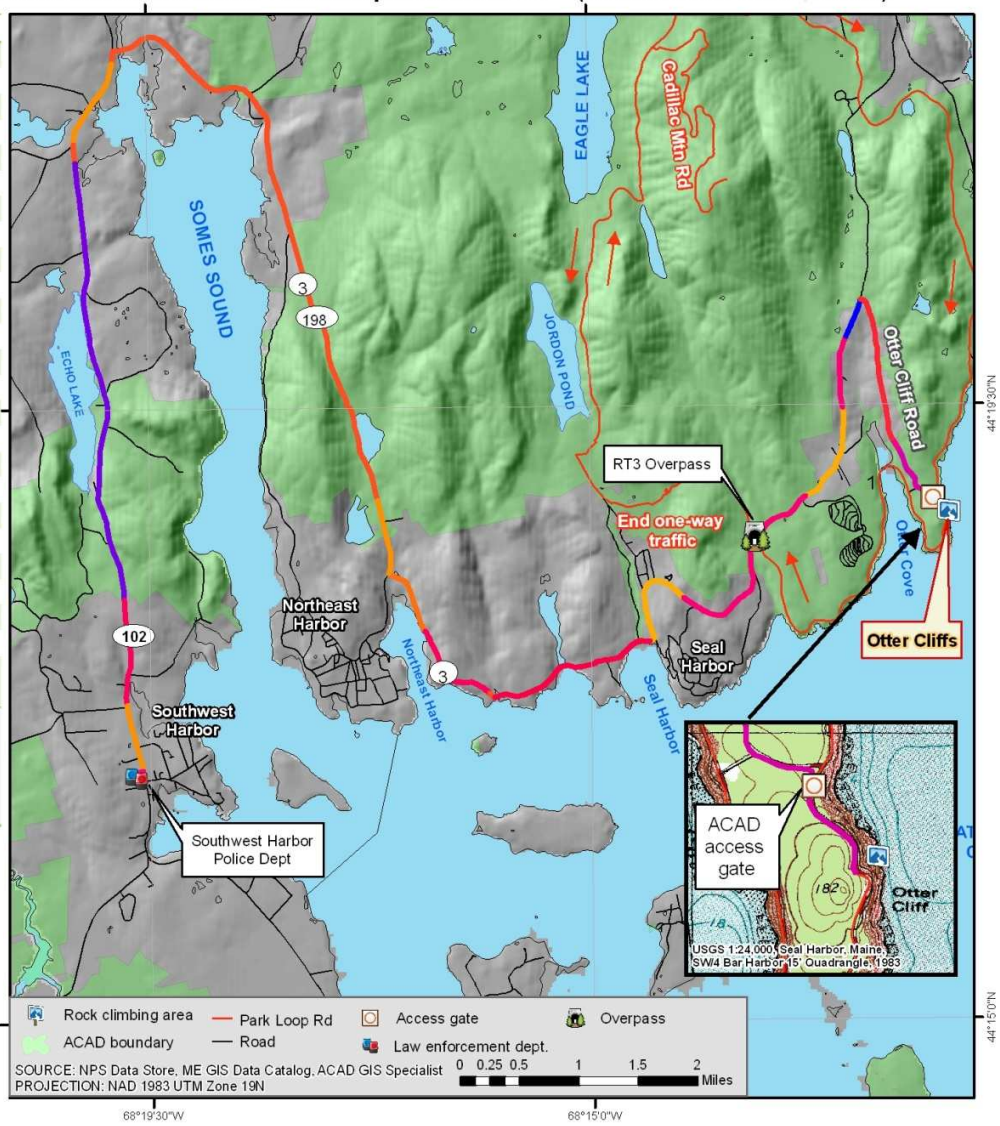


Figure 4a: The longest route as determined by least cost path.

Approximate Driving Distance/Time from Mount Desert Island Hospital to Otter Cliffs -- (Mount Desert Island, Maine)

*Route	**MPH	Length	***Time
-- Leave Mount Desert Island Hospital --			
Townway	45	0.106	0.141
State aid	25	0.169	0.407
State aid	40	1.866	2.799
State aid	50	1.448	1.737
Townway	35	1.225	2.100
Townway	45	0.092	0.123
Reservation	45	0.515	0.687
-- Arrive ACAD access gate to Park Loop Road--			
Reservation	45	0.263	0.351
-- Arrive at Otter Cliffs --			
	41 mph	**5.686 miles**	**8.345 minutes**

* Refers to entities responsible.
** Posted speed limit.
*** Does not take into account red lights, stop signs, etc. as emergency vehicles have the right of way when dispatched to an incident.

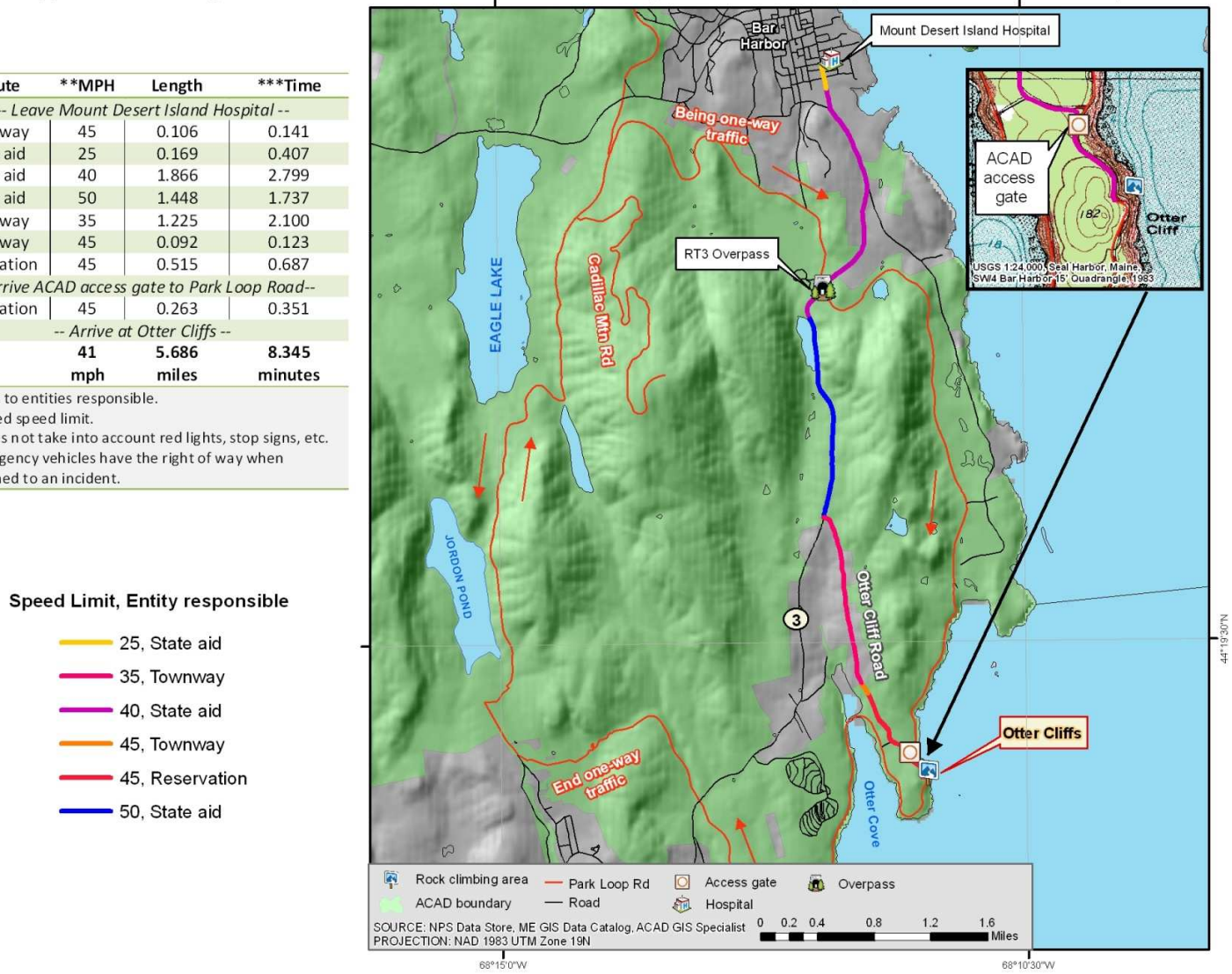


Figure 4b: The shortest route as determined by least cost path.

Approximate Driving Route/Distance/Time from Emergency Services to Otter Cliffs -- (Mount Desert Island, Maine)

Emergency Service	Location	*Route ID	**Average MPH	Distance (miles)	***Time (minutes)
Bar Harbor Ambulance	37 Firefly Lane, Bar Harbor	1,2	38	5.929	9.113
Bar Harbor Police Dept.	37 Firefly Lane, Bar Harbor	1,2	41	5.861	8.833
Mount Desert Island Hospital	10 Wayman Lane, Bar Harbor	1,2	41	5.686	8.345
Mount Desert Fire Dept. Station 1	21 Sea Street, Northeast Harbor	4,3,2	37	10.311	18.07
Mount Desert Police Dept.	21 Sea Street, Northeast Harbor	4,3,2	37	10.311	18.07
Southwest Harbor Police Dept.	26 Village Greenway, Southwest Harbor	7,5,4, 3,2	37	21.409	36.09
Bar Harbor Ambulance – Town Hill Station	1328 State Hwy 102, Town Hill	6,7, 3,2	37	17.193	29.477

* Refers to the numbers on the map that outline the route order.
** Posted speed limit.
*** Does not take into account red lights, stop signs, etc. as emergency vehicles have the right of way when dispatched to an incident.

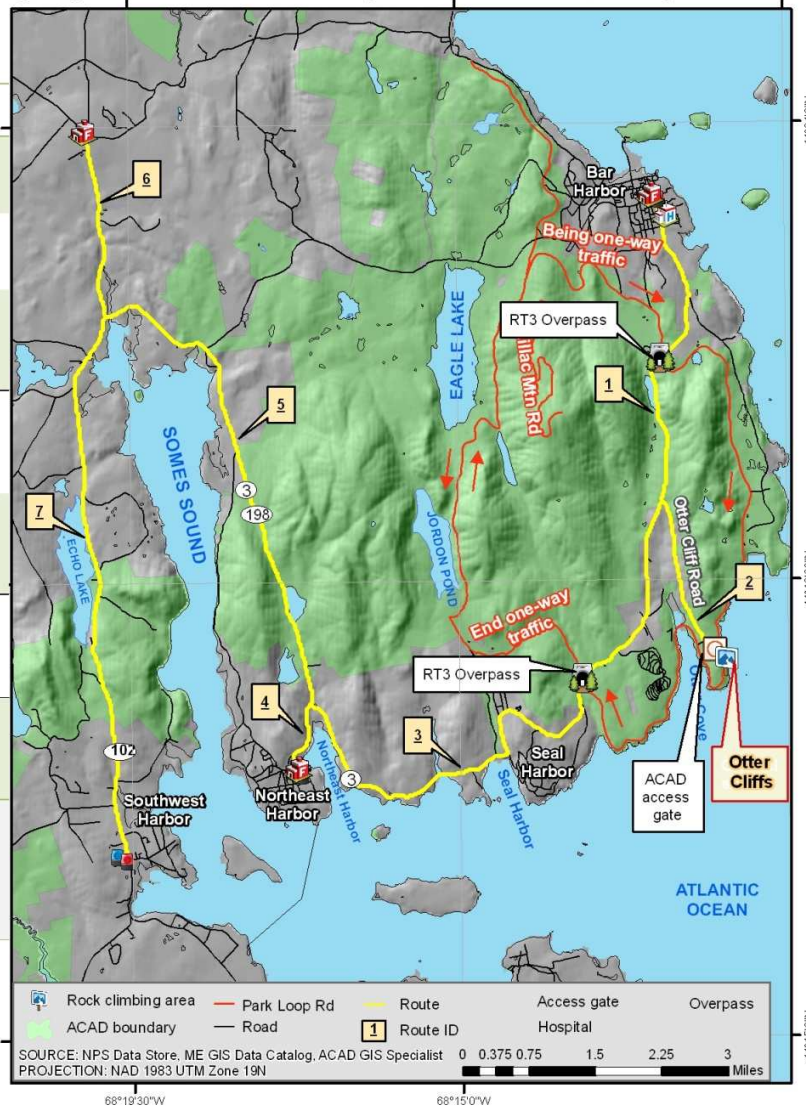


Figure 5: Approximate driving route/distance/time from all seven emergency services to Otter Cliffs based off of the least cost path and MDI road dataset.

Works Cited:

Reams, Virginia (2006), “Acadia National Park - Stories.” Retrieved 15 March 2010 from http://www.nps.gov/acad/historyculture/stories.htm

Reams, Virginia (2009), “Acadia National Park – Scenic Driving.” Retrieved 17 March 2010 from http://www.nps.gov/acad/planyourvisit/driving.htm

Data Cited:

National Park Service (2005), “Acadia National Park“. Retrieved 17 February 2010 from http://www.nps.gov/acad/planyourvisit/upload/ACADmap2005.pdf

Please see Table 1. All data downloaded and previewed between 21 and 23 February 2010.