

Geographic Factors for Data Center Site Selection

A FORTRUST White Paper

March 2008

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premium data center services

Companies rely on their data center to provide the foundation for much of their business. Because of that, a thorough evaluation of the key geographical factors related to data center site selection is critical.

This white paper examines several of the major criteria to use in geographic data center site selection, and provides an overview of the FORTRUST facility as it relates to those criteria.

If you have any questions about this white paper or FORTRUST in general, please don't hesitate to contact your FORTRUST representative for additional information.

Introduction

Any company in the midst of a data center site selection process commonly finds itself with a number of factors to consider. The site selection process is key for most companies, not only because the selected site/provider will be hosting mission-critical business services, but also because the chosen site will likely house those critical systems and platforms for the foreseeable future. Since site selection activities are often performed only once or twice, it's important that all relevant factors be evaluated.

Geographical factors are often overlooked in site selection activities, or at best are incompletely examined. And most data center providers, quite frankly, don't do much to help in that process. Many data centers produce information about hardware reliability or facility security, but often geography as a measure of a facility's ability to competently serve its clients is neglected.

To that end, FORTRUST has prepared this paper to discuss the various risk factors that may impact data center operations by geography. The included research is an extension of FORTRUST's diligence and research in establishing its own data center operations. This paper highlights the geographic advantages inherent in establishing data center operations in Colorado, addressing major events and probabilities of natural disasters such as seismic events, floods, tornadoes and hurricanes and particular issues specific to Colorado. Further, this paper illustrates the FORTRUST response to those issues (snowfall, etc.) that are more specific to Colorado.

Geography Matters: Colorado's Advantages

As stated above, companies in the process of data center site-selection use various criteria to determine the best facility to entrust their information. The prevalence of natural disasters in U.S. regions is another factor by which companies can measure data center operations. Enterprises that outsource data center operations can mitigate certain risks by choosing locations in areas deemed low risk by historical and analytical data.

The analysis of natural disasters and the subsequent categorization provides evidence of Colorado's low-risk position. Low incidences of natural disasters such as earthquakes, floods, hurricanes and tornadoes make Colorado a superior choice as a data center location. FORTRUST is ideally situated in low-risk geography sheltering it from major natural disasters providing clients with peace of mind.

Consider the map below, provided by the Federal Emergency Management Agency. Colorado is located in FEMA's region 8, one of the nation's lowest risk zones.

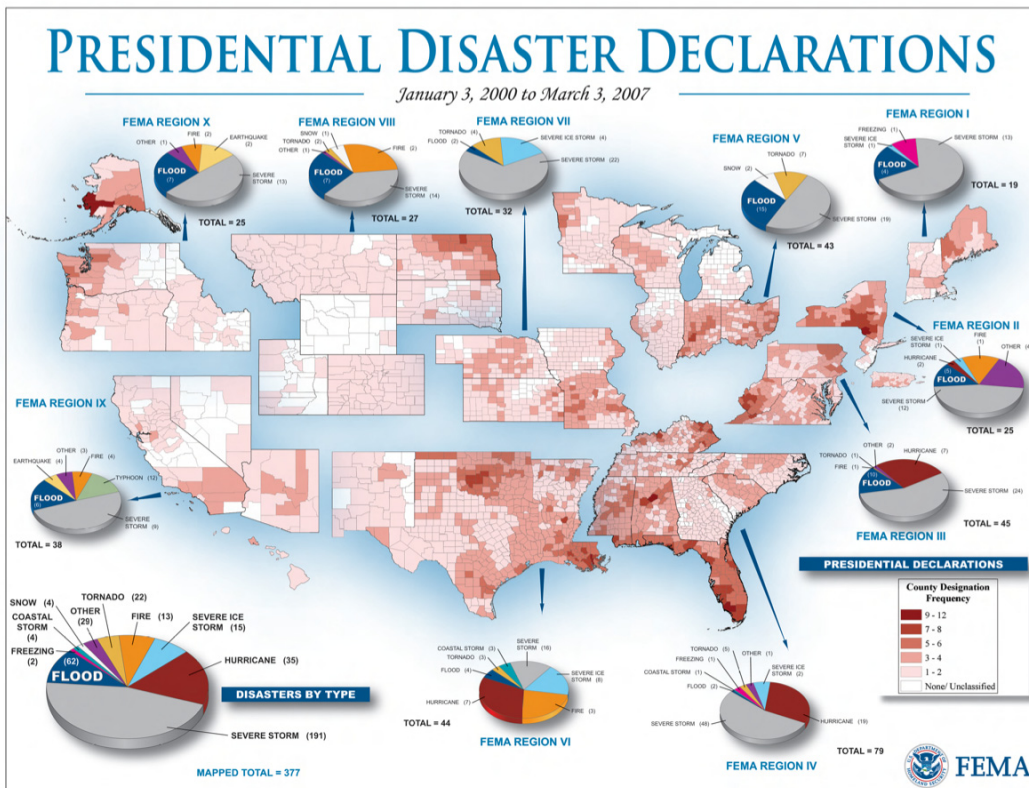
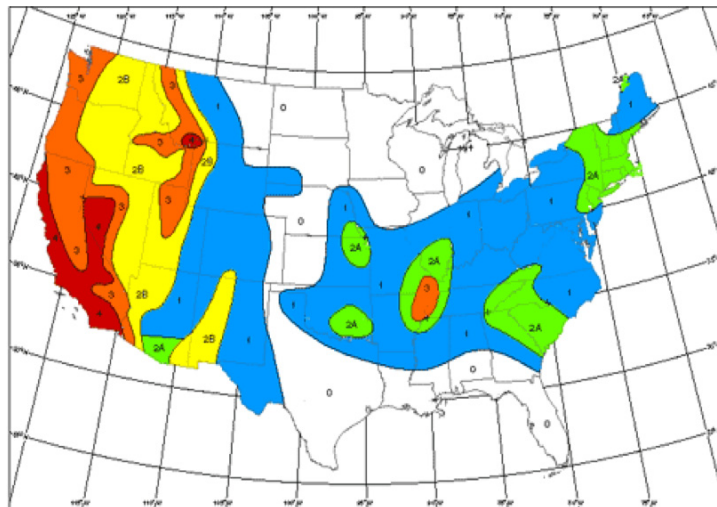


Diagram 2.1 – FEMA – Presidential Disaster Declaration Zones
(Source: Federal Emergency Management Agency)

Seismic Activity

Seismic zone data and fault line analysis provide insight as to where earthquakes are predicted to occur. Seismic zones are determined by compiling statistics about past earthquakes, specifically magnitude and frequency.

The map below illustrates U.S. seismic zones as defined by the United States Geological Survey (USGS). For the purposes of illustrating seismic activity in the United States, the USGS divides the country into zones, numbered from 0 to 4, indicating occurrences of observed seismic activity and assumed probabilities for future activity. FORTRUST's Colorado data center is located in seismic zone 1, one of the nation's lowest risk areas for earthquakes. This factor is especially important to take into consideration when comparing Colorado to other locations across the US, most notably northern and southern California, and even Nevada and Utah.



Red, Zone 4; Orange, Zone 3; Yellow, Zone 2B; Green, Zone 2A; Blue, Zone 1.

Diagram 2.2 USGS Seismological Zones

(Source: Understanding Seismic Zones, by Rebecca South, www.monolithic.com)

Threat of Flood

According to FEMA, flooding is a common event that can occur virtually anywhere in the United States, including arid and semi-arid regions. The agency has defined flood zones according to varying levels of risk with Colorado being designated as a relatively low-risk zone overall.

Flooding that occurs in Colorado is usually caused by Spring snowmelt as rivers and streams swell with water flowing from Colorado's mountain ranges. The last major flood to impact Denver occurred in 1965 and prompted the state's water infrastructure agencies and the Army Corps of Engineers to mitigate the risk of snowmelt and rain-induced flooding by collecting portions of the state's runoff water in strategically placed reservoirs. Today, Colorado's water infrastructure effectively prevents the state's snowmelt and rain from flooding populated areas. In fact, Colorado's water management model is one of the most established and effective in the country.

Based on current data, Texas maintains the distinction as the country's highest-risk flood zone. Note that FEMA is still collecting information and has not yet released statistical data regarding Hurricane Katrina's flood impact. Despite recent events, consider the following flood facts from FEMA collected between 1960 and 1995:

- Texas had the most flood-related deaths during the past 36 years
- Total flood-related deaths in Texas were double that of California
- California ranked second to Texas in number of flood-related deaths
- Texas had more flood-related deaths than any other state 21 out of 36 years

Ranking	Total Payments
1. Texas	\$2,249,450,933.34
2. Louisiana	\$1,542,959,989.27
3. Florida	\$1,479,585,524.19
4. New Jersey	\$577,019,343.82
5. North Carolina	\$550,946,543.87
6. South Carolina	\$414,951,356.42
7. Missouri	\$407,742,372.26
8. New York	\$360,534,936.08
9. California	\$353,244,485.27
10. Pennsylvania	\$313,186,521.60

Table 2.1 U.S. Flood Insurance Loss Statistics - January 1978 through September 2001
(Source: FEMA's National Flood Insurance Program)

In addition to Colorado's low risk of flooding, FORTTRUST's location in north Denver sits 49 feet above the maximum projected flood elevation level as defined by FEMA, which is three feet above grade. The facility is also outside FEMA's 100-year flood plain.

Low Incidence of Tornadoes

Like flooding, tornadoes can occur in every state of the country. However, some areas are more prone to tornadoes than others. The National Oceanic and Atmospheric Administration (NOAA) ranks Colorado ninth in the nation in terms of the number of tornadoes experienced annually. It also notes that most of the state's tornadoes develop over its vast eastern plains. Colorado falls well outside of what has historically been referred to as "tornado alley." Conversely, Texas, namely northern Texas, sits precariously in tornado alley's lower region.

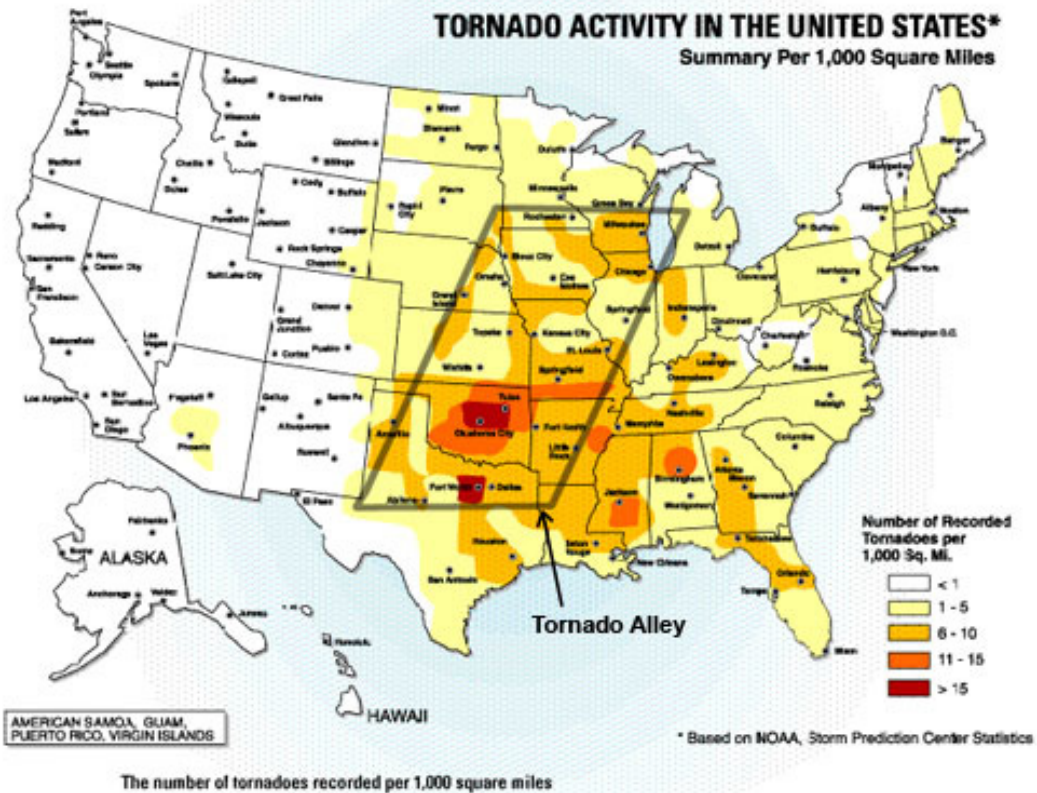


Diagram 2.3 Tornado Activity in the United States

(Source: National Oceanic and Atmospheric Association)

Hurricane Activity

While it would seem an obvious statement, it bears noting that Colorado largely escapes the major effects of hurricane activity, most commonly experienced by coastal states and those states more proximally located to the eastern and gulf coasts of the United States. While some weather systems produced by a hurricane can reach as far as Colorado, the weather produced pales in comparison to that experienced by states in the region where the hurricane made landfall.

Based on weather patterns and historical data, Colorado-based FORTRUST is largely sheltered from hurricanes and their devastating impacts. According to the NOAA map below, much of the eastern United States, especially the Southeast and across the Gulf Coast, are significantly susceptible to yearly hurricane activity.

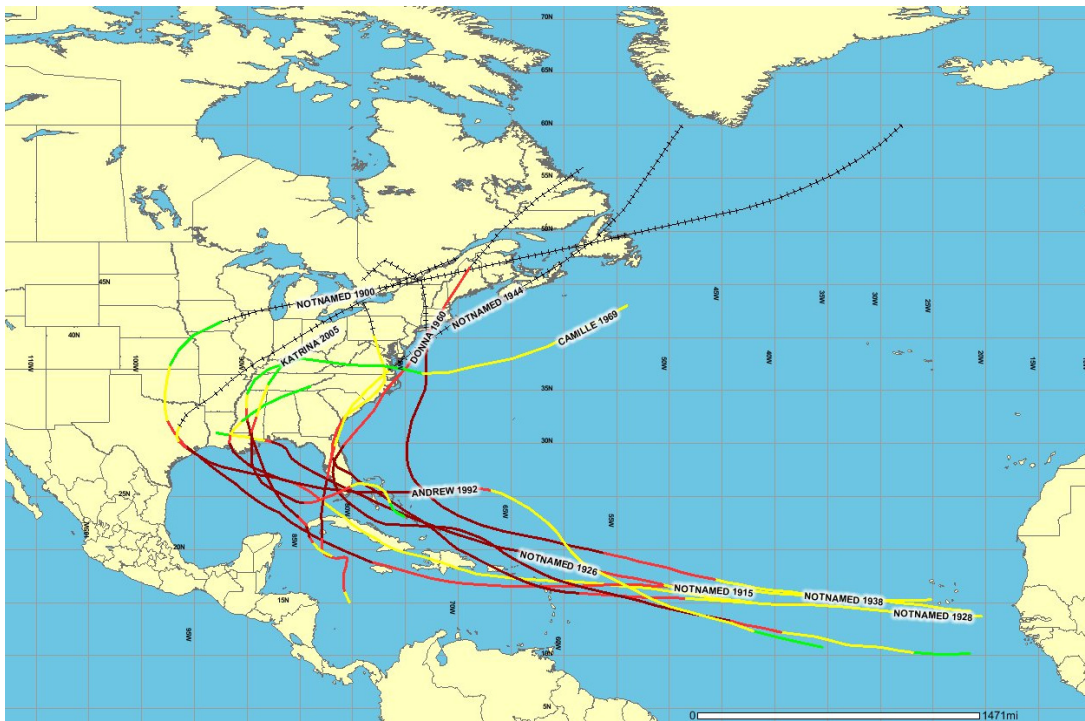


Diagram 2.4 Hurricane Activity in the United States
(Source: NOAA)

As with other natural disasters, the impact of a hurricane depends on the intensity of the storm. Historical NOAA statistics indicate that in the United States, the hardest-hitting hurricanes have struck along the Gulf Coast and the East Coast.

Top 10 Most Intense Hurricanes At Landfall In The United States			
Rank	Hurricane Name & Immediate Impact	Year	Category
1	Florida Keys	1935	5
2	Hurricane Camille Mississippi, Virginia	1969	5
3	Hurricane Katrina Louisiana, Mississippi	2005	3
4	Hurricane Andre Florida	1992	5
5	Texas (Indianola)	1886	4
6	Florida Keys	1919	4
7	Florida (Lake Okeechobee)	1928	4
8	Hurricane Donna Most of U.S. Eastern Seaboard	1960	4
9	Unnamed (New Orleans LA)	1915	4
10	Hurricane Carla Texas	1961	4

Table 2.2 Most Intense Hurricanes (at landfall) in the United States
(Source: NOAA)

Snow & Wildfires

When considering those factors that most likely present risk in Colorado, snowfall and its related effects are usually noted most commonly. Snowfall is typically associated with Colorado, and for good reason. However, actual snow accumulation is typically focused within the state's mountain regions located west of Denver. The city itself boasts a semi-arid climate, and its position at the foot of the Rocky Mountains means the climate is generally mild compared to the mountains and the plains to the east. In fact, NOAA places sunny days in Denver at slightly above 250 days of sunshine per year.

Consider the following Denver-area weather statistics from NOAA:

- Average temperature in Denver is 50.1 °F (10.1 °C)
- Average yearly precipitation is 15.81 inches (40.2 cm)
- Seasonal accumulation is 54.9 inches (156 cm)

In all of FORTRUST's years of operation, snow has not presented a risk to FORTRUST facilities.

Similar to snowfall, wildfires in Colorado have made national headlines, but have yet to produce any immediate impact to the city of Denver. Nationally, of the more than 60 significant wildfires listed by the National Interagency Fire Center, only three occurred in Colorado between 1804 and 2006, and these fires presented no risk whatsoever to the Denver area.

FEMA found the 2000 wildfire season to be one of the nation's worst since 1910. The agency reports that in 2000, nearly seven million acres burned across the United States, twice the national average. Although FEMA's data states that in 2000, wildfires burned throughout the United States, it also noted that some states were affected more than others. The chart below indicates which states FEMA reported as having had more than 200,000 acres burn.

States With Greater Than 200,000 Acres Burned		
State	Number of Fires	Acres Burned
Arkansas	351	751,233
California	7,283	235,248
Florida	6,572	200,980
Idaho	1,599	1,361,459
Montana	2,437	949,817
New Mexico	2,466	519,177
Nevada	1,078	635,715
Oregon	2,006	477,741
Utah	1,929	227,827
Washington	1,116	256,781
Wyoming	651	279,583

Table 2.3 FEMA Wildfire Statistics
(Source: FEMA)

Resource Availability

Other factors should be considered when performing site-selection activities. Not only should the presence of various geographical factors be considered, but also the availability of key resources such as power and network, to name just a couple.

Power

Power availability should be a major factor in any site-selection process. Recent headlines, if nothing else, point to the potentially disastrous effects of deficient power infrastructures.

When evaluating the power infrastructure in a given area, it's important to ascertain several key factors, including:

- **Access to more than one grid** – Is the provider in question connected to more than one feed from the energy company in question?
- **Power grid maturity** – Does the grid(s) in question also feed a large amount of residential developments, for example? Is there major construction occurring within the area served by that grid?
- **On-site power infrastructure** – Is the data center equipped to support major power requirements, and sustain itself should the main supply of power fail?

The FORTRUST power infrastructure is built with those considerations in mind. From the location of the FORTRUST facility (northwest Denver), to the mature commercial/industrial zone (feeds from two grids), to the on-site infrastructure at the FORTRUST facility, the availability, quantity and quality of power are shown to be of prime importance to FORTRUST.

While FORTRUST (as stated above) receives power via two different grids, FORTRUST has experienced excellent uptime in terms of incoming power from the provider. Following is a report summarizing FORTRUST's outage records since company inception.

Start Time	Duration	Device	Project	Order UID	Primary Cause	Secondary Cause
2/18/2006 8:55:00 AM	0h 31m	BKR_NORTH_NORT2323		OM81470	Intentional Relieve Overload	Repairs Not Needed
5/8/2005 10:34:00 AM	0h 58m	BKR_NORTH_NORT2323		OM18267	Crossarm Arm Broken	100% Restored Via Switching
4/28/2005 10:54:00 AM	0h 0m	BKR_NORTH_NORT2323		OM16978	Unknown Cause Under Invest	Repairs Not Needed
5/14/2004 7:15:16 AM	0h 42m	CB,..,2323,32152872160425	146942	146935	Failfac	Compfac2
11/2/2003 3:34:23 AM	3h 10m	CB,..,2323,32152872160425	128769	128754	Damfac	Compfac
3/14/2002 9:35:23 AM	0h 0m		118077	331966		
11/13/1999 9:32:46 AM	1h 55m		26640	38317	FAILFAC	

http://ccqr/Robo/BIN/Robo.dll?tpc=%2Frobo%2Fprojects%2Fccqr%2Fccqr%2Fccqr_home.htm%3FRINoLog28301%3DT&... 11/10/2006

Diagram 3.1 Power Outage Statistics, FORTRUST Denver facility

(Source: Excel Energy)

It's important to note that, between November 1999 and February 2006, FORTRUST has experienced just seven power interruptions in total. Further, it should be noted that due to the facility's robust back-up power system, **FORTRUST has never experienced power loss to a customer's hosted environment, or to any customer-supporting area of the facility.**

Network Neighbors: Major Carriers

As with power, network and carrier backbone availability should be considered a key resource for any data center.

And just as a site-selection matrix should take into account the quality and quantity of power available to a datacenter, so too should the availability and quality of network backbones also be taken into account. Key factors for consideration should include:

- **Fiber backbone routes and their proximity to the datacenter** – Are major carrier routes somewhat proximate to the datacenter?
- **Type of fiber in proximity** – For that fiber that is proximate to the data center, is it a major fiber route, or a smaller spur off the main backbone? How much fiber is already in place, and how much of it is 'lit', or ready for service? How much of it is 'dark'?
- **Carrier presence** – While the presence of a fiber backbone is important, it's also important to understand the presence of the carrier/ telecommunications provider in the area, from a business and support perspective. A carrier may have fiber in the area, but if they have little or no presence themselves, or rely on third parties for maintenance, service to the data center may suffer accordingly.
- **Carrier type** – Simply having a carrier's backbone nearby doesn't necessarily indicate that the carrier themselves are a Tier 1 provider. This is of particular interest when internet access to/from the data center is being supplied via those carriers. In any event, it's usually important to understand the internet carriers currently providing service into the data center, and whether or not they are also the telecommunications/fiber provider(s). It's not enough that one or more carriers are present in a data center – at least one of the carriers (optimally, more than one) should be a Tier 1 provider, meaning that they peer directly with other major backbones at private and public peering exchanges. Only a relatively small number of carriers can claim this level of efficiency, and all smaller carriers must purchase access from the major carriers, which often introduces some level of latency.

In terms of the criteria defined above, FORTRUST's Denver location provides access to multiple major communications networks and backbones. Because of Denver's unique presence between the western and eastern halves of the United States, and its size relative to any other metropolitan center in the region, virtually all major carriers in the US maintain significant presences in Denver, both from the perspective of fiber/backbone build-out, and business/support presence. Denver maintains major presences from virtually every major telecommunications provider in the country, and the city hosts the headquarters of several world-class network operators such as Qwest Communications and Level3 Communications. Other carriers with a major presence in Denver include AT&T, Time Warner, and XO Communications.

Summary

FORTRUST believes that, when viewed as a whole, the geographical advantages discussed throughout this paper present businesses in need of data center services with a sound choice. The company's founders and engineers designed the Denver data center with consideration for the area's challenges and advantages in mind. The result is a trustworthy and reliable option for those seeking a flawless data center experience.

Thanks for taking the time to read this paper, and we look forward to working with you and your team. Of course, if you have any questions about this paper or any other aspect of doing business with FORTRUST, please don't hesitate to contact your FORTRUST representative, and we'll be happy to continue the discussion with you at your earliest convenience.