Earth Factor Risk Model (EFRM)

Overview for NTSB

Nov-2024

ATMOS energy

Earth Factor Risk Model (EFRM)

Overview

Atmos developed a model that accounts for and quantifies static risks for potential differential ground movement that could affect the integrity of below ground assets – the Earth Factor Risk Model (EFRM)

- Divides Atmos' operating territory into individual, discrete grids.
- Associates local operating environment data on geology, expansive soils, soil hydrology, etc.
- Calculates a numerical EFRM value with consideration of operating environment data.
- Resulting grid-level EFRM value represents the relative potential for differential movement of each grid.

Application in Risk Models

The numerical value of an EFRM grid is applied in the DRAM risk calculations for assets in the grid.

- EFRM grids are overlaid with assets subject to risk analysis.
- Assets' threat-level values are influenced according to the associated EFRM values.*
- Higher relative EFRM values realize higher relative threat level values, and vice-versa

Benefit

Asset threat level values generated by the DRAM risk model include the EFRM risk factor model values. In this way, the EFRM influences the DRAM risk score values based on local geological and geophysical factors as they relate to the potential for asset damage or failure.

**Reference "Earth Activity Data" in JXN-NTSB-002365 (Risk Factor List for Mains and Services)*

EFRM Factors

Surficial Geology

Represents the number of unique geological formations within a grid cell. Different formations behave and swell differently in various environmental conditions, creating an increased susceptibility to differential movement. Factor value scale of 1-2.

Expansive Soils

Represents the compressive or expansive behavior of soil in response to moisture content. Expressed via the “plasticity index”, which is the difference between the liquid and plastic limits of the soil. A higher plasticity index represents an increased susceptibility to differential movement. Factor value scale of 1-6.

Soil Hydrology

Represents the potential for moisture to infiltrate or run off different hydrological soil groups with consideration of their characteristics. Soil groups with the largest amount of clay represent an increased susceptibility to differential movement. Factor value scale of 1-7.

Topography

Represents the average slope of the ground within a grid cell, expressed as a percentage. Higher percent slopes are generally less stable than flat topography and represent an increased susceptibility to differential movement. Factor value scale of 1-5.

Climatic Rating

Represents the stability of the moisture content in an expansive soil. A higher climatic rating means it’s more likely that climate will influence the shrink-swell of the soil and represents an increased susceptibility to differential movement. Factor value scale of 1-5.

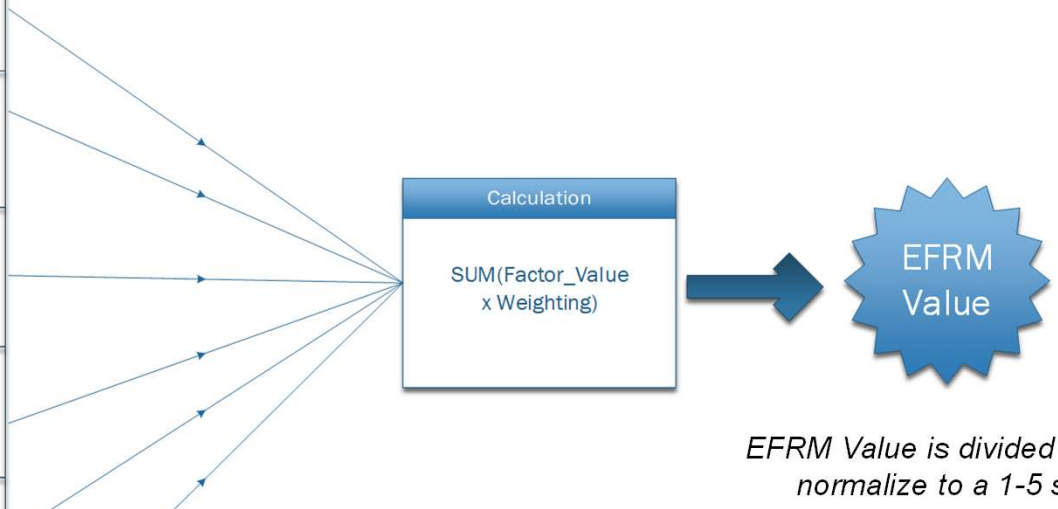
Seismic Activity

Represents the seismic activity (peak ground acceleration) and the presence and disposition of faults (active vs. inactive). A higher peak ground acceleration and the presence of an active fault represents an increased susceptibility to differential movement. Factor value scale of 1-7.

EFRM Structure

	Earth Factor	Data Sources	Weighting
1	Surficial Geology	USGS National Geologic Map Database	4
2	Expansive Soils	NRCS Soil Survey	6
3	Soil Hydrology	NRCS Soil Survey	2
4	Topography	USGS National Elevation Data	4
5	Climatic Rating	Climatic Ratings for the Continental United States	3
6	Seismic Activity	USGS Seismic Map	1

Earth Factor Risk Model



EFRM Value is divided by 20 to normalize to a 1-5 scale