JP Giroud legacy Site, Supplement to the Educator Section

Giroud, J.P., 2000, "Lessons Learned from Failures and Successes Associated with Geosynthetics", EuroGeo 2, the 2nd Eur. Conf. on Geosynthetics, Bologna, Italy, October 2000, Vol. 1, pp. 77-118. [link]

NOTE: To understand something three-dimensional, we try different (two-dimensional) cross-sections. To extract lessons from something complex, in this paper Giroud employs four different perspectives, summarized herein as Tables 1-4, including a detailed typology of modes of failure (Table 1).

Table 1. Perspective No 1: **Classification of modes of failure in five major categories and further breakdown in subcategories** (pp. 80-101, PART I of paper, Sections 2 to 6).

LEAKAGE	**CLOGGING**[1]	**INSTABILITY**	**DEFORMATION**	**DEGRADATION**[2]
Geomembrane (GM) defects (p. 80)	Clogging of filter by migrating particles (p. 85)	Interface failure (p. 89)	Differential settlements (p. 93)	Failure due to geosynthetic degradation • Fire (p. 99) • Heat (p. 100) • Ultraviolet radiation (p. 100) • Radioactivity (p. 100) • Chemicals (p. 100) • Cracking (p. 100) • Delamination and blistering (p. 101)
GM rupture due to stress concentration (p. 81)	Clogging of filter due to lack of intimate contact between filter and soil (p. 86)	Internal failure (p. 91)	Lack of support (p. 94)	
Subsidence of supporting soil causing GM rupture and leakage (p. 81)	Biological clogging (p. 87)	Surficial failure (p. 91)	Wrinkles (p. 94)	
Lack of contact between the liner and the supporting soil causing GM rupture and leakage (p. 83)	Clogging of drain by migrating particles (p. 87)	Excessive water supply (p. 91)	Uplift (p. 95)	
Preferential path (p. 84)	Clogging of drain due to lack of filter continuity (p. 87)	Water drawdown (p. 93)	Damage to geosynthetic by static forces (p. 96)	
	Intrusion of geotextile into geonet (p. 88)	Erosion (p. 93)	Damage to geosynthetics or structures incorporating geosynthetics by dynamic forces (p. 97)	
	Drainage system with insufficient flow capacity (p. 88)		Unacceptable deformation of pavements and road structures (p. 97)	
			Deformation needed to perform the function (p. 98)	
			Displacement compatibility (p. 98)	

Notes: [1] Clogging = Malfunctioning of filters and drains, [2] Degradation = Physico-chemical modes of failure

Table 2. Perspective No 2: **Modes of failure differentiated as modes common to soils and structures incorporating geosynthetics and modes specific to geosynthetics** (pp. 101-104, PART II of paper, Section 7).

GENERAL FAILURE MODE CLASS	**Specific Failure Mode Class**
FAILURE MODES COMMON TO SOILS AND STRUCTURES INCORPORATING GEOSYNTHETICS	Soil erosion and particle migration (p. 101)
	Instability of slopes and masses (p. 101)
	Deformation of soil (p. 102)
	Inadequate water control (p. 102)
	Preferential (flow) path (p. 102)
	Effect of temperature on soil and asphalt (p. 102)
GEOSYNTHETIC-SPECIFIC FAILURE MODES	Failure modes associated with the two-dimensional nature of geosynthetics (p. 103) e.g. loss of continuity, uplift, out-of-plane stresses, thermal expansion-contraction
	Failure modes due to geosynthetic degradation (p. 104) e.g. see last column of Table 1
	Failure modes due to interaction between geosynthetics and adjacent materials (p. 104)

Table 3. Perspective No 3: **Situations leading to failures, mostly concerning attitudes** (excessive expectations, including disbelief in potential failure) **and misconceptions** (pp. 104-107, PART II of paper, Section 8).

Situations leading to failures (*section titles focus on correcting attitudes leading to failures*)
The use of geosynthetic does not replace an adequate design (p. 105)
Design steps that are usual in geotechnical engineering should not be omitted (p. 105)
Useless geosynthetics may have a detrimental impact on the structure (p. 105)
Useful geosynthetics may have a detrimental impact on the structure (p. 106)
Geosynthetic redundancy may have a detrimental impact on the structure (p. 106)
Not all geosynthetics are equal (p. 106)
Disbelief in potential failure (p. 107)

Table 4. Perspective No 4: **Learning from failures → summary of high-level lessons** (pp. 107-114, PART II of paper, Section 9).

Areas where we learn from failures
Impact of design on failures associated with geosynthetics (p. 108)
High-level learning lessons from failures associated with geosynthetics (p. 109)
Summary of lessons learned regarding construction (p. 111)
Summary of lessons learned regarding failures (prediction, prevention, actions if failure occurs) (p. 113)

NOTE Titles of Section 9 were edited slightly to make clearer section contents.