Annex 5

A5-1 Experimental subsoil classification of the building sites

A5-2 Specification of the damaging mainshock level

A5-3 Documentation of damage cases

Table A5-1.1	Experimental subsoil classification of selected building sites

Investigated region/site Cumaná city, Venezuela

General description of the study region

The investigated region is situated in Northeastern Venezuela close to the Gulf of Cariaco, part of the Caribbean Sea. The small town Cariaco and the capital of the State of Sucre Cumaná were the most affected towns during the Cariaco earthquake on July 9, 1997.
The M_w 6.9 earthquake is supposed to be originated from the east-west trending El Pilar Fault; the epicenter was located north-east of the town Cariaco (R_e = 13 km). Although the epicentral distance of Cumaná City was about 80 km, severe earthquake damage could be observed here.

Geological situation

The major geological units of the study region can be described as: metamorphic rocks *(Mm)* of the Araya-Paria peninsula to the north and mainly Cretaceous sedimentary rocks of the Interior Range *(Cl)* to the south, both roughly separated by the El Pilar fault. The basement geology of Cumaná consists of Neogene rocks *(Ts)*, also exposed on the western edge of Araya peninsula and north-west of Cariaco. Both, Cumaná and Cariaco are situated on local basin structures consisting of Quaternary sediments.
Cumaná City: The city is located on a thick sequence of Holocene alluvial/delta plain deposits of the Manzanares River (BELTRÁN & RODRIGUEZ, 1995). Due to the presence of former meanders of the Manzanares River and lagoons along the seashore, large areas of Cumaná are characterized by poorly consolidated sediment layers. Thus leads to induced effects as liquefaction or lateral spread phenomena and contributes to the susceptibility of Cumaná to earthquake damage.
Cariaco City: Maximum total thickness of sediments is estimated to exceed 90 m. The uppermost layers consist of fine sands interbedded with clay, underneath are coarse grained sands with gravels overlying the weathered top of Cretaceous limestones (or relicts of Tertiary sediments; GONZÁLEZ *et al.*, 2002). The sediments of Cariaco are controlled by the El Pilar fault system. The basin is characterized by heterogeneous stratified sediments from the sedimentary range to the south and the metamorphic units to the north. Within the southern part of Cariaco, the Cariaco River *(Rio Cariaco)* left several abandoned meanders tending to liquefaction phenomena.

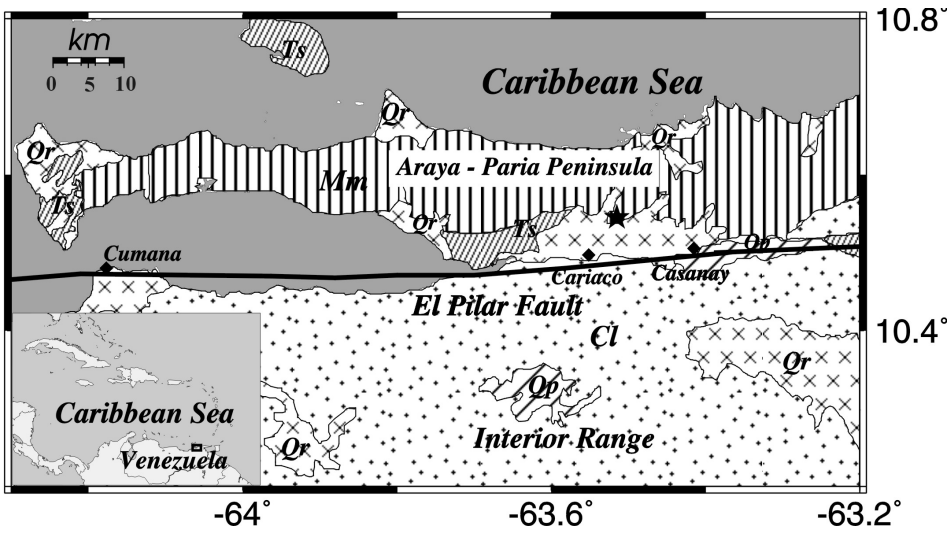
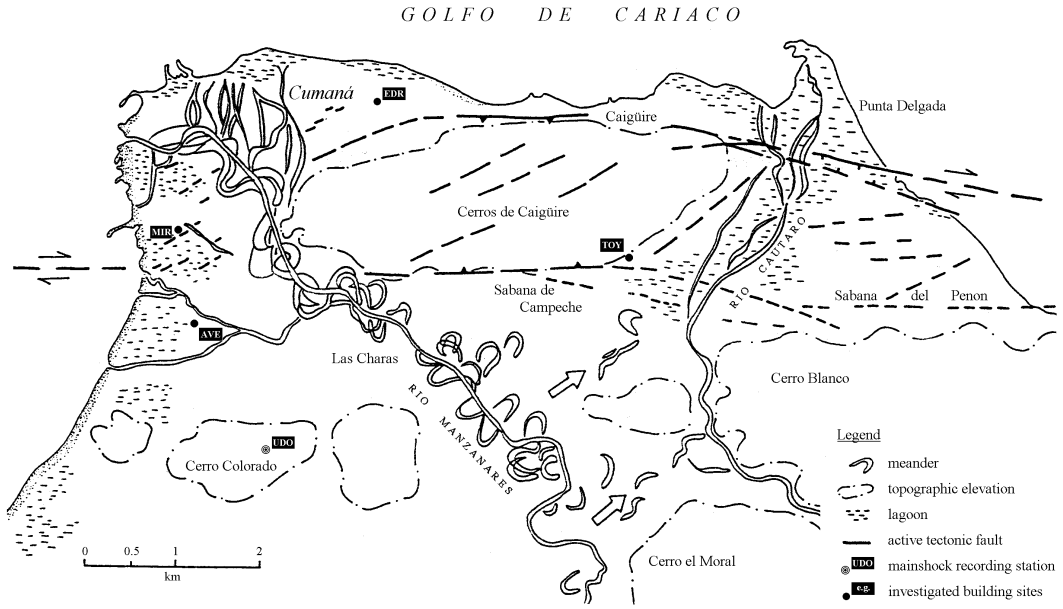


Table A5-1.1 (cont.)	Experimental subsoil classification of selected building sites

Investigated region/site Cumaná city, Venezuela

Map with geomorphologic information and investigated sites



Topography map of Cumaná with surface geology and investigated sites

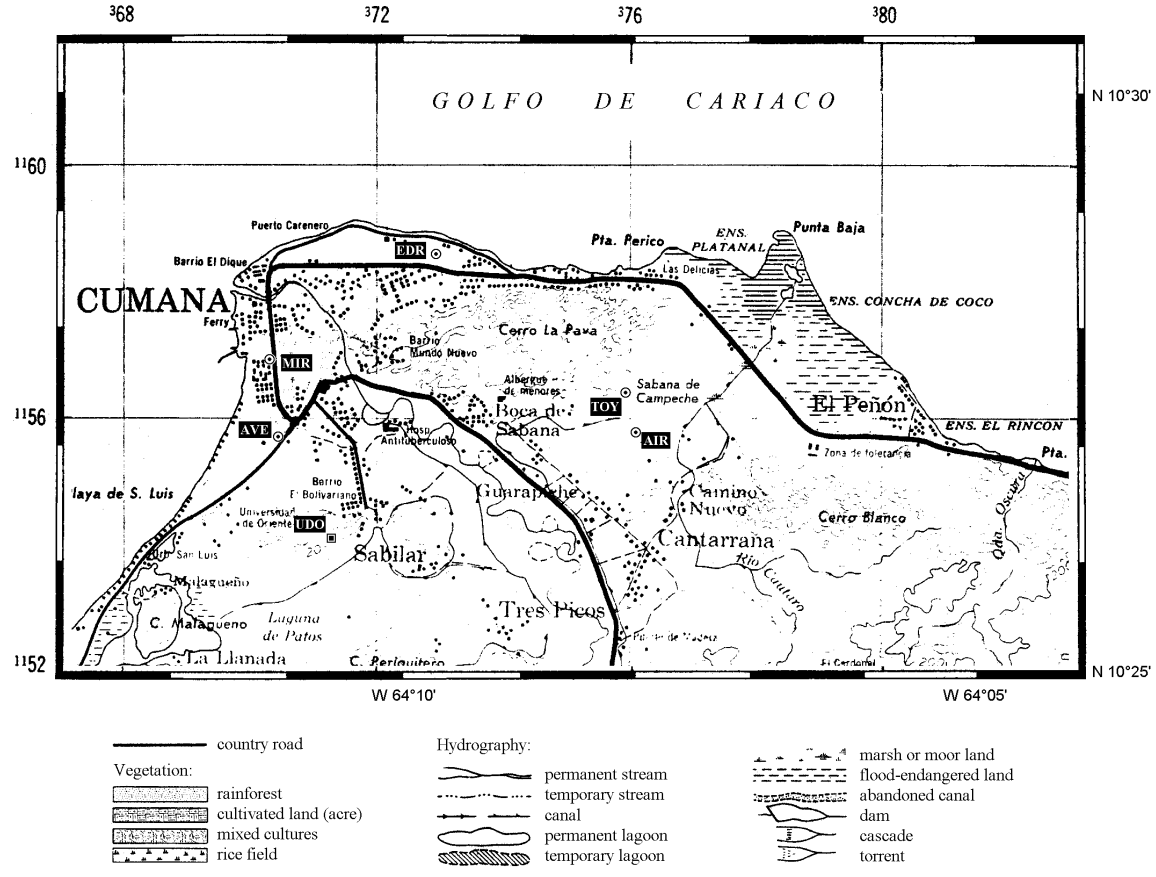


Table A5-1.1 (cont.)	Experimental subsoil classification of selected building sites

Investigated region/site Cumaná city, Venezuela

UDO

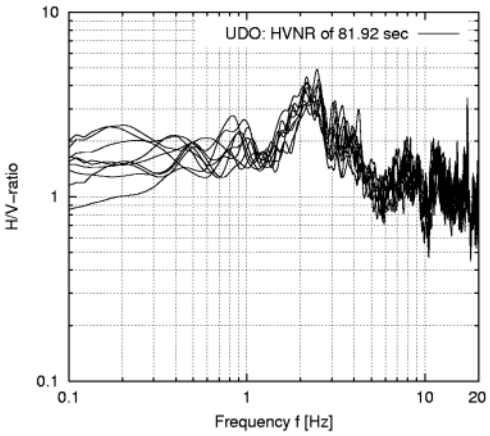
Site information

- the only (digital) recording station of the mainshock
- top of a gentle hill in southwestern Cumaná
- Pleistocene cobble alluvial sediments
- topographic feature (gentle hill)
- no structural damages in the surroundings reported

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	stiff	available subsoil information
MESSIAS (LANG *et al.*, 2003a)	B2	shape of *HVNR*

Spectral H/V-ratios on microtremors (HVNR)



AVE

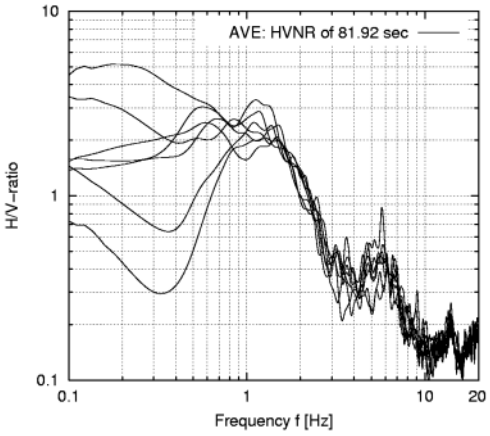
Site information

- located close to the western seashore (~ 700 m) on the rim of a former lagoon
- Holocene sediments with moderate to high susceptibility to liquefaction
- heavy structural damages to high-rise buildings in the surroundings

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	(very) soft	available subsoil information
MESSIAS (LANG *et al.*, 2003a)	B3	shape of *HVNR*

Spectral H/V-ratios on microtremors (HVNR)



MIR

Site information

- located close to the western seashore (~ 500 m) within a former lagoon
- Holocene sediments
- heavy structural damages in the surroundings reported

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	(very) soft	available subsoil information
MESSIAS (LANG *et al.*, 2003a)	B3	shape of *HVNR*

Spectral H/V-ratios on microtremors (HVNR)

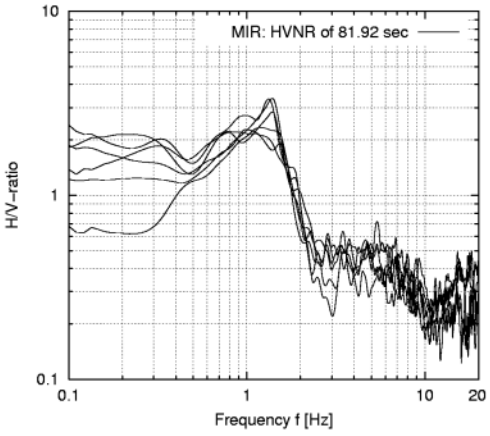


Table A5-1.1 (cont.)	Experimental subsoil classification of selected building sites

Investigated region/site Cumaná city, Venezuela

EDR

Site information

- located close to the northern seashore on the ridge of a former lagoon
- possibly Holocene sediments
- minor structural damages in the surroundings

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	soft	results of *HVNR*
MESSIAS (LANG *et al.*, 2003a)	B3	acc. to ABEKI *et al.* (1998)

Spectral H/V-ratios on microtremors (HVNR)

no data available

TOY

Site information

- located east of Cumaná on the southern base of *Cerros de Caigüire*
- Pleistocene sediments overlain by a Holocene alluvial plain (pers. comm. TOYOTA VENEZUELA)
- heavy structural damages only to the Toyota building, no other damages in the surroundings reported

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	stiff (soft)	available subsoil information
MESSIAS (LANG *et al.*, 2003a)	C2	shape of *HVNR*

Spectral H/V-ratios on microtremors (HVNR)

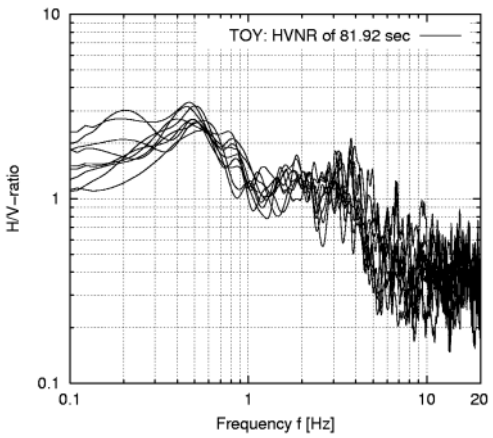
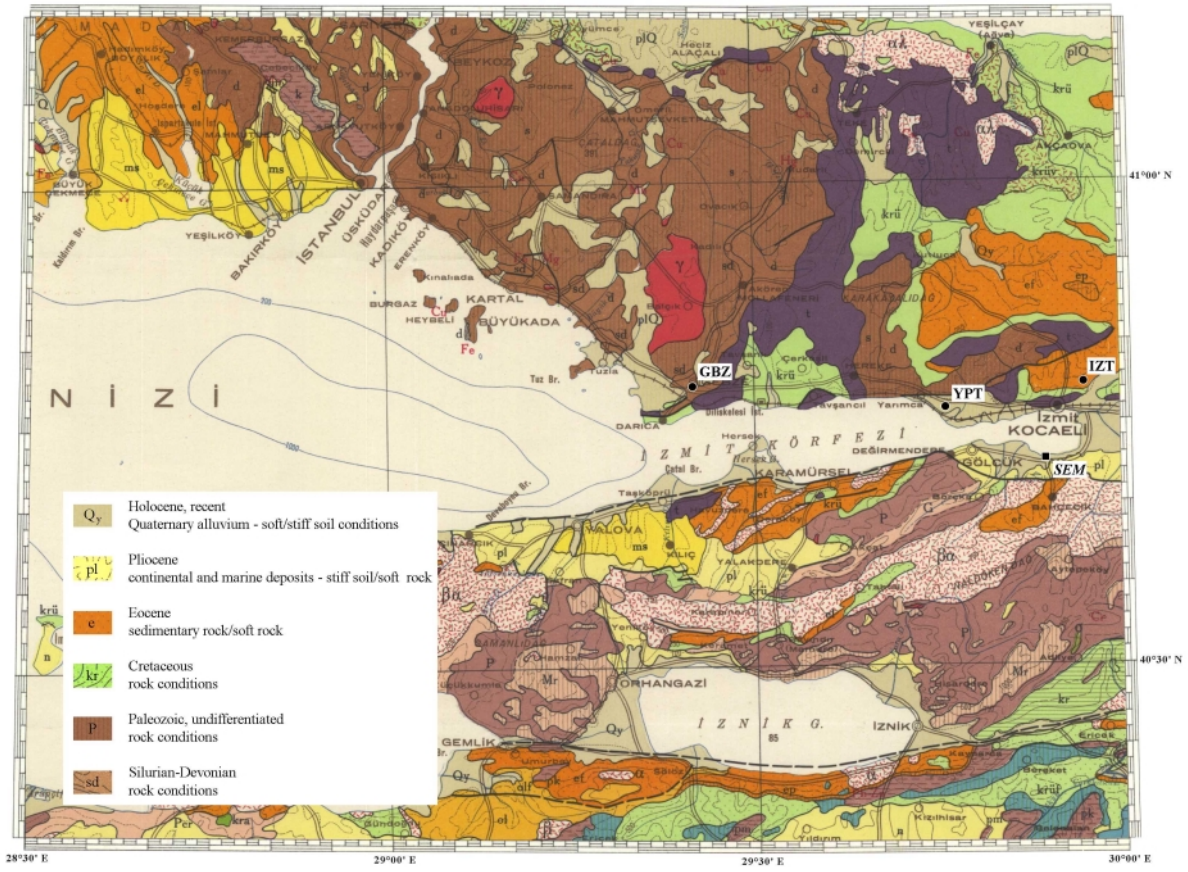


Table A5-1.2 (cont.)	Experimental subsoil classification of selected building sites

Investigated region/site Northanatolian provinces, Türkiye

Geological map of the provinces with surface geology and investigated sites (MTA, 2002)



SEM

Site information

- located south of *İzmit Bay*, in a distance of approximately 200 m
- soft surface geology (Holocene sediments), with moderate total thickness of overlying stratum
- devastating structural damage in the surroundings reported

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	(very) soft	available subsoil information
MESSIAS (LANG *et al.*, 2003a)	B3	shape of *HVNR*

Spectral H/V-ratios on microtremors (HVNR)

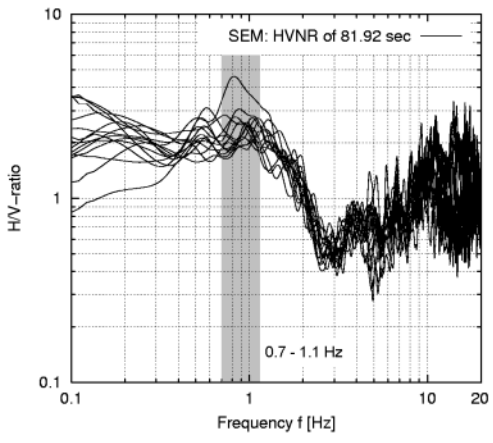
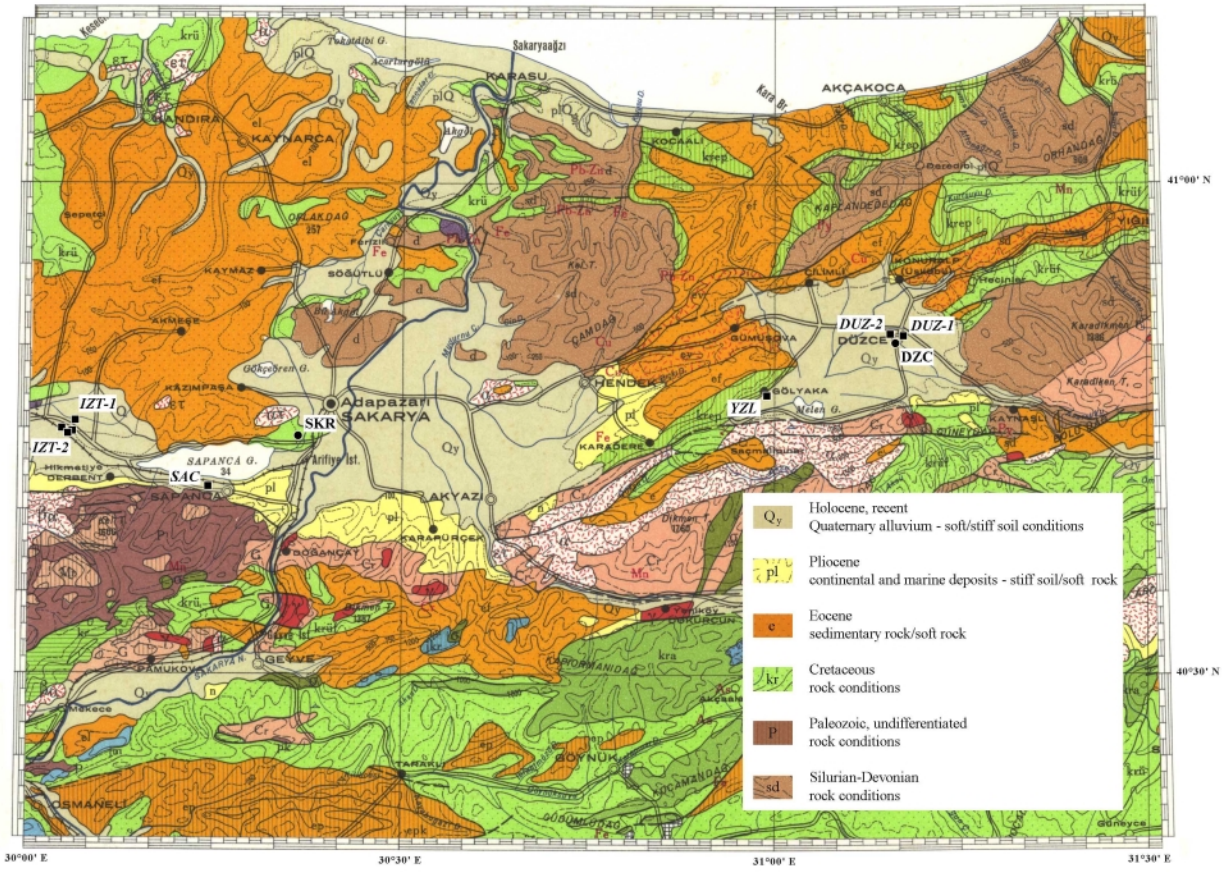


Table A5-1.2 (cont.)	Experimental subsoil classification of selected building sites

Investigated region/site	Northanatolian provinces, Türkiye

Geological map of the provinces with surface geology and investigated sites (MTA, 2002)



IZT-1

Site information

- located within a sedimentary basin, which is characterized by small topographic inclinations
- Holocene sediments of high thickness (~ 200 m)
- heavy structural damage in the surroundings reported

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	soft	available subsoil information
MESSIAS (LANG *et al.*, 2003a)	C3	shape of *HVNR*

Spectral H/V-ratios on microtremors (HVNR)

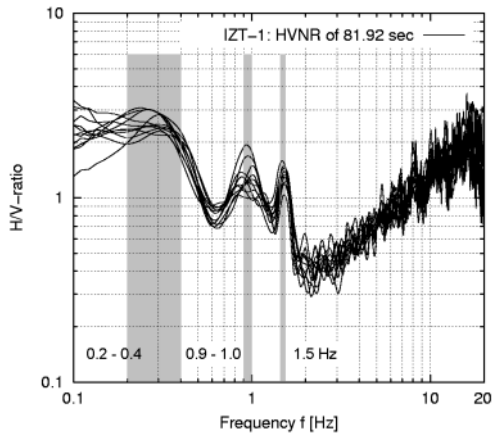


Table A5-1.2 (cont.)	Experimental subsoil classification of selected building sites

Investigated region/site Northanatolian provinces, Türkiye

IZT-2

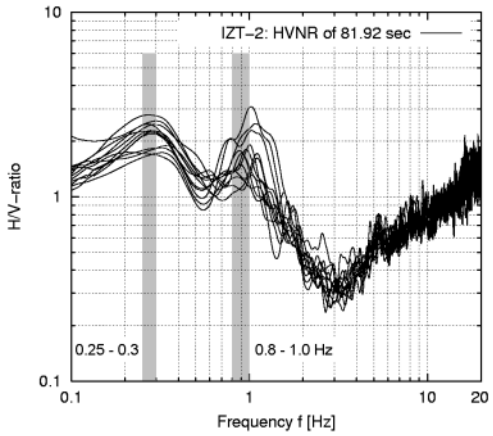
Site information

- located within a sedimentary basin, which is characterized by small topographic inclinations
- Holocene sediments of high thickness (~ 200 m)
- heavy structural damage in the surroundings reported

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	soft	available subsoil information
MESSIAS (LANG *et al.*, 2003a)	C3	shape of *HVNR*

Spectral H/V-ratios on microtremors (HVNR)



SAC

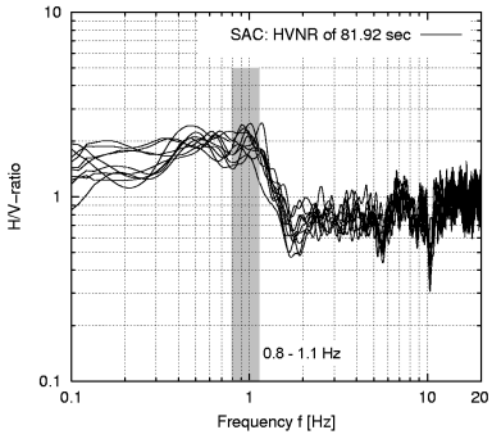
Site information

- located at the southern edge of the city Sapanca
- small elevated topography
- geological conditions are characterized by Holocene sediments adjoining Pleistocene sediments in the east and Paleozoic rocks in the south
- moderate structural damage to high-rise buildings in the surroundings

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	stiff (soft)	in-situ observation
MESSIAS (LANG *et al.*, 2003a)	B2	shape of *HVNR*

Spectral H/V-ratios on microtremors (HVNR)



YZL

Site information

- located at the margin of a basin, filled with quaternary alluvium (and basal layer of Pleistocene-age lake deposits), uppermost sediments consist of Holocene alluvium, sediment thickness up to 50 m
- heavy structural damage in the surroundings reported

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	(very) soft	available subsoil information
MESSIAS (LANG *et al.*, 2003a)	B3	shape of *HVNR*

Spectral H/V-ratios on microtremors (HVNR)

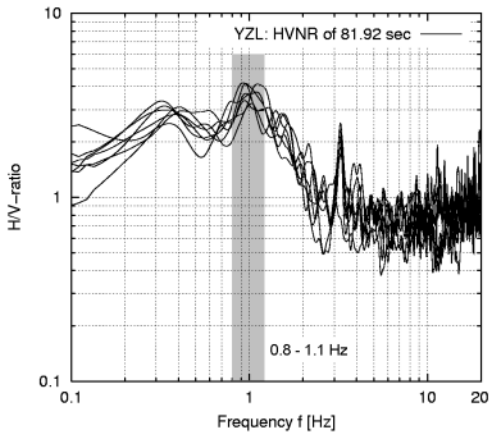


Table A5-1.2 (cont.)	Experimental subsoil classification of selected building sites

Investigated region/site Northanatolian provinces, Türkiye

DUZ-1

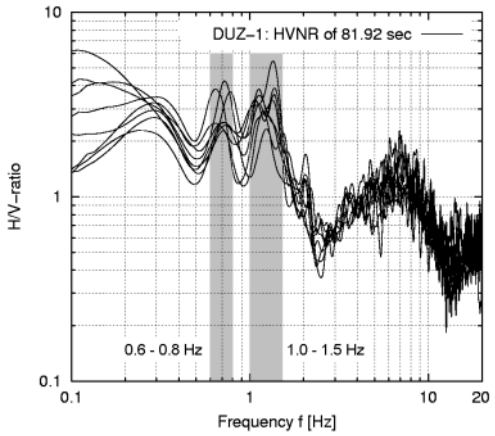
Site information

- located in the center of a basin filled with Quaternary alluvium (and basal layer of Pleistocene-age lake deposits), uppermost sediments consist of Holocene alluvium, sediment thickness 10 to 100 m
- light to moderate structural damage in the close surroundings reported (northern part of Düzce city)

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	soft	available site information
ɴESSIAS (LANG *et al.*, 2003a)	B3	shape of *HVNR*

Spectral H/V-ratios on microtremors (HVNR)



DUZ-2

DZC

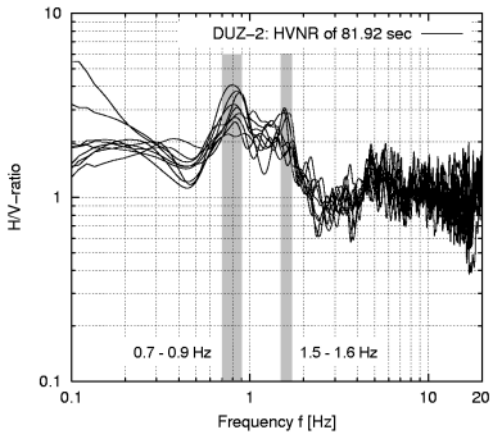
Site information

- equal to the mainshock recording station Düzce Meteorology Station (DZC) run by AFET
- located in the center of a basin filled with Quaternary alluvium (and basal layer of Pleistocene-age lake deposits), uppermost sediments consist of Holocene alluvium, sediment thickness 10 to 100 m
- rock found at depth of 128 m (KUDO *et al.*, 2002)
- occurrence of liquefaction in the surroundings
- heavy structural damage to high-rise buildings in the surroundings (south-western part of Düzce city)

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	(very) soft	available site information
ɴESSIAS (LANG *et al.*, 2003a)	B3 (C3)	shape of *HVNR*

Spectral H/V-ratios on microtremors (HVNR)



GBZ

Site information

- mainshock recording station run by AFET
- local topography has rolling hills, undisturbed soil was reported to be 3-4 m thick over bedrock, rocky soil near the station, float collected from soil is reddish sandstone
- no damage in the vicinity are reported

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	rock (stiff soil)	available site information
ɴESSIAS (LANG *et al.*, 2003a)	A1	shape of *HVNR*

Spectral H/V-ratios on microtremors (HVNR)

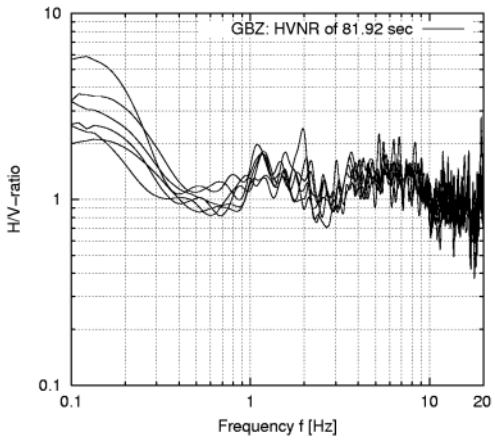


Table A5-1.2 (cont.) Experimental subsoil classification of selected building sites

Investigated region/site Northanatolian provinces, Türkiye

YPT

Site information

- mainshock recording station run by KOERI
- located on flat topography within a river delta dominated by sediment accumulation, fine-grained clays and silts at the surface with v_s = 340 m/sec
- deepest layer observed (with v_s = 950 m/sec) is estimated at a depth of ~ 500 m (KUDO *et al.*, 2002)
- v_s = 700/750 m/sec at depth of 226 m (RATHJE *et al.*, 2003)

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	soft soil	available subsoil information
mESSIAS (LANG *et al.*, 2003a)	C3 (H > 250m)	available *S*-wave velocity profiles

Spectral H/V-ratios on microtremors (HVNR)

no data available

IZT

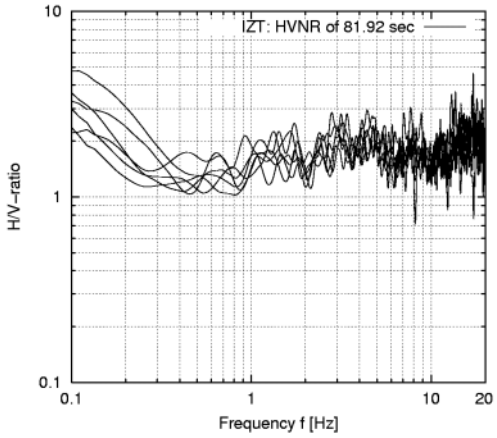
Site information

- mainshock recording station run by AFET
- located on a steep hillside, geological process would be erosion and soil formation of underlying bedrock (maybe sandstone/limestone mix)
- v_s = 1500 m/s at depth of 10 m (RATHJE *et al.*, 2003)
- record is esteemed as not being representative due to the hillside location

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	rock	available subsoil information
mESSIAS (LANG *et al.*, 2003a)	A1	shape of *HVNR*

Spectral H/V-ratios on microtremors (HVNR)



SKR

Site information

- mainshock recording station run by AFET
- gentle hillside with moderate slope, steeper hills to the north and west, exposed bedrock is limestone
- v_s = 800 m/s at depth of 5-15 m (RATHJE *et al.*, 2003)
- no damage in the vicinity are reported

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	rock	available subsoil information
mESSIAS (LANG *et al.*, 2003a)	A2	shape of *HVNR*

Spectral H/V-ratios on microtremors (HVNR)

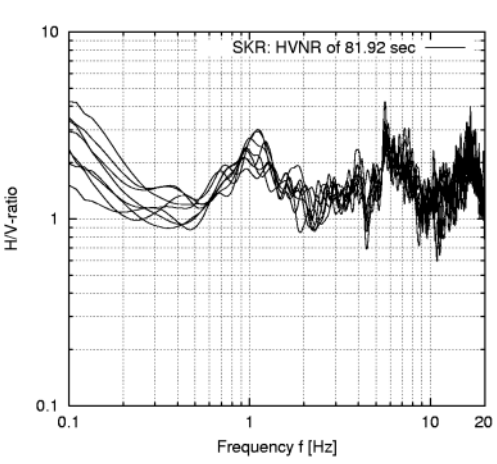
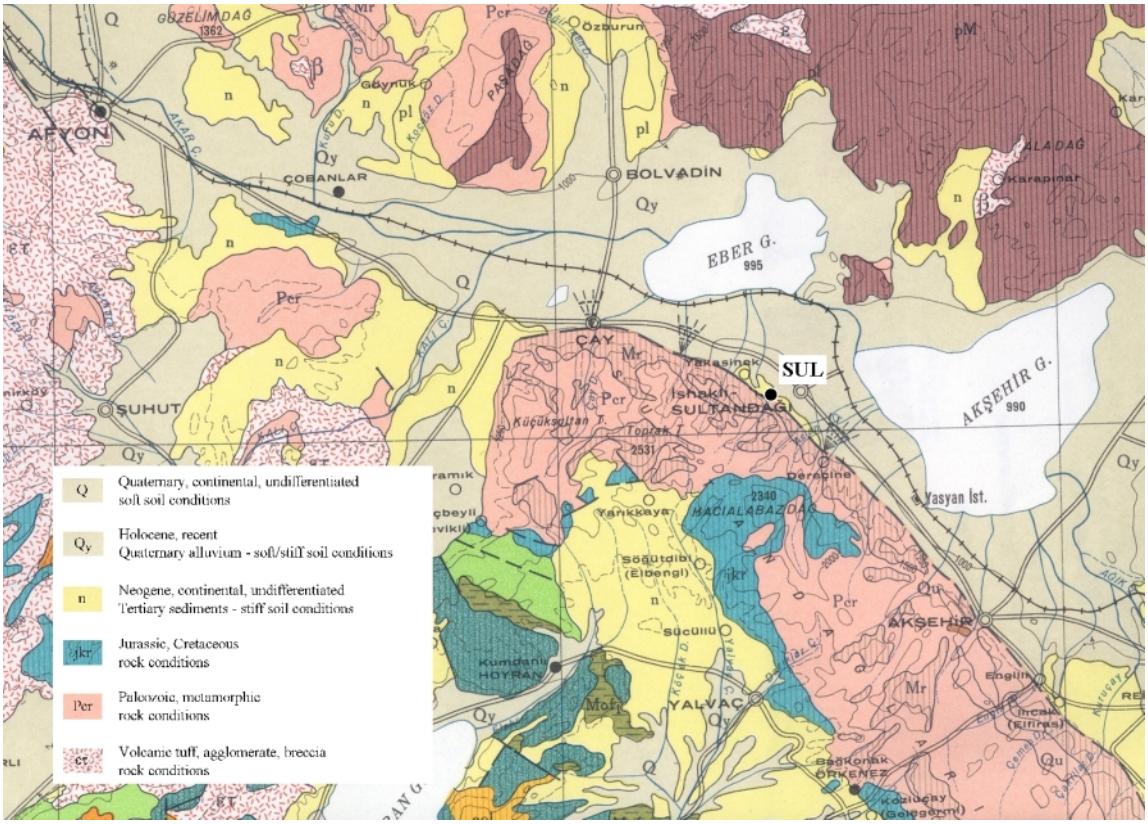


Table A5-1.3	Experimental subsoil classification of selected building sites

Investigated region/site	Sultandağı (Afyon), Türkiye

Geological map of the province with surface geology and the investigated site (MTA, 2002)



SUL	*Site information*	*Spectral H/V-ratios on microtremors (HVNR)*

- located within the transition zone between the sedimentary plain and the southwestern mountains, moderate inclined topography
- local geology seems to be characterized by stiff sediments with small layer thicknesses
- heavy structural damage in the surroundings reported

Subsoil classification

according to	*site class*	*on the basis of*
AMBRASEYS *et al.* (1996)	stiff	in-situ observation of the site
MESSIAS (LANG *et al.*, 2003a)	A2-B2	shape of *HVNR*

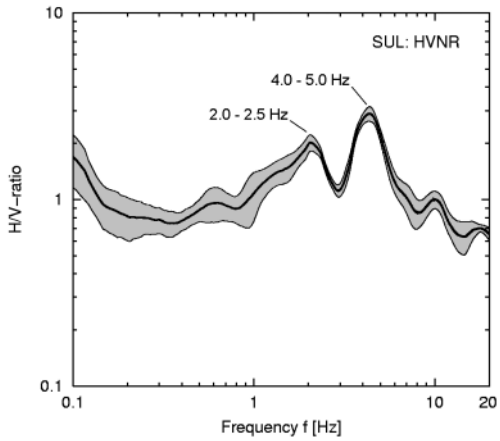
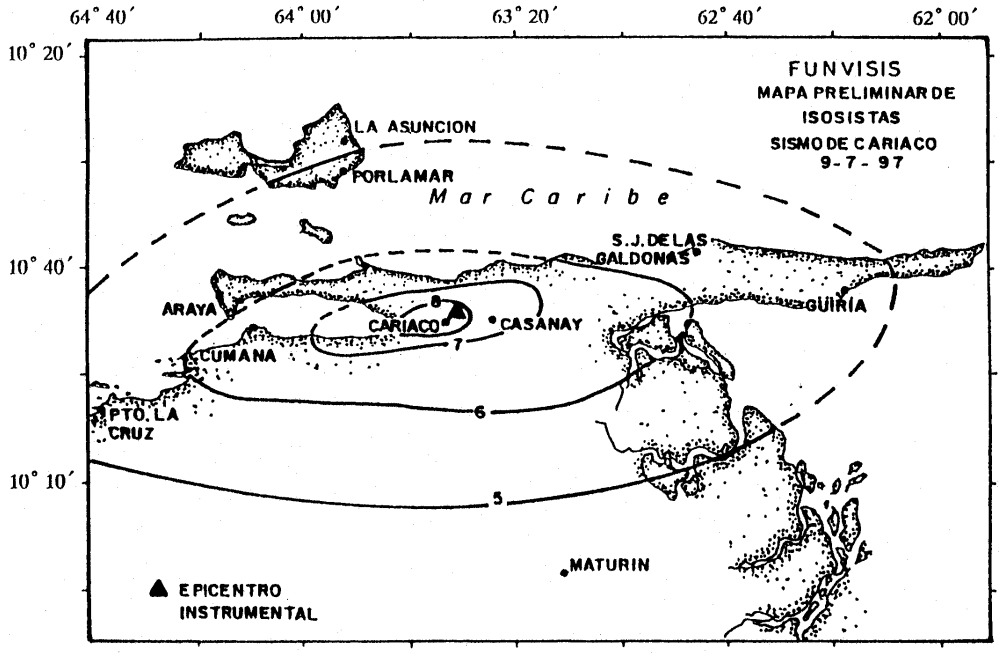


Table A5-2.1	Intensity map of the 1997 Cariaco, Venezuela, earthquake

Preliminary map of shaking intensities I_{MMI} (according to FUNVISIS Caracas, 1997)



Intensity (I_{EMS}) *map of the city Cumaná based on observed shaking effects* (SCHWARZ *et al.*, 2000)

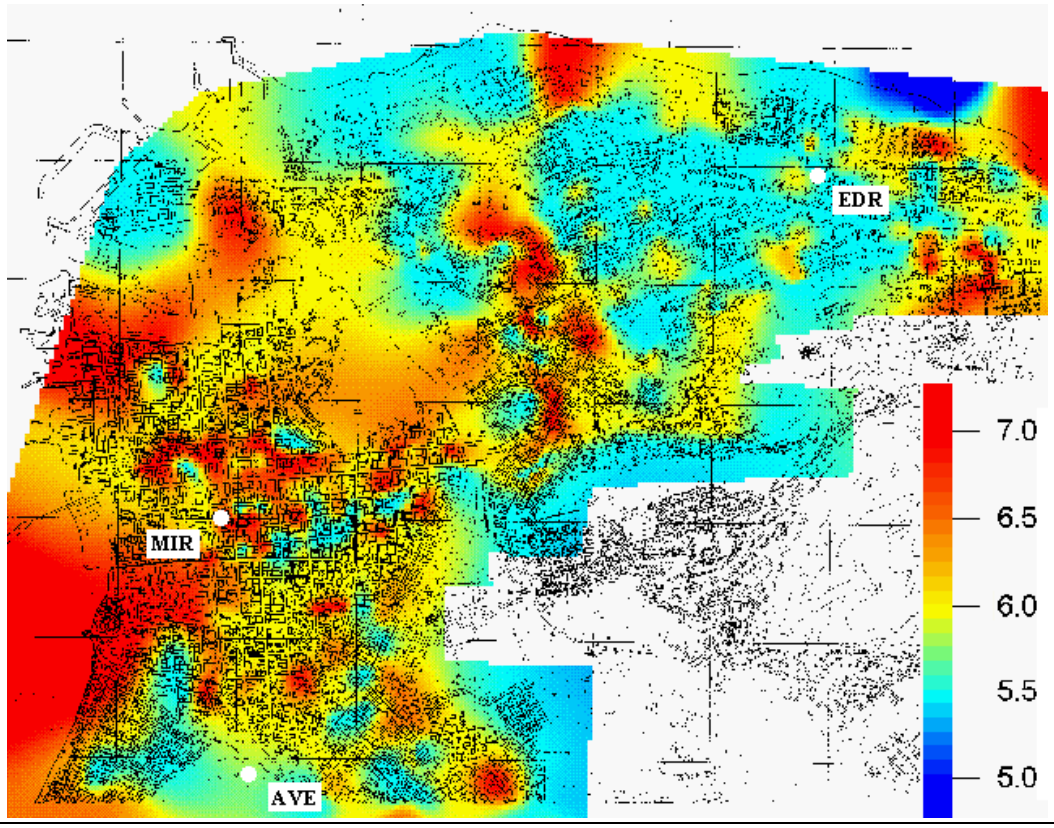
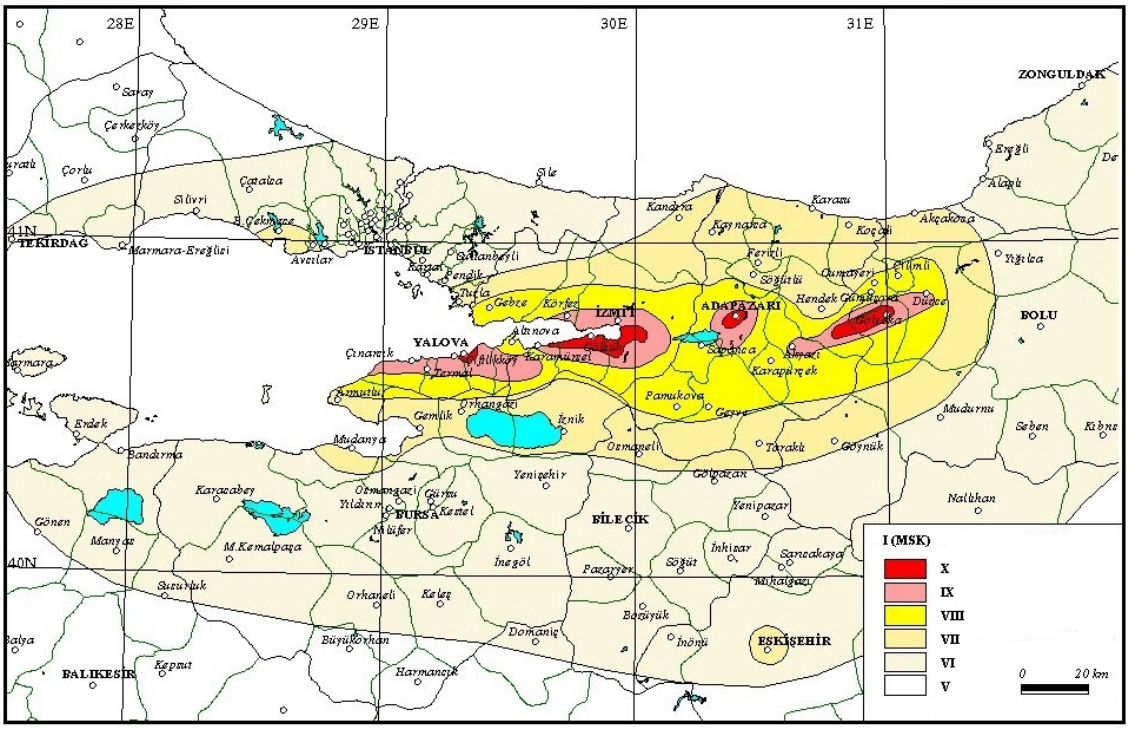


Table A5-2.2	Intensity maps of the 1999 İzmit, Türkiye, earthquake

Estimated shaking intensities I_{MSK} (ÖZMEN, 2000)



Estimated shaking intensities I_{MMI} (in YOUD (eds.) *et al.*, 2000)

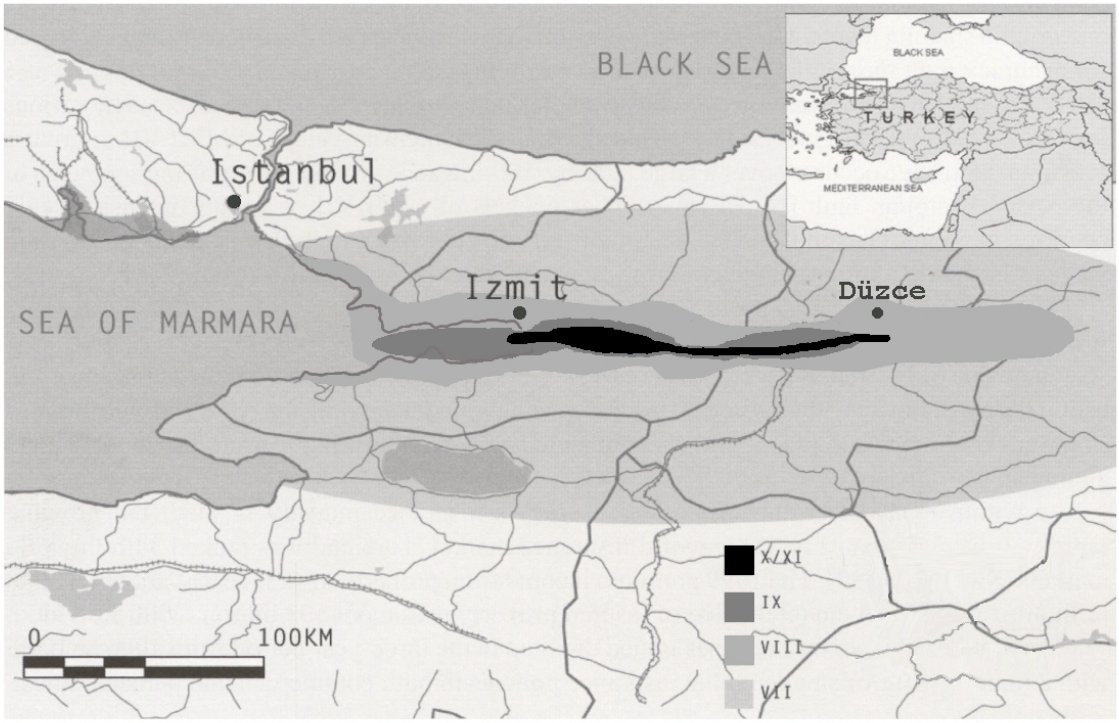


Table A5-2.2 (cont.)	Intensity maps of the 1999 İzmit, Türkiye, earthquake

Estimated shaking intensities I_{EMS} (RASCHKE, 2001)

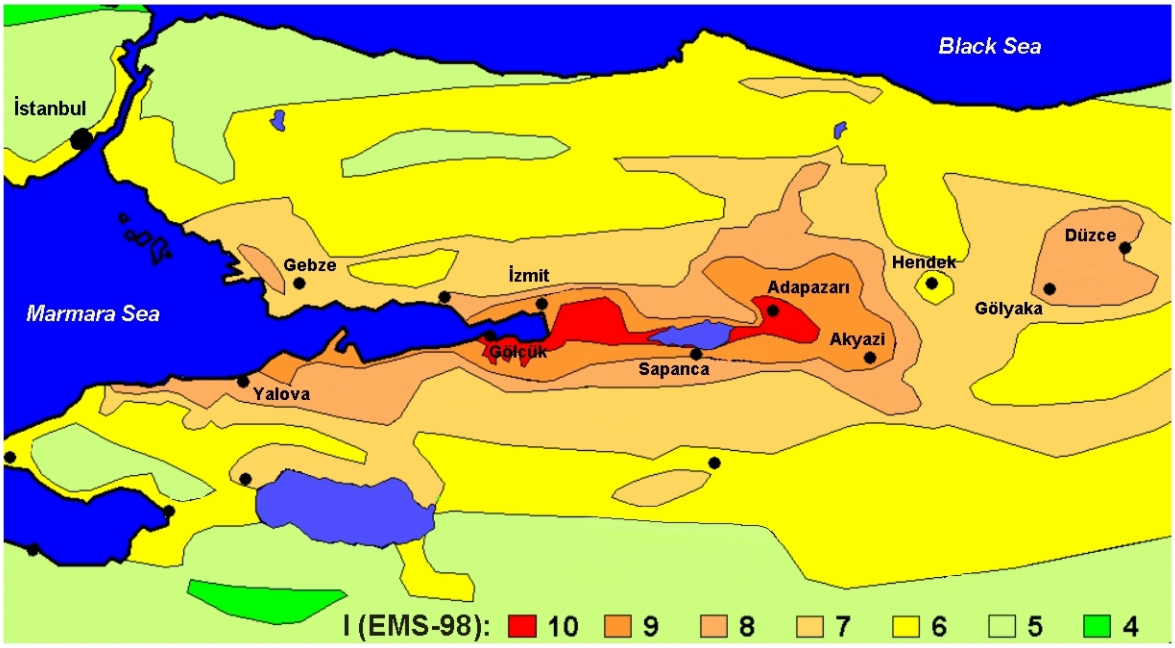


Table A5-2.3	Intensity maps of the 2002 Sultandağı, Türkiye, earthquake

Estimated shaking intensities I_{EMS} (ERDIK *et al.*, 2002)

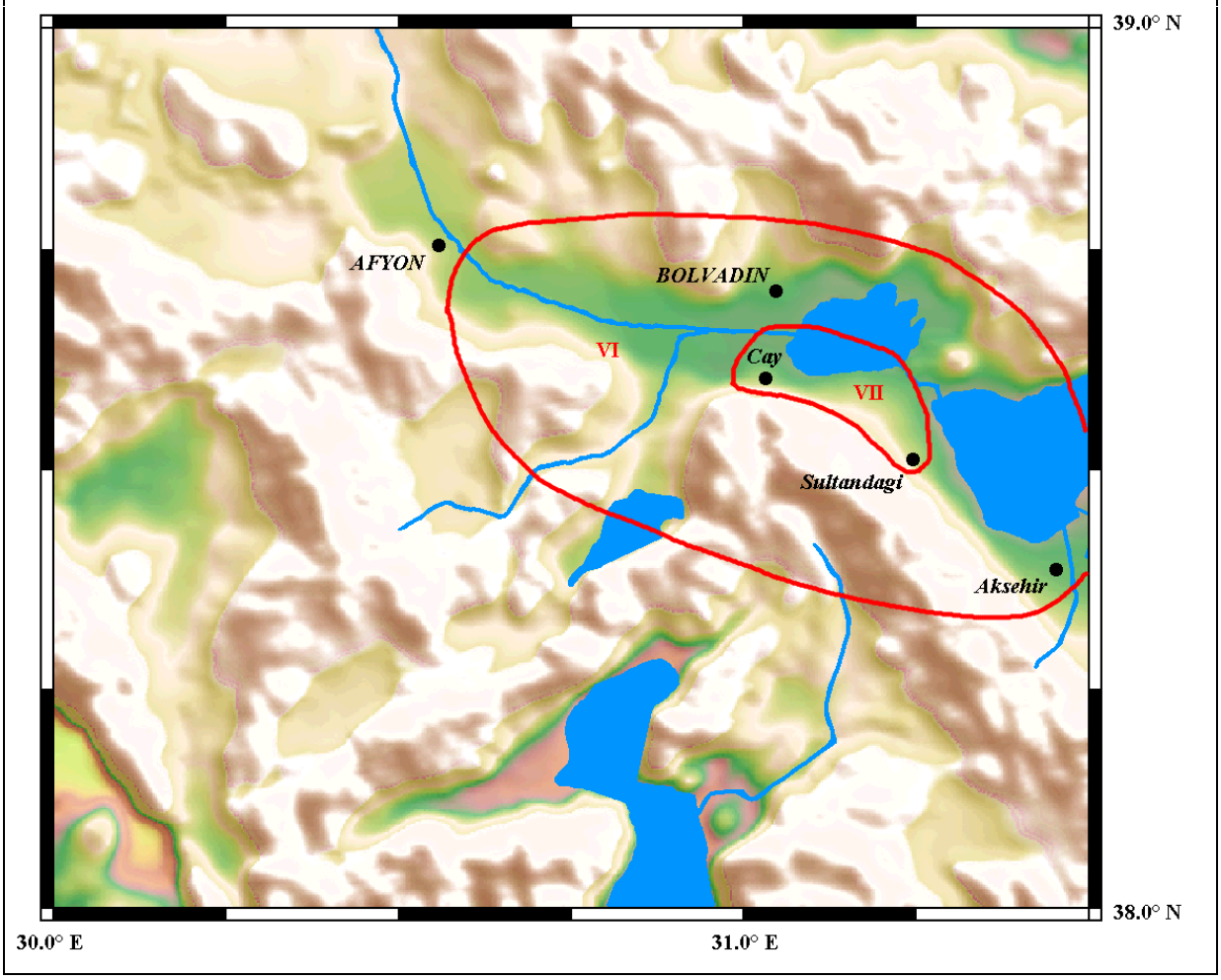


Table A5-3.1	Damage case: Sultandağı, residential building	**SUL**

Structural type 5-story RC-frame structure (building shell)

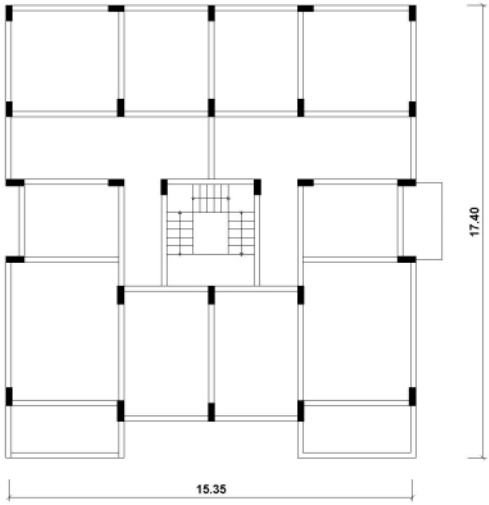
Description of the structure

Year of construction:	2001/02	Elevation design:	regular
Anti-seismic design:	no	Plan design:	regular
Type of use:	residential building	Type of foundation:	RC strip foundation
No. of stories:	5	Type of slabs:	reinforced-concrete (t = 0.12 m)
Basement:	0	Type of infills:	no
Cores:	0	Grade of damage:	*DG* (EMS-98) = 3

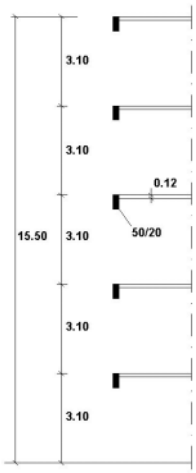
Structural layout

General view of the northwest facade

General view of the south facade



Floor plan (arrangement of columns and beams)



Schematic cross-section (story heights)

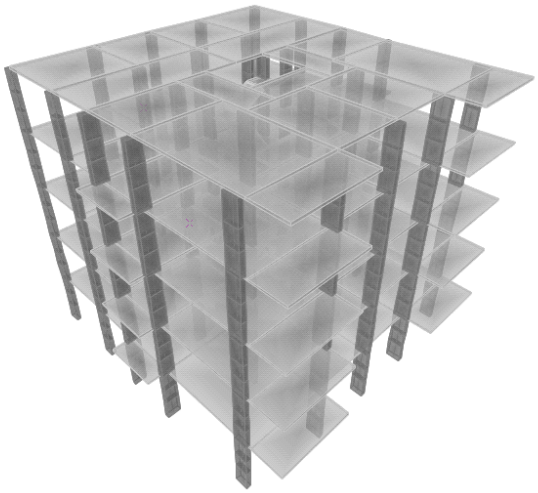
Table A5-3.1 (cont.)	Damage case: Sultandağı, residential building	**SUL**

Structural type 5-story RC-frame structure (building shell)

Structural damage

- small cracks in columns and beams, especially at the ground story
- damage to stair landings of ground and first upper story showing spalling of concrete covers and element displacements of few centimeters (cf. →)

Structural model [1)]



[1)] adopted from SCHOTT *et al.* (2003)

Table A5-3.2	Damage case: İzmit, residential building	**IZT-1**

Structural type 7-story RC-frame structure (building shell)

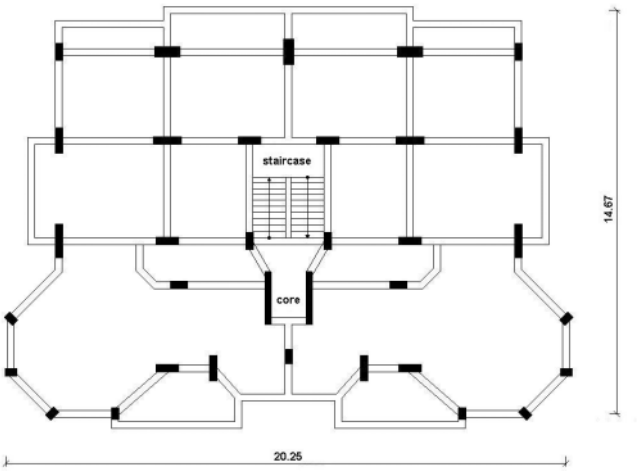
Description of the structure

Year of construction:	1999	Elevation design:	irregular (partly brick infills in 1st/2nd story)
Anti-seismic design:	no		
Type of use:	residential building	Plan design:	regular
No. of stories:	7	Type of foundation:	RC plate-strip foundation
Basement:	0	Type of slabs:	reinforced-concrete (t = 0.12 m)
Cores:	1 (elevator shaft)	Type of infills:	red bricks, cellular concrete
		Grade of damage:	*DG* (EMS-98) = 3

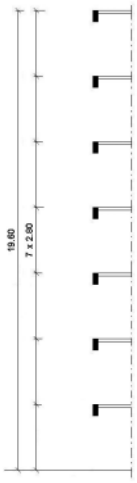
Structural layout

General view of the northwest facade

General view of the south facade



Floor plan (arrangement of columns and beams)



Schematic cross-section

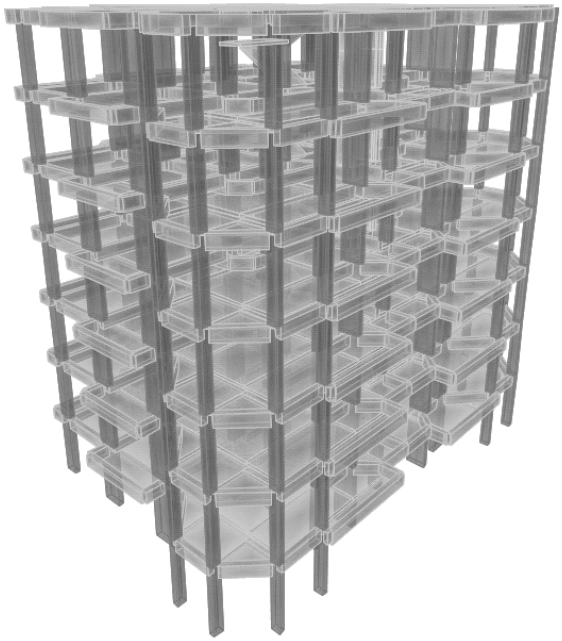
Table A5-3.2 (cont.)	Damage case: İzmit, residential building	**IZT-1**

Structural type 7-story RC-frame structure (building shell)

Extent of structural damage

- small cracks in columns and beams, especially at the lower stories
- damage to stair landings even at higher floors showing a few spalling of concrete covers (cf. →)

Structural model [1)]



1) adopted from SCHOTT *et al.* (2003)

Table A5-3.3	Damage case: İzmit, residential building	**IZT-2a**

Structural type 6-story RC-frame structure (building shell)

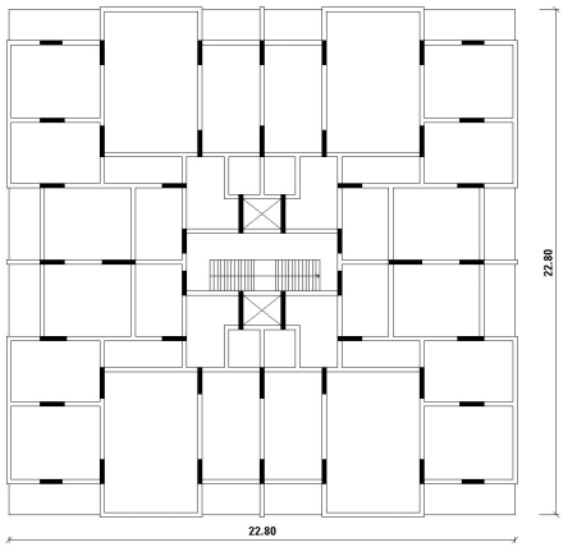
Description of the structure

Year of construction:	1999	Elevation design:	regular
Anti-seismic design:	no	Plan design:	regular
Type of use:	residential building	Type of foundation:	RC plate foundation
No. of stories:	6	Type of slabs:	reinforced-concrete (t = 0.12 m)
Basement:	0	Type of infills:	no
Cores:	1 (elevator shaft)	Grade of damage:	*DG* (EMS-98) = 3

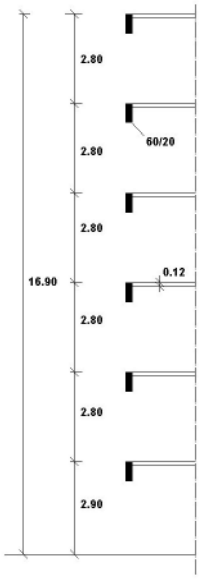
Structural layout

General view of the east facade

General view of the south facade



Floor plan (arrangement of columns and beams)



Schematic cross-section (story heights)

Table A5-3.3 (cont.)	Damage case: İzmit, residential building	**IZT-2a**

Structural type 6-story RC-frame structure (building shell)

Extent of structural damage

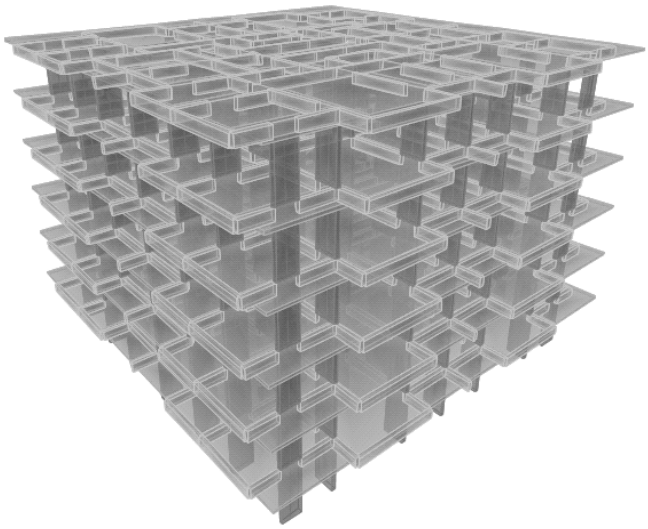
- cracks in columns and beams, especially at the ground story
- hinges have formed at column bases and beam-column joints causing spalling of concrete cover
- damage to stair landings of ground floor showing heavy spalling of concrete cover and element displacements of few centimeters, partly caused by pounding effects to the vertical structural elements

Large crack at beam-column joint at ground floor

Damage to stair landings of ground floor (bottom view)

Spalling of concrete cover at ground floor column

Structural model [1)]



[1)] adopted from SCHOTT *et al.* (2003)

Table A5-3.4	Damage case: İzmit, residential building	IZT-2b

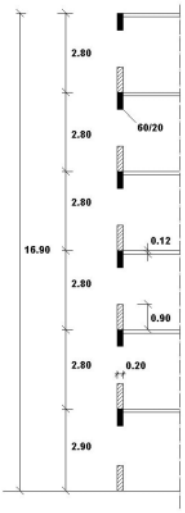
Structural type 6-story RC-frame structure with masonry infills

Description of the structure

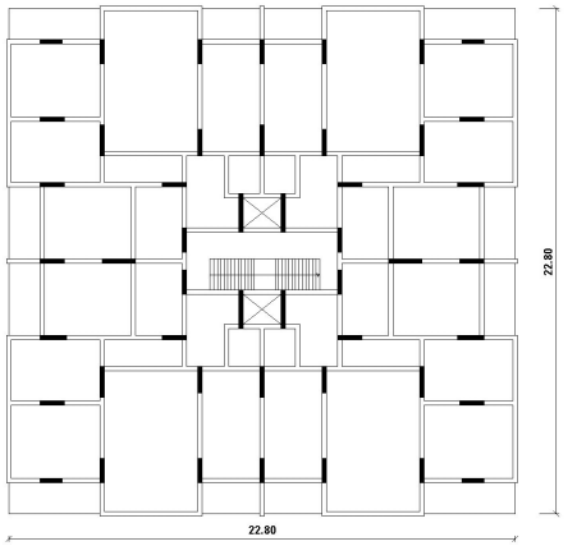
Year of construction:	1999	Elevation design:	irregular (softer ground story)
Anti-seismic design:	no	Plan design:	regular
Type of use:	residential building	Type of foundation:	RC plate foundation
No. of stories:	6	Type of slabs:	reinforced-concrete (t = 0.12 m)
Basement:	0	Type of infills:	red bricks (horizontal holes)
Cores:	1 (elevator shaft)	Grade of damage:	*DG* (EMS-98) = 3

Structural layout

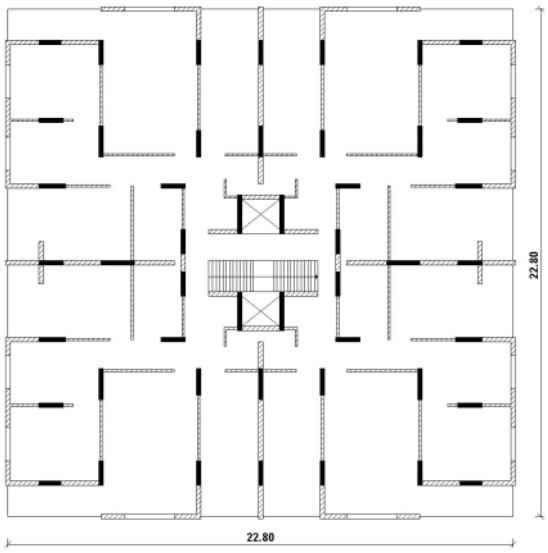
General view of the east facade



Schematic cross-section (story heights)



Floor plan (arrangement of columns and beams)



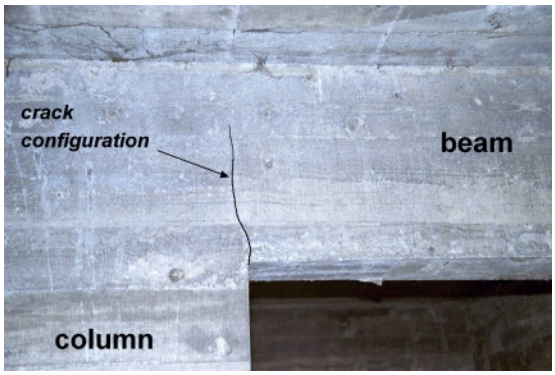
Floor plan (arrangement of infill walls)

Table A5-3.4 (cont.)	Damage case: İzmit, residential building	**IZT-2b**

Structural type 6-story RC-frame structure with masonry infills

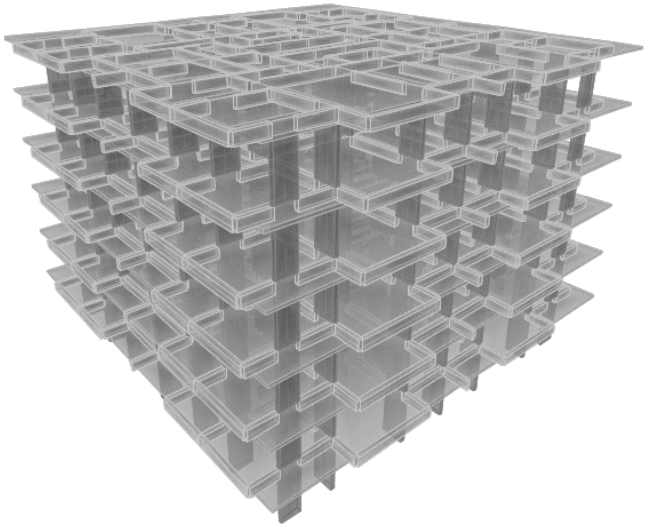
Extent of structural damage

- small cracks in columns and beams, especially at the ground story (cf. →)
- few hinges have formed at column bases and beam-column joints
- damage to stair landings of ground floor showing heavy spalling of concrete cover and element displacements of few centimeters
- moderate to heavy damage to nonstructural masonry infill walls, especially at higher floors



Beam-column joint at ground floor

Structural model [1)]



[1)] adopted from SCHOTT *et al.* (2003)

Table A5-3.5	Damage case: İzmit, residential building	**IZT-2c**

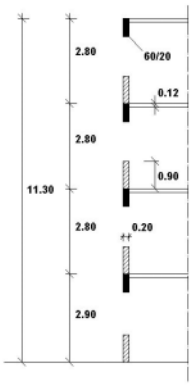
Structural type 4-story RC-frame structure with masonry infills

Description of the structure

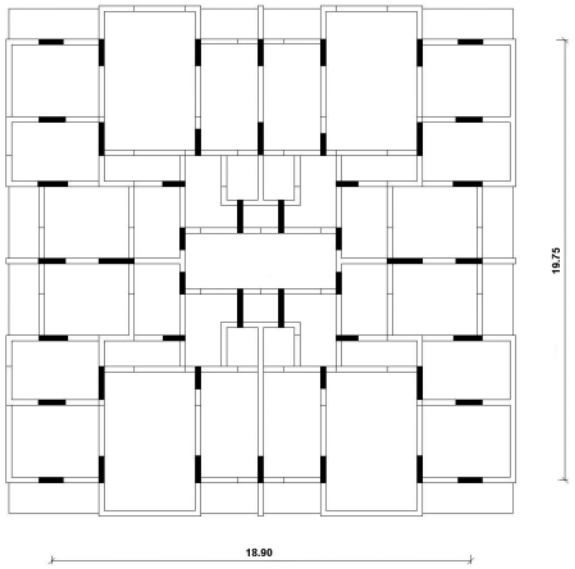
Year of construction:	2002	Elevation design:	irregular (soft ground story)
Anti-seismic design:	yes	Plan design:	regular
Type of use:	residential building	Type of foundation:	RC slab foundation
No. of stories:	4	Type of slabs:	reinforced-concrete (t = 0.12 m)
Basement:	0	Type of infills:	red bricks (horizontal holes)
Cores:	1 (elevator shaft)	Grade of damage:	-

Structural layout

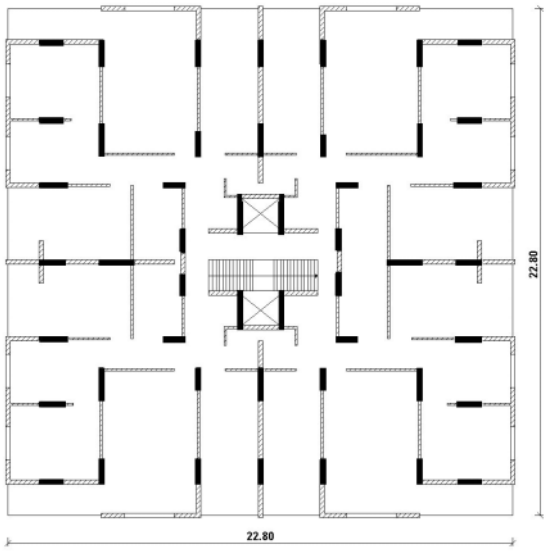
General view of the north facade



Schematic cross-section (story heights)



Floor plan (arrangement of columns and beams)



Floor plan (arrangement of brick infill walls)

Table A5-3.6	Damage case: Düzce, residential building	**DUZ-1**

Structural type 4-story RC-frame structure with masonry infills

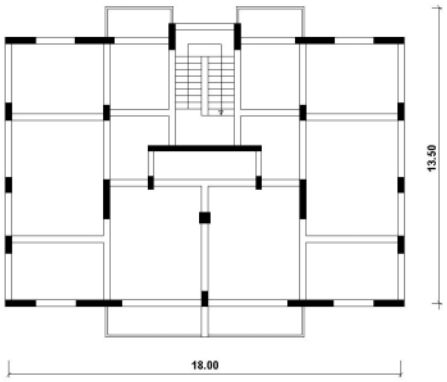
Description of the structure

Year of construction:	1999	Elevation design:	irregular
Anti-seismic design:	no	Plan design:	irregular
Type of use:	hospital and sanitary center	Type of foundation:	plate foundation
No. of stories:	4	Type of slabs:	reinforced-concrete (t = 0.12 m)
Basement:	1 (stiff box)	Type of infills:	red bricks (horizontal holes)
Cores:	no	Grade of damage:	*DG* (EMS-98) = 0

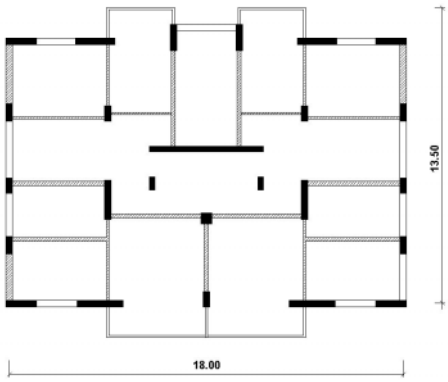
Structural layout

General view of the north facade

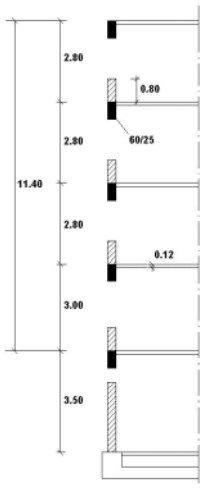
General view of the west facade



Floor plan (columns and beams)



Floor plan (infill walls)



Schematic cross-section

Extent of structural damage

- no structural damages were documented and visible at the time of inspection

Table A5.3-7	Damage case: Düzce, residential building	**DUZ-2**

Structural type 5-story RC-frame structure with masonry infills

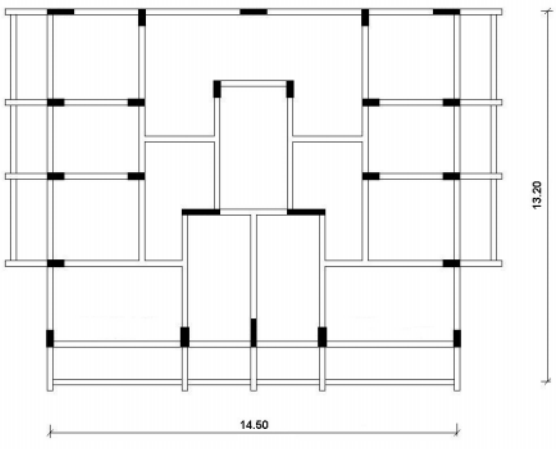
Description of the structure

Year of construction:	1995/96	Elevation design:	irregular (cantilevering upper stories)
Anti-seismic design:	no		
Type of use:	residential building	Plan design:	regular
No. of stories:	5	Type of foundation:	RC plate foundation
Basement:	1	Type of slabs:	reinforced-concrete (t = 0.10 m)
Cores:	no	Type of infills:	red bricks (horizontal holes)
		Grade of damage:	*DG* (EMS-98) = 2-3

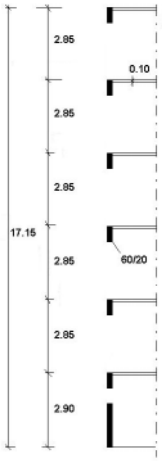
Structural layout

General view of the south facade

General view of the south-west facade



Floor plan (arrangement of columns and beams)



Schematic cross-section (story heights)

Extent of structural damage

- very few small cracks to structural elements
- moderate to heavy damage to nonstructural infill walls at every story
- collapsed roof consisting of timber trusses and red tiles

Table A5-3.8	Damage case: Seymen, residential building	**SEM**

Structural type 4-story RC-frame structure with masonry infills

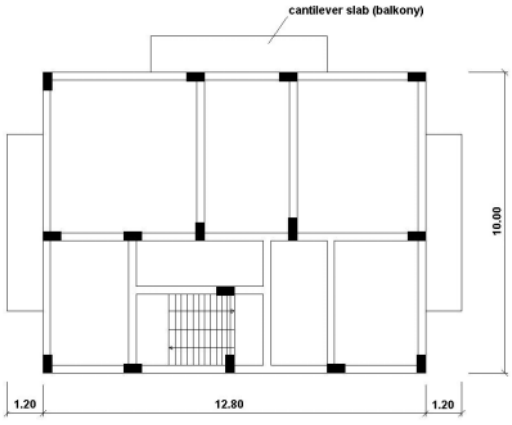
Description of the structure

Year of construction:	< 1995	Elevation design:	irregular
Anti-seismic design:	no	Plan design:	irregular
Type of use:	residential building	Type of foundation:	plate-strip foundation
No. of stories:	4	Type of slabs:	reinforced-concrete (t = 0.10 m)
Basement:	0	Type of infills:	red bricks (horizontal holes)
Cores:	no	Grade of damage:	*DG* (EMS-98) = 2

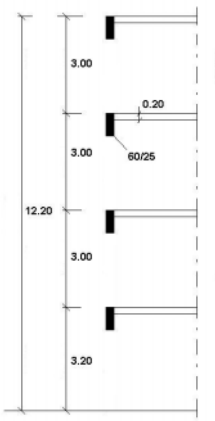
Structural layout

General view of the south facade

General view of the east facade



Floor plan (arrangement of columns and beams)



Schematic cross-section (story heights)

Extent of structural damage

- small cracks to structural elements (RC frames), however no spalling of concrete
- moderate damage to masonry infill walls of ground floor (diagonal cracking), spalling of plaster

Table A5-3.9	Damage case: Sapanca, residential building	SAC

Structural type 3-story RC-frame structure with masonry infills

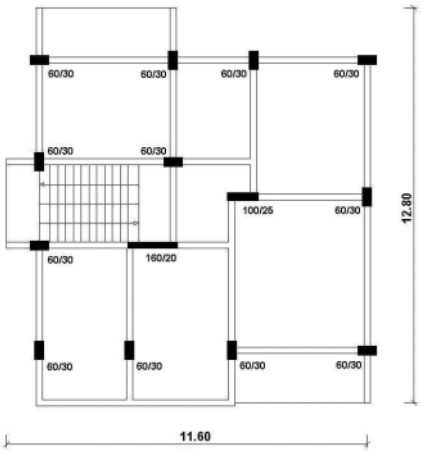
Description of the structure

Year of construction:	2002	Elevation design:	irregular (soft ground story)
Anti-seismic design:	no	Plan design:	irregular
Type of use:	residential building	Type of foundation:	RC strip foundation
No. of stories:	3	Type of slabs:	reinforced-concrete (t = 0.10 m)
Basement:	0	Type of infills:	red bricks (horizontal holes)
Cores:	0	Grade of damage:	-

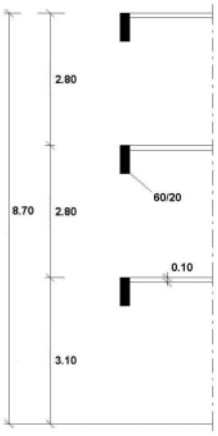
Structural layout

General view of the east facade

General view of the west facade



Floor plan (arrangement of columns and beams)



Schematic cross-section (story heights)

Table A5-3.10	Damage case: Gölyaka, Yavuzlar Fındık	**YZL**

Structural type 4-story RC-frame structure with masonry infills

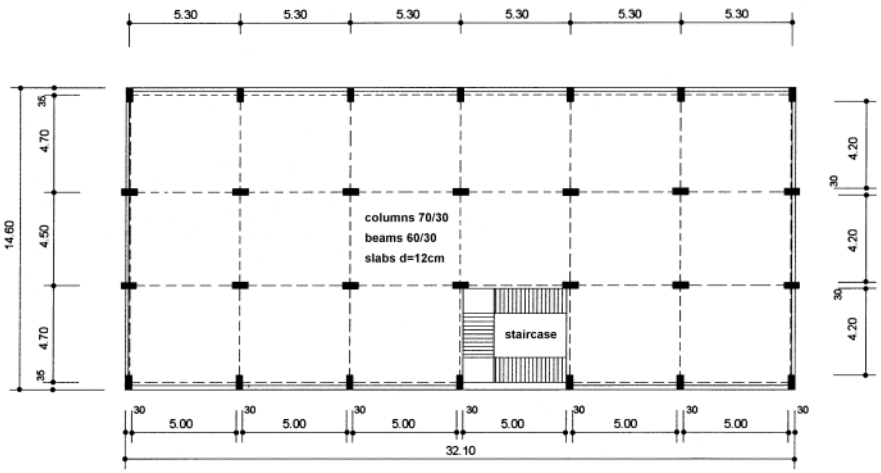
Description of the structure

Year of construction:	1994	Elevation design:	irregular (larger height of ground story)
Anti-seismic design:	no		
Type of use:	factory and storage building	Plan design:	regular
No. of stories:	4	Type of foundation:	no information
Basement:	0	Type of slabs:	reinforced-concrete
Cores:	1 (internal staircase)	Type of infills:	red bricks (horizontal holes)
		Grade of damage:	*DG* (EMS-98) = 5

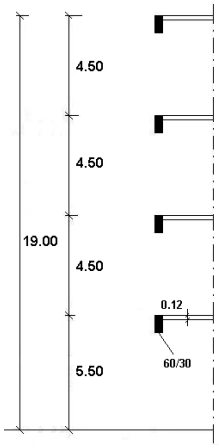
Structural layout

General view (1994)

General view after the damaging 1999 İzmit (Kocaeli) earthquake



Floor plan (arrangement of columns and beams)



Schematic cross-section (story heights)

Table A5-3.10 (cont.)	Damage case: Gölyaka, Yavuzlar Fındık	**YZL**

Structural type	4-story RC-frame structure with masonry infills

Extent of structural damage

General view of the south facade

General view of the east facade

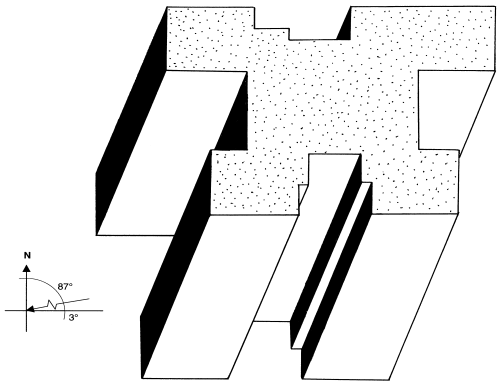
Table A5.3-11	Damage case: Cumaná, Avenida Perimetral	**AVE**

Structural type 7-story RC-frame structure with masonry infills

Description of the structure

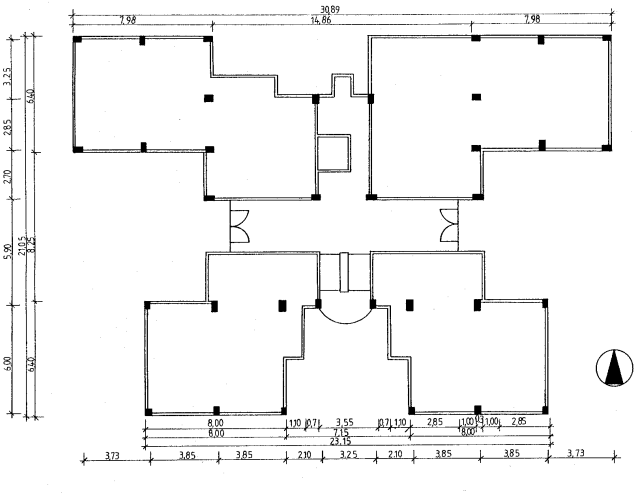
Year of construction:	1997	Elevation design:	irregular (soft ground story)
Anti-seismic design:	no	Plan design:	irregular (strong setoffs)
Type of use:	residential building	Type of foundation:	RC slab foundation
No. of stories:	7	Type of slabs:	rib and filler tile (hollow bricks)
Basement:	0	Type of infills:	red bricks (horizontal holes)
Cores:	1 (elevator shaft)	Grade of damage:	*DG* (EMS-98) = 3

Structural layout

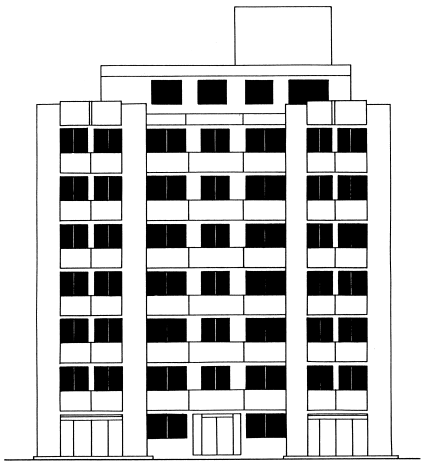


Orientation scheme

General view of the north facade



Layout of the building

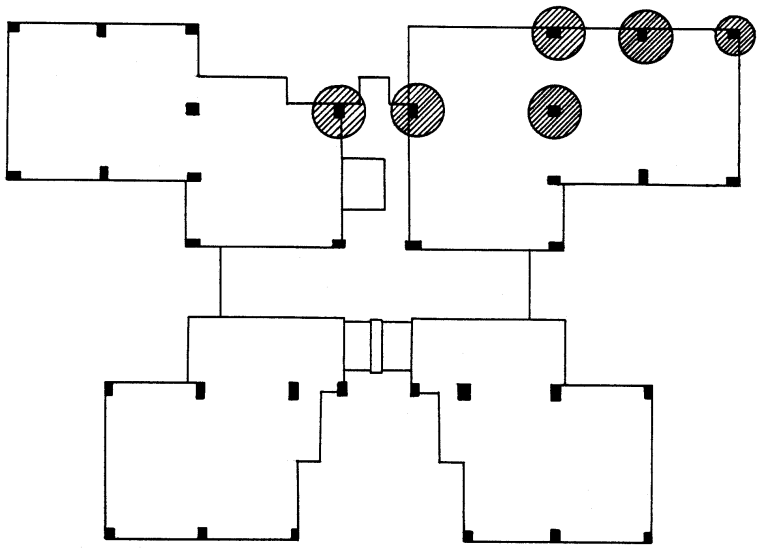


Schematic view of the east facade

Table A5.3-11 (cont.)	Damage case: Cumaná, Avenida Perimetral	**AVE**

Structural type	7-story RC-frame structure with masonry infills

Extent of structural damage



Locations of damage to structural elements of ground floor

Damaged column-beam connection of ground floor

Damaged column base of ground floor

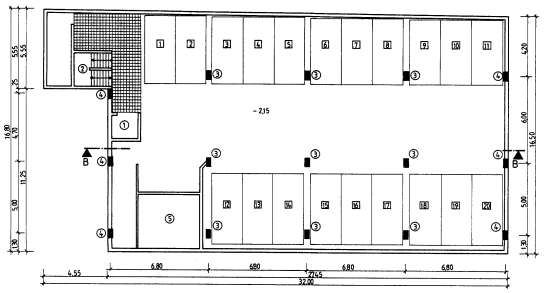
Table A5.3-12	Damage case: Cumaná, Edificio Miramar	**MIR**

Structural type 9-story RC-frame structure with masonry infills

Description of the structure

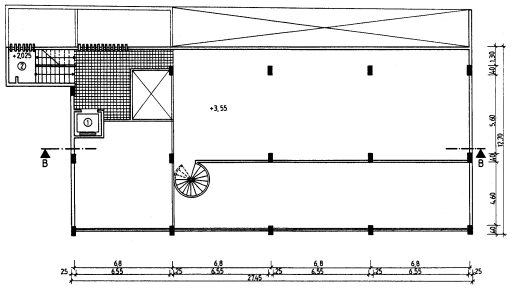
Year of construction:	1978/79	Elevation design:	irregular (soft 1st/2nd story)
Anti-seismic design:	yes	Plan design:	irregular (excentric cores)
Type of use:	business/residential building	Type of foundation:	no information
No. of stories:	9	Type of slabs:	reinforced-concrete
Basement:	1 (stiff box)	Type of infills:	red bricks (horizontal holes)
Cores:	2 (staircase, elevator shaft)	Grade of damage:	*DG* (EMS-98) = 5

Structural layout

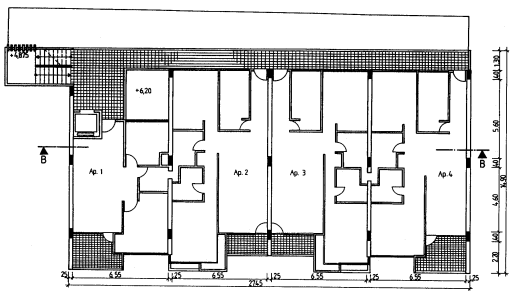


Layout of the basement (underground parking lot)

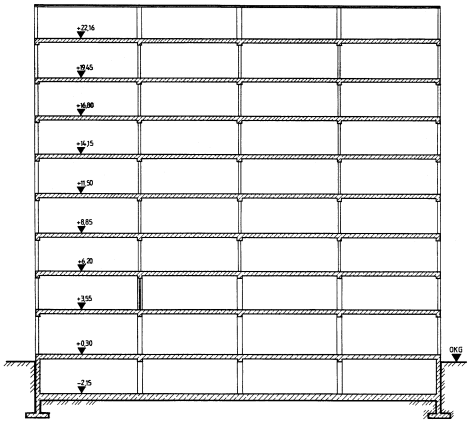
Schematic view of the west facade



Layout of ground and first floor (business premises)



Layout of the upper floors (apartments)



Cross-section B-B

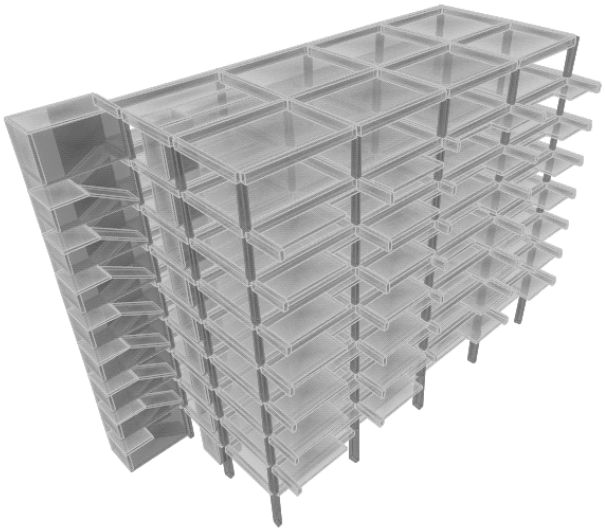
Table A5.3-12 (cont.)	Damage case: Cumaná, Edificio Miramar	**MIR**

Structural type 9-story RC-frame structure with masonry infills

Extent of structural damage

Total collapse of the Miramar building in the front (background: multi-story buildings of similar height and structural type sustained the mainshock without any damages)

Structural model [1)]



1) adopted from LANG *et al.* (2003b)

Table A5-3.13	Damage case: Cumaná, Edificio Residencial	**EDR**

Structural type	9-story RC-frame structure with masonry infills

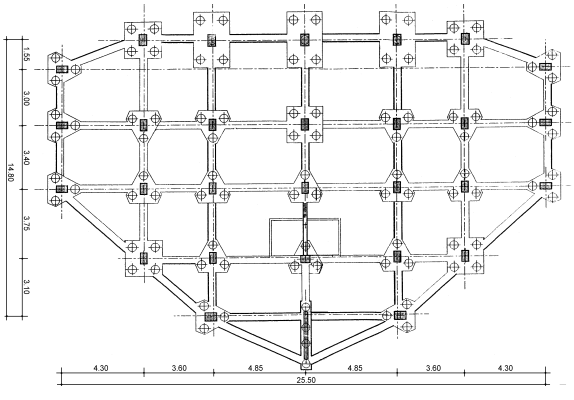
Description of the structure

Year of construction:	1995/96	Elevation design:	regular
Anti-seismic design:	yes	Plan design:	regular
Type of use:	residential building	Type of foundation:	pile-strip foundation
No. of stories:	9	Type of slabs:	rib and filler tile (hollow bricks)
Basement:	0	Type of infills:	bricks
Cores:	1 (staircase/elevator; U-shape)	Grade of damage:	*DG* (EMS-98) = 0

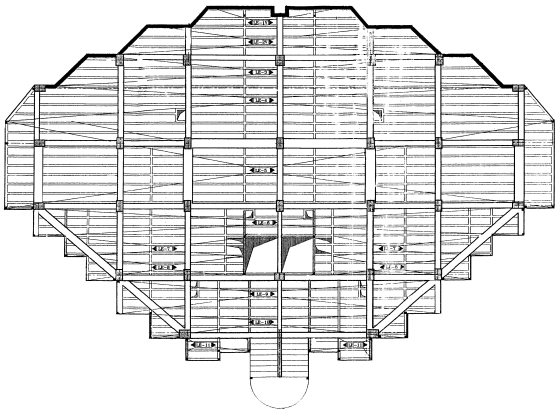
Structural layout

General view of the north facade

General view of the south facade



Foundation plan



Layout and slab orientation plan

Table A5-3.13 (cont.)	Damage case: Cumaná, Edificio Residencial	**EDR**

Structural type	9-story RC-frame structure with masonry infills

Structural model

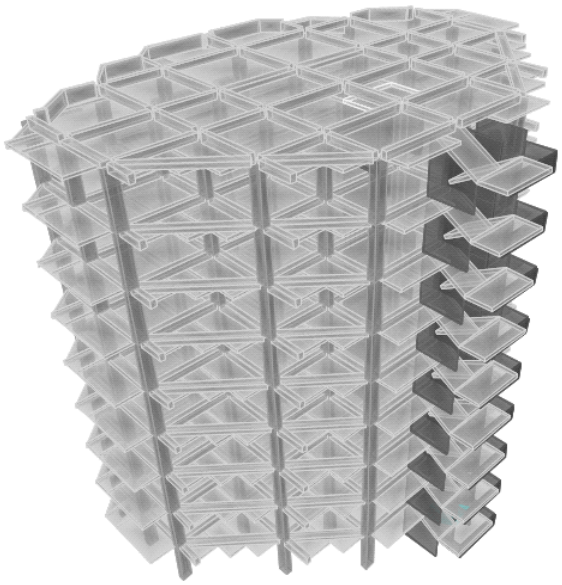


Table A5-3.14	Damage case: Cumaná, Edificio de oficinas Toyota	**TOY**

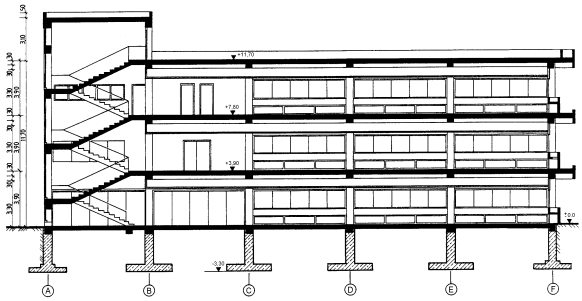
Structural type 9-story RC-frame structure with masonry infills

Description of the structure

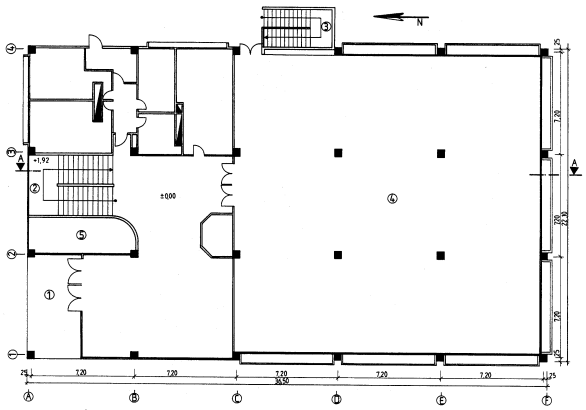
Year of construction:	1997	Elevation design:	regular
Anti-seismic design:	acc. to COVENIN 1756-82	Plan design:	irregular (excentric arrangement of brick infills and staircases)
Type of use:	office building		
No. of stories:	3	Type of foundation:	single sleeve foundations
Basement:	0	Type of slabs:	RC caissons with top RC layer
Cores:	2 (internal, external staircase)	Type of infills:	red bricks (horizontal holes)
		Grade of damage:	*DG* (EMS-98) = 3-4

Structural layout

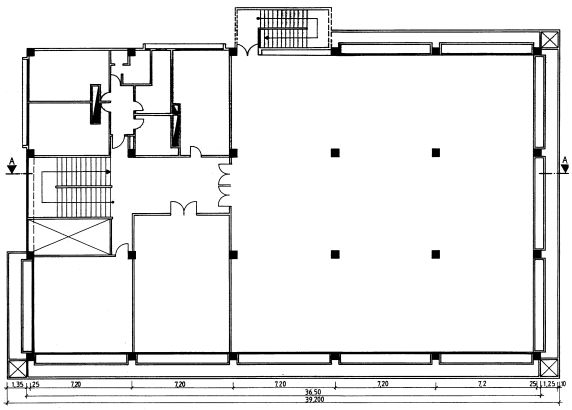
General view of the south facade (P1)



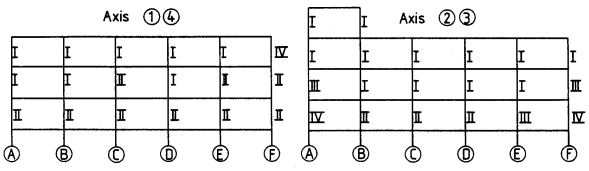
Cross-section A-A



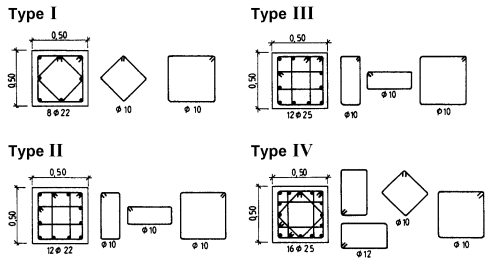
Layout of ground floor



Layout of the upper floors



Arrangement of different column types

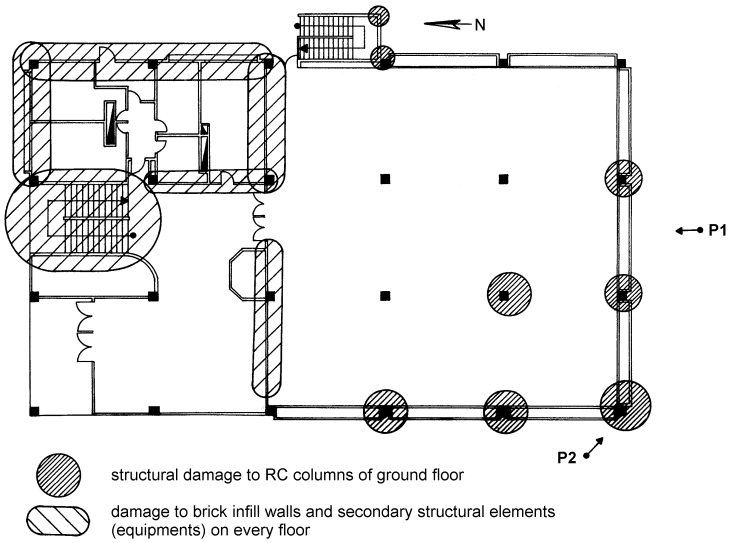


Reinforcement detailing of column types

Table A5-3.14 (cont.)	Damage case: Cumaná, Edificio de oficinas Toyota	**TOY**

Structural type 9-story RC-frame structure with masonry infills

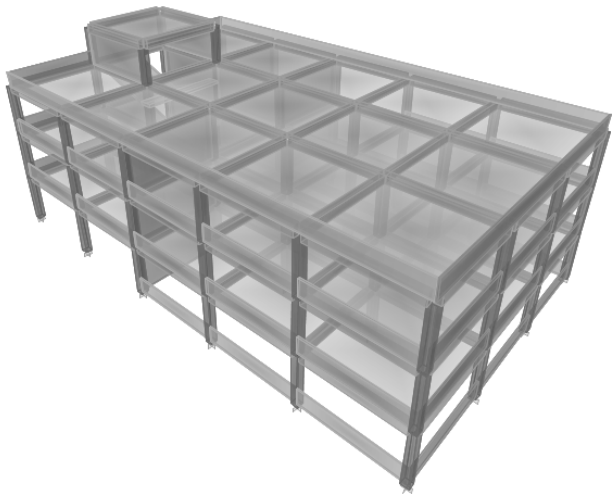
Extent of structural damage



Locations of damage to structural elements
(for P1, P2 see photos on the page before and on the right)

Detailing of the damaged corner column (P2)

Structural model [1)]



[1)] adopted from LANG *et al.* (2003b)

Curriculum vitae

Personal data

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Education

1984 - 1993	Johann-Christian-Reinhart Gymnasium in Hof/Saale Graduation: university-entrance diploma (Allgemeine Hochschulreife)
1993 - 1998	Study of Civil Engineering at Bauhaus-Universität Weimar (formerly Hochschule für Architektur und Bauwesen) Graduation: graduate engineer (Dipl.-Ing.)
1998 - 2000	scientific help at the Institute of Structural Engineering of Bauhaus-Universität Weimar
2000 - 2004	scientific assistant at the Institute of Structural Engineering of Bauhaus-Universität Weimar