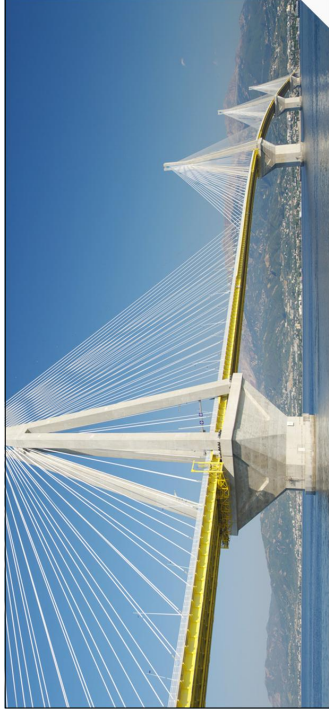




完工土木工程保險 CECR – Civil Engineering Completed Risks Insurance

8 Apr. 2015

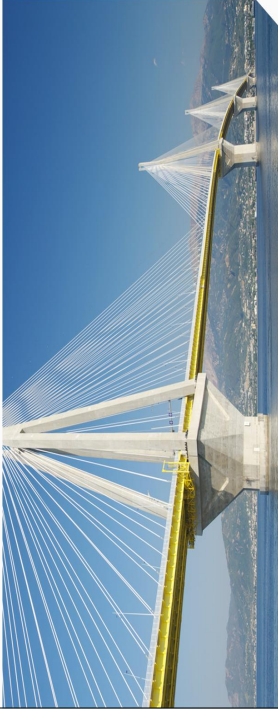
Chris Wang, Munich Re Hong Kong



大綱 Agenda



- 天然災害對公共工程之衝擊
 - 募再CECR全球承保經驗
 - 風險評估與核保考量
 - 計價原則與方法
 - 核保建議
- Infrastructure Damages due to NatCat
- MR CECR Portfolio
- Risk Assessment & UW Consideration
- MR's Pricing Methodology
- Recommendation to UWs





天然災害對公共工程之衝擊 PUBLIC INFRASTRUCTURE DAMAGES DUE TO NATURAL HAZARDS

1995 日本阪神地震 Kobe Earthquake, Japan, 17 Jan.1995



- 芮氏規模7.3
- 神戶一地鐵站(DAIKAI)完全倒塌
- 隧道段及數個地鐵站於此地震中遭受損毀
- 多處中間柱倒塌，尤其地鐵站的月台
- 神戶地鐵一年後才重新對外開放
- 整體經濟損失估計達 USD 1500 億，保險損失約 USD 60 億

Image credit: AP / Jiji Press

CECR – Civil Engineering Completed Risks Insurance

30.03.2015

4

2002 歐洲百年大洪水- 捷克布拉格地鐵 Biggest flood in history came to the Prague, 14 August 2002

Munich RE



- 16公里的捷運線及19個捷運站遭洪水淹沒, 其中B線的下層月台被淹沒逾40公尺
- 受損的地鐵系統停止營運達數月, 最後一個捷運站在2003三月才對外開放
- 捷運系統損失估計達USD 2億

CECH - Civil Engineering Completed Risks Insurance

14/03/2003 5

2011 東日本大地震伴隨海嘯 Devastating earthquake and tsunami, Japan, 11 March 2011

Munich RE



- 芮氏規模9.0, 震央距離東京382km, 後續並出現規模不小的餘震(規模7.4)
- 一列JR East列車在運行中出軌, 然後被海嘯掃移動, 無倖存者生還
- 23車站遭沖毀, 660處軌道受損, 修復費用超過15億美元

CECH - Civil Engineering Completed Risks Insurance

14/03/2003 7

2005 卡崔納颶風 Hurricane Katrina, USA, 29 Aug. 2005

Munich RE



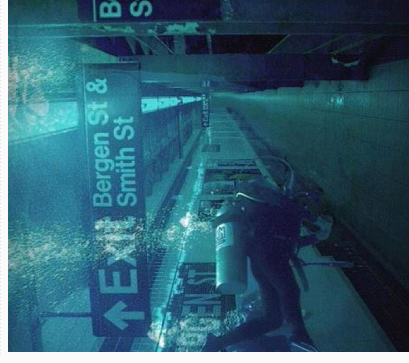
- 卡崔納颶風席捲美國南方墨西哥灣, 引發海水倒灌, 堤防潰堤, 造成數千人死亡, 數十萬災民被迫撤離
- 紐奧良市53處防波堤遭沖毀, 造成八成城市浸泡在水裡, 防波堤修復費用超過7億美元
- 同時造成90多座橋樑損毀, 修復費用超過30億美元

CECH - Civil Engineering Completed Risks Insurance

16/03/2013 6

2012 珊迪颶風 Hurricane Sandy, USA, 29 Oct. 2012

Munich RE



- 10/29傍晚開始降下大雨, 造成紐約市地鐵系統開始淹水
- 紐約市地鐵系統有108年歷史, 受災最重的一次
- 隧道、腳度場與鐵道大淹水, 並有八個車站淹水
- 東河(East River)底下由曼哈頓通往皇后區與布魯克林的所有7條地鐵隧道都進水
- 颶風「珊迪」給紐約地鐵系統造成的損失高達48億美元
- 美國國會通過總額505億美元的「珊迪」颶風援助法案, 主要用於支持災區重建、公共交通系統重置以及針對未來自然災害的預防措施

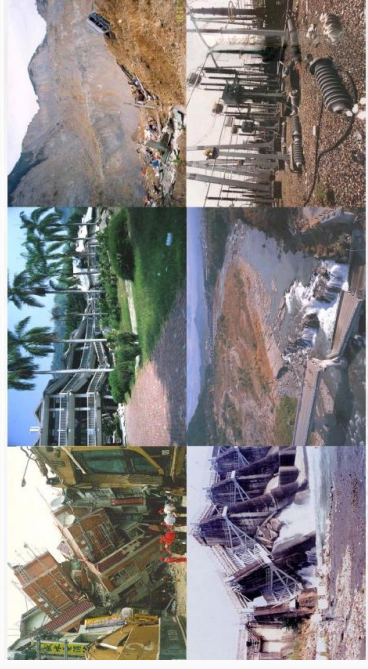
CECH - Civil Engineering Completed Risks Insurance

16/03/2013 8

1999 九二一大地震

Chi-Chi Earthquake – Sep 21, 1999

Munich RE



資料來源：臺灣地震資料中心

CECR - Civil Engineering Completed Risks Insurance

19/03/2015

9

2001 桃芝颱風

Typhoon Toraji – 30 July 2001

Munich RE



http://forums.chinatimes.com/wispecallytyphoon_main.htm

CECR - Civil Engineering Completed Risks Insurance

19/03/2015

11

2000 碧利斯颱風 – 高屏大橋斷裂

Kaoping Bridge collapsed – Bilis Typhoon, 27 Aug. 2000

Munich RE



<http://www.sina.com.cn>

CECR - Civil Engineering Completed Risks Insurance

16/03/2015

10

2001 納莉颱風 - 捷運系統16個車站及行控中心淹水

Taipei MRT flooded - Nari Typhoon – 17 Sep. 2001

Munich RE



資料來源：臺北捷運局網站

CECR - Civil Engineering Completed Risks Insurance

16/03/2015

12

2008 辛樂克颱風 – 1斷斷6橋

6 bridges collapsed - Sinlaku Typhoon, 14 Sep. 2008

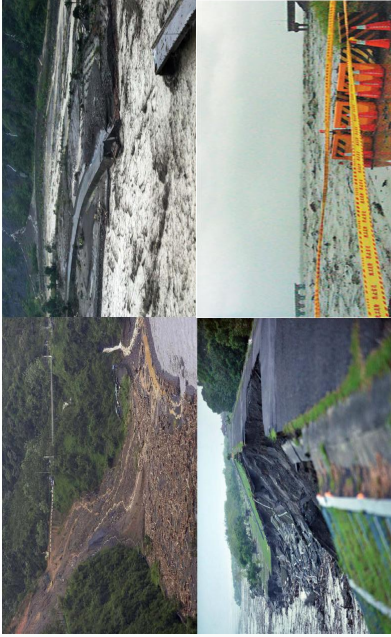


1985-2011年天災之公共設施損失(水利/ 鐵路/ 公路/ 電力) Critical Infrastructure Losses due to NH in Taiwan (1985-2011)



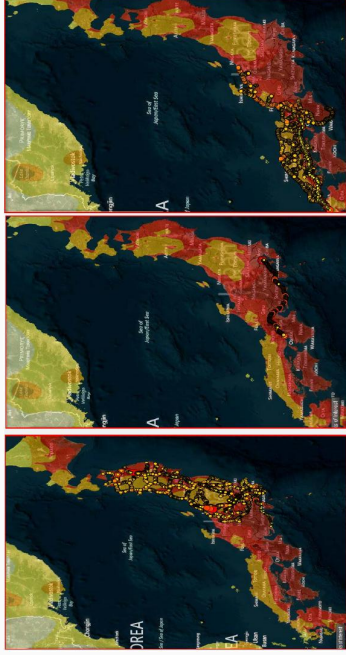
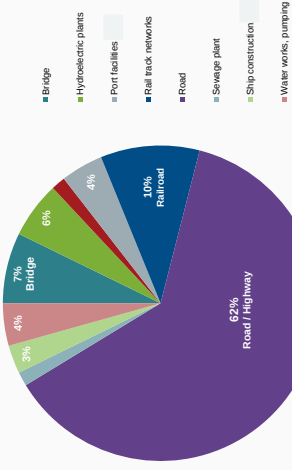
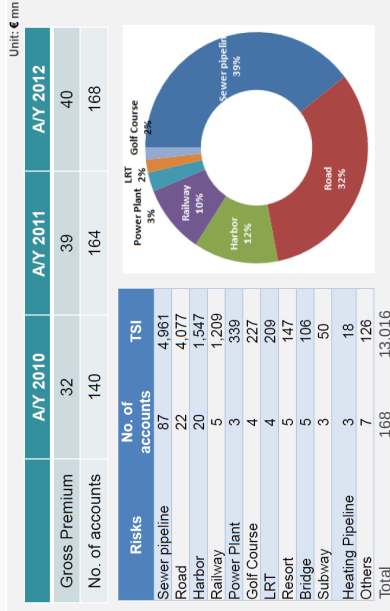
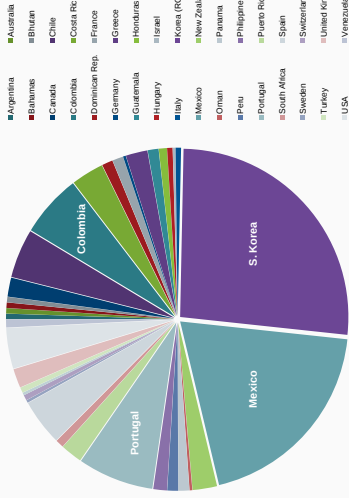
*龍尼再保險公司華中區業務局「1985-2011年台灣國災災情各項災害損失統計資料」統計數據 (以2012年的幣值表示)

2009 莫拉克颱風 – 造成多處道路、橋樑坍塌中斷、潰堤 Morakot Typhoon – August 8, 2009



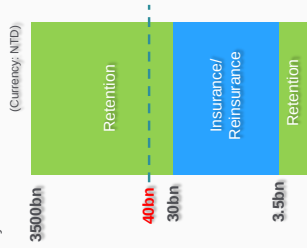
慕再CECR全球承保經驗 MR CECR PORTFOLIO



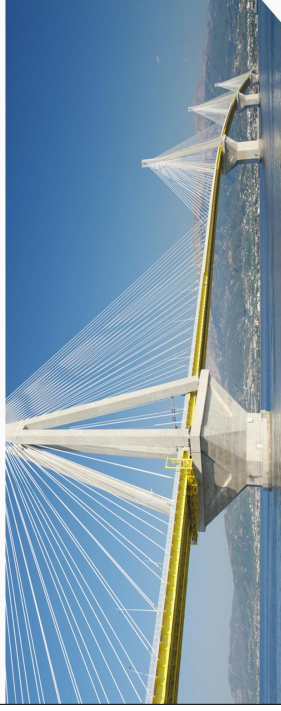


東日本旅客鐵道 311地震造成的經濟損失與保險賠付金額
JR East - Earthquake & Tsunami 2011

- TSI : about 3.5 trillion (for 7 railway lines)
- CECR policy (but for EQ only)
- Annual premium about 1.5-2 bn and has been insuring for 8 years
- Loss amount resulting from 311 EQ is exceeding 40bn



風險評估與核考量 - 完工土木工程保險
RISK ASSESSMENT & UW CONSIDERATION - CECR



完工土木工保險
Civil Engineering Completed Risk (CECR) Insurance

- 主要承保之土木工程設施。
 - Roads
 - Runways
 - Bridges
 - Tunnels
 - Dams of all kinds
 - Weirs
 - Harbors
 - Dry docks
 - Overhead lines
 - Pipelines (conveying non-combustible substances)
 - Water reservoirs
 - Sewer systems
 - Transmission & distribution lines

- Civil structures commonly look for comprehensive insurance protection against loss or damage after the construction work has been completed.
- In such structures, the fire risk is often negligible, so that the standard fire policy is unsuitable.



完工土木工程保險(CECR)
係專為土木工程結構/設施而設計之保單



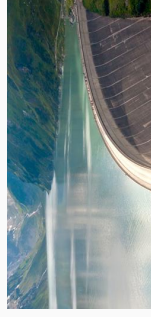
Bridges



Tunnels



Roads



Dams

Definition of Civil Engineering Completed Risk(s)

完工土木工程保險

Civil Engineering Completed Risk (CECR) Insurance

被保險人

- 政府單位/機關
- 特許營運公司 (PPP, BOT)
- 私人機構

承保標的物

- 已完工之土木工程結構物
- 火災風險相對較低之結構物

承保範圍

- 財產損失 Property Damage
- 營業中斷 Business Interruption

A Named-Perils policy covering any unforeseen and sudden physical loss or damage

主要承保風險:

- 地震、火山爆發、海嘯
- 風速達到蒲福氏風級表(The Beaufort Scale)八級以上之風災
- 洪水、漲水、洩水、浪潮
- 土崩、岩崩、土石流、地陷或土地移動
- 冰害、雪崩
- 火災、閃電、雷擊及爆炸
- 各型船隻/機動車輛及飛行器與其墜落物之碰撞
- 第三人之惡意破壞行為

各型船隻/機動車輛及飛行器與其墜落物之碰撞

Impact of landborne or waterborne vehicles or aircraft



完工土木工程保險

Civil Engineering Completed Risk (CECR) Insurance

Standard exclusions

- War, invasion, act of foreign enemy, hostilities
- Strike, riot, civil commotion
- Nuclear reaction, nuclear radiation or radioactive contamination
- Willful act or willful negligence of the insured or his representatives
- Inherent defects, wear and tear, gradual deterioration, expansion or contraction
- Lack of maintenance**
- Consequential losses of all kinds
- Terrorism

The coverage may be extended to include

- Debris removal
- Expediting costs
- Machinery breakdown
- Strike, riot and civil commotion
- Consequential loss (separate BI section)

CECR vs CECR-AR

CECR		CECR-AR
Scope of Cover	Named Perils	All Risks
Accidental Damage	Not Covered	Covered
Business Interruption	Covered by Endorsement 1000	Covered (optional)
BI extensions	Not by Munich Re endorsement	By Munich Re Endorsements
Definitions - Perils - Civil engineering risk(s)	- Not Defined - Not Defined	- Defined - Named CECR

Why do we need a new Form?

No maintenance of old Munich RE policy forms

No definitions

CECR are in general excluded in the most property wordings

All Risks coverage meets market demand in general

And is in particular requested on 3P / BOT Projects

Civil Engineering Completed Risks Insurance (CECR) Underwriting Considerations

- CECR policy is not a substitute for regular maintenance and overhaul
- Does not constitute an anti-selection in respect of object and location
 - Type of risk and condition
 - Geographical and topographical location
 - Exposures to natural hazards
 - Special construction methods and experience during the construction period
 - Special exposure to fire, explosion, blasting work or other hazards
- Inspection reports indicating design parameters in respect of natural hazards and use of the risk
 - All previous damage and repair details
- Maintenance schedule
- Presence and qualifications of operating personnel

Use Munich Re CECR Questionnaire

Civil Engineering Completed Risks Insurance (CECR) Typical exposures (depending on location)

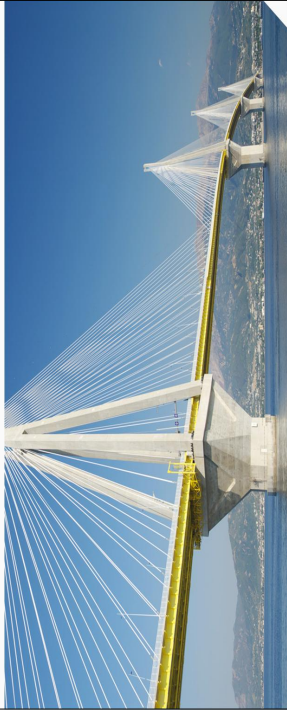
	Bridges	Dams	Harbours	Pipelines	Roads	Railways	Runways	Transmission lines	Tunnels	Sewer & Water	Waterways
EQ (named peril)	X	X	X	X	X	X	X	X		X	
Tsunami (named peril)	X	X	X	X	X	X	X	X			X
Flood (named peril)	X	X	X	X	X	X	X	X		X	X
Frost, ice (named peril)				X				X		X	
Fire (named peril)				X					X		
Explosion (named peril)				X					X		
Landslide / rockfall (named perils)	X	X	X	X	X	X		X		X	
Aircraft impact (named peril)	X	X	X	X			X	X			
Vessel impact (named peril)	X	X	X								X
Motor vehicle impact (named peril)	X				X				X		

Civil Engineering Completed Risks Insurance (CECR) Underwriting information

Type of object	Bridges	Dams	Harbours	Pipelines	Roads	Railways	Runways	T & C Lines	Tunnels	Sewer & Water	Waterways
General description	X	X	X	X	X	X	X	X	X	X	X
Age of construction	X	X	X	X	X	X	X	X	X		
Topography			X	X	X	X	X	X	X		
Natural perils	X	X	X	X	X	X	X	X	X	X	X
Surroundings	X	X	X	X	X	X	X	X	X		
Design standards	X	X	X	X	X	X	X	X	X		
Route	X	X	X	X	X	X	X	X	X		
Exact location	X	X	X	X	X	X	X	X	X	X	X
Inspection and maintenance procedures	X	X	X	X	X	X	X	X	X		
Bridges: max span, length, height, load capacity, stability, single tube, length, height, fire protection of control centres	X	X	X	X	X	X	X	X	X		
Number & location of toll stations (for BI purposes)			X			X	X				
Type and structure of the object	X	X				X					
Rolling stock included						X					
Maintenance facilities						X					
Substations			X			X		X			
Maintenance concept of dams			X			X					
Emergency plan			X		X	X					
Cost breakdown	X	X	X	X	X	X	X	X	X	X	X
EMI study	X	X	X	X	X	X	X	X	X	X	X
Loss history (including construction)	X	X	X	X	X	X	X	X	X	X	X

1. New replacement value (including all materials, wages, freight, customs duties and dues)
 - For risks that are transferring from the project phase to the operational phase, typically the project (CAR policy) sum insured is sufficient. However, in many cases the risk to be insured under a CECR policy is an existing, not a newly built construction, the definition and calculation of the sum insured is vitally important. The sums insured should not be less than the full cost of replacement of the insured items (New Replacement Value).
 - It is recognized that there are difficulties in calculating this value in the current market place due to the age of some insured properties and the fluctuation of prices depending on areas, technologies, materials and many other components that directly affect the sum insured.
 - Introduction of linear/volumetric unit prices as basis for the evaluation of sums insured as well as for claims evaluation.
2. Renewal - Sum insured to be examined and adjusted annually

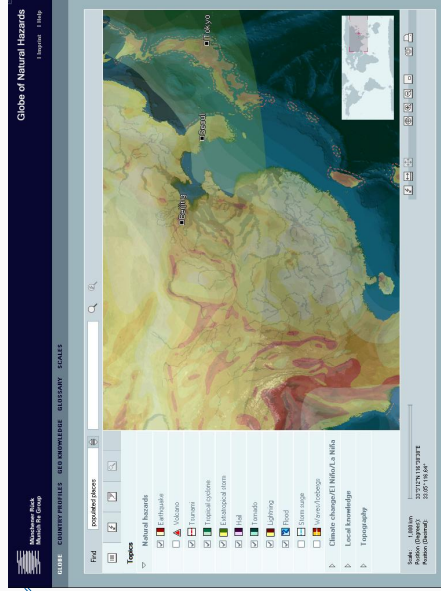
計價原則與方法 - 完工土木工程保險 MR's Pricing Methodology for CECR



Structure Types

Code no.	Project or structure	7000
5000	Roads, Airports and Railways	Galleries, Tunnels
5200	Roads	7100
5220	Roads and Highways through flat and/or mountainous terrain	Galleries, Tunnels
5400	Airports	7110
5400	Airports	Unlined galleries and tunnels
5410	Airports	7120
5410	Airports	Lined galleries and tunnels
5500	Railways through flat and/or mountainous terrain	7300
5500	Railways through flat and/or mountainous terrain	Tunnels submerged
5500	Railways through flat and/or mountainous terrain	Underground railway structures
6000	Hydraulic Structures, Dams, Harbours	7500
6000	Hydraulic Structures, Dams, Harbours	Caverns
6100	Hydraulic Structures	8200
6100	Hydraulic Structures	Bridges
6120	Canals-navigable	8210
6120	Canals-navigable	Beams Bridges and flyovers
6170	Harbours	8220
6170	Harbours	Arched Bridges
6175	Breakwaters	8230
6175	Breakwaters	Suspension bridges
6177	Jetties, terminals	8240
6177	Jetties, terminals	Cable-stayed bridges
6180	Dry docks	9000
6180	Dry docks	Sewerage Channels, Water Reservoirs, Water Supply
6200	Dams	9100
6200	Dams	Sewer systems
6210	Earth dams	9110
6210	Earth dams	Sewer systems
6220	Concrete Dams	9400
6220	Concrete Dams	Water Reservoirs
6225	Concrete Dams - gravity type	9420
6225	Concrete Dams - gravity type	Water reservoir below ground
6225	Concrete Dams - arch type	9600
6225	Concrete Dams - arch type	Water Supply systems
6300	Hydro-Power projects	9600
6300	Hydro-Power projects	Water Supply systems complete
6310	Hydro-Power projects complete	

Globe of Natural Hazards - NATHAN



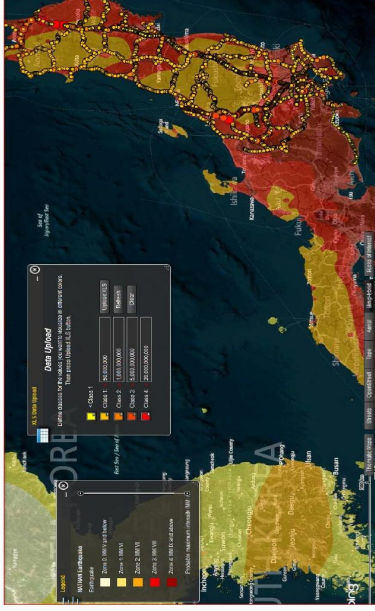
Pricing Considerations

- Original design criteria for windstorm, inundation and earthquake
- Special exposure to inundation, windstorm, landslide, earthquake etc due to the exposed location of the risk
- The age and condition of the insured object (maintained regularly & adequately?)
- Loss experience during operation and construction period

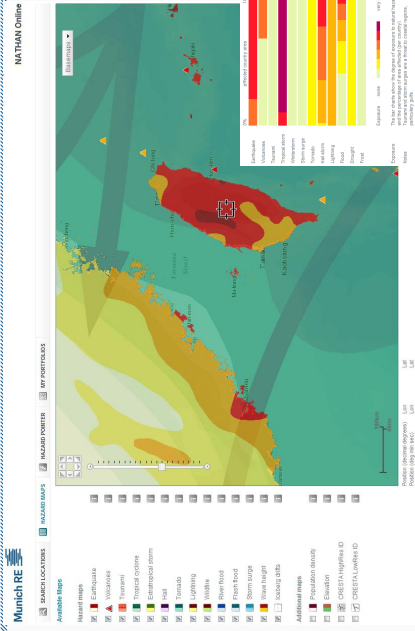
Example - JR East, Japan Earthquake Pricing

No	Insured Object	Occupancy	Country	Longitude	Latitude	Budget Zone Type	Budget Zone Code	TSI	Quality factor Q1, Q2, Q3	BaseRate System	Rate System % incl. Co-ins.
1	Shizuoka	9510 Rail track network	Japan	139.594	34.9714	22205	CHESTAI	250,265,519	1.1	5,319	6,4150
2	Shizuoka	9510 Rail track network	Japan	139.594	35.4427	22205	CHESTAI	250,265,519	1.1	5,319	6,4150
3	Shizuoka	9510 Rail track network	Japan	139.593	35.0023	22205	CHESTAI	250,265,519	1.1	5,344	6,3754
4	Shizuoka	9510 Rail track network	Japan	139.594	35.0377	22205	CHESTAI	24,170,001	1.1	5,152	6,1880
5	Shizuoka	9510 Rail track network	Japan	139.593	35.0377	22205	CHESTAI	24,170,001	1.1	5,152	6,1880
6	Shizuoka	9510 Rail track network	Japan	139.593	35.4419	22205	CHESTAI	25,164,601	1.1	5,152	6,1880
7	Shizuoka	9510 Rail track network	Japan	139.593	35.4419	22205	CHESTAI	25,164,601	1.1	5,152	6,1880
8	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
9	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
10	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
11	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
12	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
13	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
14	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
15	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
16	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
17	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
18	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
19	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
20	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
21	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
22	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
23	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
24	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
25	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
26	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
27	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
28	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
29	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
30	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
31	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
32	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
33	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
34	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
35	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
36	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
37	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
38	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
39	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
40	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
41	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
42	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
43	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
44	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614
45	Shizuoka	9510 Rail track network	Japan	139.593	35.0239	22205	CHESTAI	120,283,596	1.1	5,176	6,1614

Example - JR East, Japan TSI : about NT\$3.5 trillion (for 7 railway lines) Over 17,400 exact geo-coded spots



NATHAN NatCat - Taiwan



Recommendation to UWs

- Apply MR or local standard CECR Policy, or MR CECR-AR
- Sum Insured should be New Replacement Value (NRV)
 - *Introduction of linear/volumetric unit prices as basis for the evaluation of sums insured as well as for claims evaluation.*
- Maximum period of insurance: 12 months
- Be cautious to the structures completed before 2005 (the latest building code)
- Avoid mountainous terrains and risk along the dangerous rivers
- Introduction of **loss/event limit**, particularly in locations which have a high natural catastrophe exposure such as earthquake, storm, flood, debris flow, landslide etc.
- Sound underwriting assessment and adequate premium consideration

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