ISSN 0917-057X

December 2010
防災科学技術研究所研究資料　第350号
Technical Note of the National Research Institute
for Earth Science and Disaster Prevention　No.350

アジア防災科学技術情報基盤（DRH-Asia）コンテンツ集

Collection of Technology and Knowledge Information by the Disaster Reduction Hyperbase – Asian Application (DRH – Asia)

独立行政法人
防災科学技術研究所
National Research Institute for Earth Science and Disaster Prevention, Japan

防災科学技術研究所研究資料　第三五〇号　アジア防災科学技術情報基盤（DRH-Asia）コンテンツ集　防災科学技術研究所

National Research Institute for Earth Science and Disaster Prevention
Tennodai 3-1, Tsukuba, Ibaraki, 305-0006 Japan

防災科学技術研究所研究資料

第 274 号　強震ネットワーク　強震データ　Vol. 18（平成 16 年 No. 3）（CD-ROM）．2005 年 3 月発行
第 275 号　全国を対象とした確率論的地震動予測地図作成手法の検討（付録 CD-ROM 1 枚）　393pp．2005 年 8 月発行
第 276 号　シンポジウム「日本の地震観測の現状と将来展望」講演速記録集　90pp．2005 年 9 月発行
第 277 号　地すべり地形分布図 第 24 集「姫路」15 葉（5 万分の 1）．2005 年 11 月発行
第 278 号　地すべり地形分布図 第 25 集「松江・高梁」26 葉（5 万分の 1）．2005 年 12 月発行
第 279 号　三陸沖北部の地震を想定した地震動予測地図作成手法の検討（CD-ROM）．2005 年 9 月発行
第 280 号　長岡における積雪観測資料 (29)（2004 年 11 月～ 2005 年 4 月）　39pp．2005 年 11 月発行
第 281 号　琵琶湖西岸断層帯の地震を想定した地震動予測地図作成手法の検討（CD-ROM）．2005 年 10 月発行
第 282 号　高山・大原断層帯の地震を想定した地震動予測地図作成手法の検討（CD-ROM）．2005 年 11 月発行
第 283 号　石狩低地東縁断層帯の地震を想定した地震動予測地図作成手法の検討（CD-ROM）．2005 年 12 月発行
第 284 号　地震ハザードステーション J-SHIS DVD 2005 年版（DVD）．2005 年 12 月発行
第 285 号　地すべり地形分布図 第 26 集「浜田・大社」17 葉（5 万分の 1）．2006 年 1 月発行
第 286 号　地すべり地形分布図 第 27 集「広島」 16 葉（5 万分の 1）．2006 年 2 月発行
第 287 号　強震ネットワーク　強震データ　Vol. 19（平成 17 年 No. 1）（CD-ROM）．2006 年 3 月発行
第 288 号　強震ネットワーク　強震データ　Vol. 20（平成 17 年 No. 2）（CD-ROM）．2006 年 3 月発行
第 289 号　新庄における気象と降積雪の観測 (2004 / 05 年冬期) 41pp．2006 年 3 月発行
第 290 号　地すべり地形分布図 第 28 集「山口」21 葉（5 万分の 1）．2006 年 3 月発行
第 291 号　地すべり地形分布図 第 29 集「岡山及丸亀」15 葉（5 万分の 1）．2006 年 3 月発行
第 292 号　日本の火山ハザードマップ集（付録 DVD 2 枚）　20pp．2006 年 3 月発行
第 293 号　水害に対する住民の防災意識と防災行動等に関するアンケート調査資料集（CD-ROM）．2006 年 3 月発行
第 294 号　山崎断層帯の地震を想定した地震動予測地図作成手法の検討（CD-ROM）．2006 年 3 月発行
第 295 号　中央構造線断層帯（金剛山地東縁･和泉山脈南縁）の地震を想定した地震動予測地図作成手法の検討 (CD-ROM)．2006 年 3 月発行
第 296 号　日向灘の地震を想定した地震動予測地図作成手法の検討（CD-ROM）．2006 年 3 月発行
第 297 号　地すべり地形分布図 第 30 集「徳島・剣山」23 葉（5 万分の 1）．2006 年 9 月発行
第 298 号　神奈川県西部山北南高感度地震観測井の掘削および坑内検層　32pp．2006 年 10 月発行
第 299 号　地すべり地形分布図 第 31 集「高知・窪川」17 葉（5 万分の 1）．2007 年 3 月発行
第 300 号　強震ネットワーク　強震データ　Vol. 21（平成 18 年 No. 1）（CD-ROM）．2007 年 3 月発行
第 301 号　強震ネットワーク　強震データ　Vol. 22（平成 18 年 No. 2）（CD-ROM）．2007 年 3 月発行
第 302 号　長岡における積雪観測資料 (30)（2005. 11 ～ 2006. 3）　37pp．2007 年 3 月発行
第 303 号　2003 年十勝沖地震の観測記録を用いた強震動予測手法の検証（CD-ROM 版）．2007 年 3 月発行
第 304 号　アジア・太平洋国際地震・火山観測網構築計画に関する事前調査　96pp．2007 年 3 月発行
第 305 号　新庄における気象と降積雪の観測 (2005/06 年冬期) 45pp．2007 年 3 月発行
第 306 号　地震荷重を受ける減肉配管の破壊過程解明に関する研究報告書　78pp．2007 年 3 月発行
第 307 号　根尾谷断層水鳥地区における深層ボーリング調査と地殻応力測定（付録 CD-ROM）33pp．2007 年 8 月発行
第 308 号　地すべり地形分布図 第 32 集「松山・宇和島」26 葉（5 万分の 1）．2007 年 9 月発行
第 309 号　地すべり地形分布図 第 33 集「大分」18 葉（5 万分の 1）．2007 年 11 月発行
第 310 号　Geological and Logging Data of the NIED wells, Japan -Active fault, Seismogenic zone, Hingeline － 29pp．2008 年 3 月発行
第 311 号　新庄における気象と降積雪の観測 (2006/07 年冬期)　35pp．2007 年 11 月発行
第 312 号　地すべり地形分布図 第 34 集「延岡・宮崎」19 葉（5 万分の 1）．2008 年 3 月発行
第 313 号　微動探査観測ツールの開発 その 1 －常時微動解析ツール－（付録 CD-ROM）133pp．2008 年 3 月発行
第 314 号　距離減衰式による地震動予測ツールの開発 (付録 CD-ROM) 66pp．2008 年 3 月発行
第 315 号　地すべり地形分布図 第 35 集「八代」18 葉（5 万分の 1）．2008 年 3 月発行
第 316 号　地すべり地形分布図 第 36 集「熊本」15 葉（5 万分の 1）．2008 年 3 月発行
第 317 号　2004 年新潟県中越地震による斜面変動分布図（付録 CD-ROM）37pp．2008 年 3 月発行
第 318 号　強震ネットワーク　強震データ　Vol. 23（平成 19 年 No. 1）（CD-ROM 版）．2008 年 3 月発行
第 319 号　強震ネットワーク　強震データ　Vol. 24（平成 19 年 No. 2）（CD-ROM 版）．2008 年 3 月発行
第 320 号　平成 17 年度大都市大震災軽減化特別プロジェクトⅡ 木造建物実験 - 震動台活用による構造物の耐震性向上研究 -（付録 CD-ROM）152pp．2008 年 3 月発行

表紙写真・・・・・アジア防災科学技術情報基盤（DRH-Asia）
ウェブサイト（http://drh.edm.bosai.go.jp）のトップページ

防災科学技術研究所研究資料

第 321 号　平成 17 年度大都市大震災軽減化特別プロジェクト 実大 6 層 RC 建物実験報告書（付録 CD-ROM）46pp．2008 年 3 月発行
第 322 号　地すべり地形分布図 第 37 集「福岡・中津」24 葉（5 万分の 1）．2008 年 8 月発行
第 323 号　地すべり地形分布図 第 38 集「長崎・唐津」29 葉（5 万分の 1）．2008 年 9 月発行
第 324 号　地すべり地形分布図 第 39 集「鹿児島」24 葉（5 万分の 1）．2008 年 11 月発行
第 325 号　地すべり地形分布図 第 40 集「一関・石巻」19 葉（5 万分の 1）．2009 年 2 月発行
第 326 号　新庄における気象と降積雪の観測 (2007/08 年冬期）　33pp．2008 年 12 月発行
第 327 号　防災科学技術研究所 45 年のあゆみ（付録 DVD）224pp．2009 年 3 月発行
第 328 号　地すべり地形分布図 第 41 集「盛岡」18 葉（5 万分の 1）．2009 年 3 月発行
第 329 号　地すべり地形分布図 第 42 集「野辺地・八戸」24 葉（5 万分の 1）．2009 年 3 月発行
第 330 号　地域リスクとローカルガバナンスに関する調査報告　53pp．2009 年 3 月発行
第 331 号　E-Defense を用いた実大 RC 橋脚（C1-1 橋脚）震動破壊実験研究報告書 -1970 年代に建設された基部曲げ破壊タイプの RC 橋脚震動台実験 -（付録 DVD）　107pp．2009 年 1 月発行
第 332 号　強震ネットワーク　強震データ　Vol. 25（平成 20 年 No. 1）（CD-ROM 版）．2009 年 3 月発行
第 333 号　強震ネットワーク　強震データ　Vol. 26（平成 20 年 No. 2）（CD-ROM 版）．2009 年 3 月発行
第 334 号　平成 17 年度大都市大震災軽減化特別プロジェクトⅡ 地盤基礎実験 - 震動台活用による構造物の耐震性向上研究 -（付録 CD-ROM）　62pp．2009 年 10 月発行
第 335 号　地すべり地形分布図 第 43 集「函館」14 葉（5 万分の 1）．2009 年 12 月発行
第 336 号　全国地震動予測地図作成手法の検討（７分冊＋ CD-ROM 版）．2009 年 11 月発行
第 337 号　強震動評価のための全国深部地盤構造モデル作成手法の検討（付録 DVD）．2009 年 12 月発行
第 338 号　地すべり地形分布図 第 44 集「室蘭・久遠」21 葉（5 万分の 1）．2010 年 3 月発行
第 339 号　地すべり地形分布図 第 45 集「岩内」14 葉（5 万分の 1）．2010 年 3 月発行
第 340 号　新庄における気象と降積雪の観測 (2008/09 年冬期) 33pp．2010 年 3 月発行
第 341 号　強震ネットワーク　強震データ　Vol. 27（平成 21 年 No. 1）（CD-ROM 版）．2010 年 3 月発行
第 342 号　強震ネットワーク　強震データ　Vol. 28（平成 21 年 No. 2）（CD-ROM 版）．2010 年 3 月発行
第 343 号　阿寺断層系における深層ボーリング調査の概要と岩石物性試験結果（付録 CD-ROM）15pp．2010 年 3 月発行
第 344 号　地すべり地形分布図 第 46 集「札幌・苫小牧」19 葉（5 万分の 1）．2010 年 7 月発行
第 345 号　地すべり地形分布図 第 47 集「夕張岳」16 葉（5 万分の 1）．2010 年 8 月発行
第 346 号　長岡における積雪観測資料（31）（2006/07 , 2007/08 , 2008/09 冬期）47pp．2010 年 9 月発行
第 347 号　地すべり地形分布図 第 48 集「羽幌・留萌」17 葉（5 万分の 1）．2010 年 11 月発行
第 348 号　平成 18 年度 大都市大震災軽減化特別プロジェクト実大 3 層 RC 建物実験報告書（付録 DVD) 68pp．2010 年 8 月発行
第 349 号　防災科学技術研究所による深層掘削調査の概要と岩石物性試験結果（足尾・新宮・牛伏寺）（付録 CD-ROM）12pp．2010 年 8 月発行

防災科学技術研究所研究資料 第 350 号

平成 22 年 12 月 24 日 発行

編集兼 独 立 行 政 法 人
発行者 防 災 科 学 技 術 研 究 所
〒 305-0006
茨 城 県 つ く ば 市 天 王 台 3 － 1
電話 (029)863-7635
http://www.bosai.go.jp/

印刷所　松 枝 印 刷 株 式 会 社
茨城県常総市水海道天満町 2438

※防災科学技術研究所の刊行物については，ホームページ（http://www.bosai.go.jp/library/publication.htm）をご覧下さい．

Technical Note of the National Research Institute for Earth Science and Disaster Prevention, No. 350 ; December, 2010

Collection of Technology and Knowledge Information by the Disaster Reduction Hyperbase – Asian Application (DRH-Asia)

Edited by Hiroyuki KAMEDA*, Hiroaki NEGISHI*, Koichi SHIWAKU*, Naho IKEDA*, and Miho TOKUTAKE*

Earthquake Disaster Mitigation Research Center, National Research Institute for Earth Science and Disaster Prevention, Japan

Abstract

Disaster Reduction Hyperbase-Asian Application (DRH-Asia) is a facility disseminating disaster reduction technology and knowledge. While DRH-Asia is focused on Asian context, it is ready to accommodate contributions from other regions to enhance cross-regional collaboration. DRH-Asia is originally operated as Web-based database system and the contents are provided via Internet. The operation of this web-database has started in 2006. About 60 technologies have been submitted and 38 of them have passed through the facilitation process and registered in DRH database (as of October 2010). This volume is the collection book of the DRH contents registered in the DRH-Asia Web-database system, which consists of the main contents of each technologies represented by DRH Template form. There are index lists by the category of technologies, hazards focused, and countries where the technology originated in the end of this volume, to identify the target DRH contents easily. In the original DRH-Asia Web database, not only DRH Template documents printed in this volume but also various kinds of advanced data (movie, executable application, etc.) can be referred. The readers are encouraged to access to the DRH-Asia Website (http://drh.edm.bosai.go.jp), too.

Key words : Disaster reduction technology, DRH-Asia, Implementation strategy, Database

Contents

Foreword 7

Collection of DRH-Asia Contents 9

DRH 1 : Earthquake Early Warning and its Application to Mitigate Human and Social Damages 10
Hiroaki Negishi

DRH 2 : Effective Disaster Reduction Education by Making Simple Equipments and Experimental Apparatus from Accessible Materials 16
Hiroaki Negishi and Yasuyuki Nohguchi

DRH 3 : Application of Spatial Temporal GIS for Earthquake Disaster Recovery Service 22
Hiroyuki Yamada, Takashi Furuto and Shigeru Kakumoto

DRH 4 : Disaster Protection Technology of Traditional Wooden cultural Buildings 27
Yasuhiro Araki

DRH 6 : Proposal to Realize RARMIS (Risk Adaptive Regional Management Information System) Concept by Spatial Temporal Information System DiMSIS-EX and Some Case Studies - Toward Collaborative Realization of Common Software (System) Platform for Disaster Prevention (CSPDP) - 37
Shigeru Kakumoto, Takashi Furuto, Hiroyuki Yamada, Mitsuaki Sasaki and Koichi Shiwaku

DRH 8 : Indigenous Knowledge from Japan Experience: Prevention, Damage Reduction and Erosion Control by Flood Disaster 44
Yukiko Takeuchi, Hiroyuki Kameda, Rajib Shaw and Naho Ikeda

DRH 10 : Application of Mangrove Forest for Countermeasure Against Tsunami Disaster 48
Dinar Catur Istiyanto

DRH 11 : Rediscovery and Revival of Traditional Earthquake-Resistant Techniques in Algeria: The Casbah of Algiers (Algeria). 55
Amina Aicha Abdessemed-Foufa and Djillali Benouar

DRH 12 : Tsunami Disaster Mitigation Technique by Coastal Greenbelt 62
Tetsuya Hiraishi

DRH 13 : Integrated Natural Risk Reduction through a Sustainable Cities Programme 66
Julio Kuroiwa

DRH 15 : Village Tank Cascade Systems of Sri Lanka 78
C.M.Madduma Bandara

DRH 16 : Stilt House Building Technology for Flood Disaster Reduction in Flood-prone Areas 84
Weihua Fang and Fei He

DRH 17 : Indigenous Knowledge on Flood Risk Management in Bangladesh **89**
Muhammad Saidur Rahman

DRH 18 : Bamboo T-shelter for Post Disaster Reconstruction **95**
Atsushi Iizuka, T. Shigemura and T. Asai

DRH 19 : Effective Cyclone Early Warning Dissemination at Community Level **99**
Muhammad Saidur Rahman

DRH 22 : Process for Community Acceptance of Earthquake Technology --- UNCRD Experiences Applying NSET Approach of Shaking-table Demonstration --- **105**
Shoichi Ando, Phong Van G. Tran, Hayato Nakamura and Amod M. Dixit

DRH 23 : Engineering of Non-Engineered Masonry Houses for Better Earthquake Resistance in Indonesia **111**
Ir Teddy Boen and Krishna S. Pribadi

DRH 24 : Social Skills Required to the Researchers Ensuring for Acceptability to Disaster Area **116**
Tomohide Atsumi

DRH 25 : Earthquake Risk Reduction and Education **121**
Farokh Parsizadeh and Mohsen-Ghafory Ashtiany

DRH 26 : Disaster Management Support System by Utilizing Satellites under the Framework of "Sentinel Asia" **129**
Takayuki Nakamura

DRH 28 : Community Based Disaster Risk Reduction (CBDRR) **135**
Krishna S. Pribadi, Teti Argo and Wayan Sengara

DRH 29 : Indigenous Knowledge for Water Management and Drought Mitigation in India **141**
Vinod K. Sharma

DRH 33 : Numerical Model for Tsunami Inundation and Making Tsunami Hazard Map **147**
Fumihiko Imamura

DRH 36 : Traditional Construction Method: the Saihiro Itabame Panel Dam **152**
Masahiro Goto

DRH 38 : Promoting Earthquake Resistant School Buildings in Japan - Policies, National Subsidies and Prioritization of Vulnerable School Buildings - **156**
Takashi Fujii

DRH 39 : RADIUS Program for Earthquake Damage Estimation **164**
Kenji Okazaki

DRH 40 : Nonstructural Seismic Retrofitting for School Buildings in Japan -Publication of a Reference Book - **172**
Koichi Shinpo, Masao Yamakawa and Takayuki Nakamura

DRH 41 : Seismic Retrofitting for School Buildings in Japan- Publication of a Reference Book - **177**
Masao Yamakawa, Koichi Shinpo and Takayuki Nakamura

DRH 44 : Dujiangyan Project **183**
Weihua Fang, Xingchun Zhong, Fei He and Hong Xu

DRH 45 : Karez Technology for Drought Disaster Reduction **188**
Weihua Fang, Fei He and Hong Cheng

DRH 48 : Experiences Sharing and School Disaster Education: Implementation of Essay and Drawing Competition as School Disaster Education **192**
Koichi Shiwaku, Muhammad Shakeel, Yukiko Takeuchi, Rajib Shaw, Ayako Fujieda and Jishnu Subedi

DRH 49 : Hazards Mapping and Assessment for Effective Community-based Disaster Risk Management or "READY" Project **200**
Lenie Duran-Alegre and Renato U. Solidum, Jr.

DRH 50 : Safety Confirmation System using GIS and QR code **211**
Koichi Shiwaku, Mitsuaki Sasaki, Shigeru Kakumoto and Takashi Furuto

DRH 51 : Effective International Communication Method with Video Conference Network System **219**
Tatsuo Narafu

DRH 53 : Implementation of Folk-Song Program in Disaster Awareness Raising **224**
Binaya Kumar Mishra and Kaoru Takara

DRH 56 : Low-cost and Adaptive Technology to Support a Community-based Landslide Early Warning System in Developing Countries **230**
Teuku Faisal Fathani, Dwikorita Karnawati, Kyoji Sassa and Hiroshi Fukuoka

DRH 57 : University-Community Collaborative Education Model for Developing Resilient Society in the Areas Vulnerable for Geological Disasters, in Indonesia. **239**
Dwikorita Karnawati, Teuku Faisal Fathani, Wahyu Wilopo, Budi Andayani, Kyoji Sassa and Hiroshi Fukuoka

DRH 58 : School-Catchments Network for Water-related Disaster Prevention **249**
Masato Kobiyama

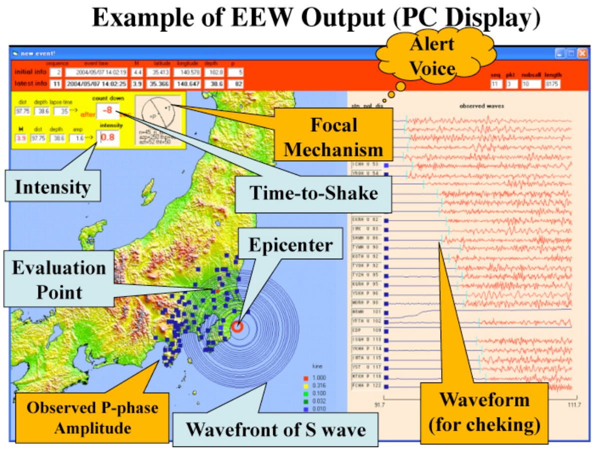
Appendix : DRH Template (ver.7.3) **255**

Index A : Category Index **263**

Index B : Hazard Index **264**

Index C : Country/Region Index **265**

Implementation Oriented Technology (IOT)



Information on earthquake early waning system (DRH 1)

Shake-table demonstration (DRH 22)

Disaster management training using safety confirmation system by GIS and QR code (DRH 50)

Process Technology (PT)

Drawing competition as school disaster education (DRH 48)

International communication with video conference system (DRH 51)

Tsunami evacuation drill (DRH 49)

Transferable Indigenous Knowledge (TIK)

Traditional step well for rain water harvesting (DRH 29)

Maximum reuse and minimum replace for traditional wooden cultural building (DRH 4)

Foreword

This document is a collection of disaster reduction technology information compiled in the Disaster Reduction Hyperbase–Asian Application (DRH-Asia). DRH-Asia is an interactive web-based facility constructed to disseminate appropriate technology for disaster risk reduction. It is a major product of the DRH Initiative whose basis was the DRH-Asia Project conducted in April 2005-March 2006 (Phase I) and July 2006-March 2009 (Phase II). EDM-NIED (Earthquake Disaster Mitigation Research Center of the National Research Institute for Earth Science and Disaster Prevention) served as the lead institution in this international project. MEXT, CAO, and Kyoto University collaborated as core institutions in managing the project.

The DRH development has a clear policy basis. At the UN World Conference on Disaster Reduction (WCDR), January 2005, the Japanese government proposed international promotion of "Disaster reduction portfolio", effective information platforms for disaster risk reduction. The proposal was intended to contribute to implementing the Hyogo Frame for Action 2005-2015 adopted at the WCDR. The DRH Project was launched to substantiate the proposal. On this basis, the project was operated in close collaboration with UN International Strategy for Disaster Reduction (UN/ISDR) Secretariat, particularly with its Information Management Unit.

DRH-Asia was designed as a vehicle to compile and disseminate "useful" disaster reduction technology and knowledge and to facilitate its implementation. To realize this objective, the DRH Project team practiced various challenging tasks including conceptualization of useful DRR technology, definition of DRH attributes, compilation of DRH contents, and establishing international ties to promote such activities. A key issue was how to make DRH a significant tool that will help fill gaps between research and practice, the notion being referred to as "implementation strategy". Another important component of the DRH Initiative was the EDM-NIED International Team who constructed a web system Tech-DRAW, which was applied as the DRH-Asia platform, a powerful tool to substantiate the DRH philosophy.

Through the DRH Initiative, new concept developments and system productions were realized, including "implementation technology", "implementation oriented technology (IOT)", "process technology (PT)", "transferable indigenous knowledge (TIK)", "understandable, doable, and shown to be useful (DRH contents acceptance criteria)", "multilingual operation using Tech-DRAW", etc.

These activities led to the current state of DRH-Asia (http://drh.edm.bosai.go.jp/), operating stably, now with thirty-eight DRH Contents registered in the DRH Database. Continuing efforts are being taken for increasing the number of registered DRH Contents and for disseminating them. Actions are also being taken to offer the Tech-DRAW software to assist establishing national DRH systems.

While all disaster reduction technology information is readily accessible on the DRH-Asia web site, it was judged appropriate to publish an exhaustive collection of all registered DRH contents in a hard copy to publicize DRH-Asia where internet is not available as well as to invite the readers to an initial visual contact with the DRH contents. It is hoped that this document will be a good guide for those who are interested in approaching useful disaster reduction technology information.

Finally, it is emphasized that successful management of the DRH Initiative was enabled by many institutional as well as personal cooperation and supports. The DRH-Asia Project (Phase I and Phase II) was financially supported by MEXT, government of Japan. Under this framework, international participants dedicated their time and efforts for realizing DRH-Asia as our common property. They were from eleven countries (Asia: Bangladesh, China, India, Indonesia, Iran, Japan, Nepal, Philippines, Sri Lanka / Africa: Algeria / South America: Peru) and international institutions including UN-ISDR, EC/JRC, etc.

The true fruits of DRH-Asia are the set of disaster risk reduction technology and knowledge compiled in DRH Database. They have been contributed by researchers and NGO practitioners from Algeria, Bangladesh, China, India, Indonesia, Iran, Japan, Nepal, Peru, Philippines, and Sri Lanka. Edition of this volume relied very much on these accomplishments.

All these contributions are gratefully acknowledged.

October 30, 2010

EDM-NIED Editorial Team
Hiroyuki Kameda, Hiroaki Negishi, Koichi Shiwaku, Naho Ikeda, and Miho Tokutake

Collection of DRH – Asia Contents

DRH ID is applied to each contents in order of proposing, so the DRH ID that does not exist in this volume is still under facilitation process at the time of the publication.

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 1)

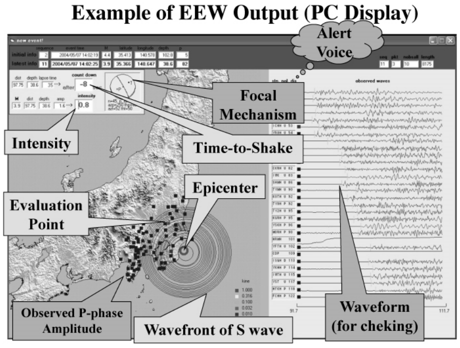
I. Heading

1. Title

Earthquake Early Warning and its Application to Mitigate Human and Social Damages

ID:	DRH 1
Hazard:	Earthquake, Tsunami
Category:	Implementation Oriented Technology (IOT)
Proposer:	Hiroaki Negishi
Country:	JAPAN;
Date posted:	07 January 2008
Date published:	29 September 2010

Example of EEW Output (PC Display)



Earthquake Early Warning system in Japan.

Contact
Hiroaki NEGISHI (Senior Researcher)
National Research Institute for Earth Science and Disaster Prevention,
3-1, Tenno-dai, Tsukuba, Ibaraki, 305-0006, Japan
E-mail: negishi@bosai.go.jp

2. Major significance / Summary

By applying quick determination of epicenter and magnitude of an earthquake within a few seconds after its occurrence, we may be able to take urgent action to mitigate damages before arriving strong motion and/or Tsunami. Such information can save not only human lives (e.g., evacuation from crushing death cause by falling furniture), but also social and economic loss (e.g., to minimize defective units at instrument factory)

3. Keywords

Earthquake Early Warning (EEW), immediately before, alarm, automated control

II. Categories

4. Focus of this information

Implementation Oriented Technology (IOT)

5. Anticipated Users

5-1. Practitioners: Administrative officers, National governments and other intermediate government bodies (state, prefecture, district, etc.), Commercial entrepreneurs, Financing and insurance business personnel, Information technology specialists
5-2. Other users: Motivated researchers

6. Hazards focused

Earthquake, Tsunami

7. Elements at risk

Human lives, Business and livelihoods, Information and communication system, Urban areas, Coastal areas

III. Contact Information

8. Proposer(s) information (Writer of this template)

Hiroaki NEGISHI (Senior Researcher)
National Research Institute for Earth Science and Disaster Prevention,
3-1, Tenno-dai, Tsukuba, Ibaraki, 305-0006, Japan
E-mail: negishi@bosai.go.jp

9. Place where the technology/knowledge originated

JAPAN;

10. Names and institutions of technology/knowledge developers

National Research Institute for Earth Science and Disaster Prevention,
Japan Meteorological Agency

11. Title of relevant projects if any

The Leading Project "Research Project for the Practical Use of Real-time Earthquake Information networks" by Ministry of Education, Culture, Sports, Science and Technology (MEXT) and NIED, JAPAN

12. References and publications

Horiuchi, S., H. Negishi, A. Kana, A. Kamimura, and Y. Fujinawa, “An Automatic Processing System for Broadcasting Earthquake Alarms”, Bulletin of Seismological Society of America, Vol. 95, No. 2, 708-718, 2005.

Negishi, H., and S. Yamamoto, Earthquake early warning system at a local government and a private company in Japan, Proceedings of 1st European Conference on Earthquake Engineering and Seismology, Paper No.741, 1-7, 2006.

Earthquake Early Warnings in Japan (Japan Meteorological Agency):

http://www.jma.go.jp/jma/en/Activities/eew.html

Research on the transmission and utilization of real-time earthquake information (“Endeavor research project” by NIED, 2002-2006) http://www.bosai.go.jp/tokutei/reis/eng/index.htm

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

An all-Japan dense seismic network (Hi-net) was established after the 1995 Kobe Earthquake, and the development of the earthquake early warning system of a nationwide scale was conducted. Since EEW should be actually spread to the society, we need to investigate not only scientific side of EEW but also various kinds of applications using EEW information, such as automatic control unit, information distribution system to quite a lot of houses at the same time, and effective pictogram and sound for announce.

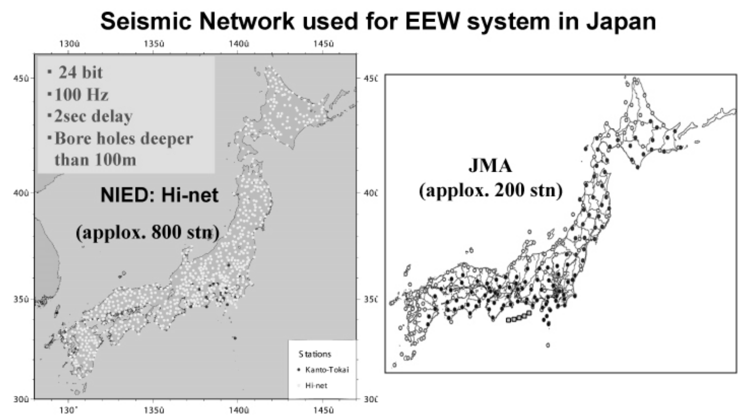


Fig. 1 All-Japan seismic network used for Earthquake Early Warning system in Japan. National Research Institute for Earth Science and Disaster Prevention (NIED) and Japan Meteorological Agency (JMA) are operating about 1,000 seismic stations with real-time telemetry. These real-time monitoring data is processed automatically.

V. Description

15. Feature and attribute

Just a few seconds after a big earthquake occurs, EEW system using a seismic network provide the information about the forthcoming strong motion (predicted intensity and time to shake). The information is provided to people by sound and pictogram to press a prompt evacuation action. Moreover, the machine operation with the possibility of harming the person is stopped, and the equipment of the factory is also stopped before the economic loss occurs due to product of defective goods by strong motion, made by the information triggering.

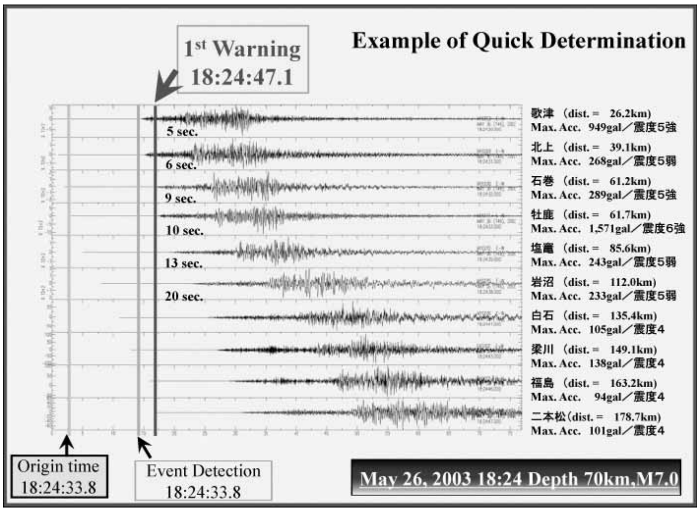


Fig. 2 Example of Earthquake Early Warning information broadcasted by our system. This event occurred in the offshore of Miyagi Prefecture, Tohoku, Japan in 26 May 2003. The rupture of this earthquake began at the depth of about 70 km, and 10.8 seconds after that the nearest station to the epicenter caught the P-wave. The first earthquake early warning information was sent momentarily at the time when P-wave reached the secondarily nearest station. As the result, we succeeded in giving a warning 10 to 20 seconds before the main shock hits to some major cities, such as Shiogama (about 13 seconds) and Sendai (about 16 seconds).

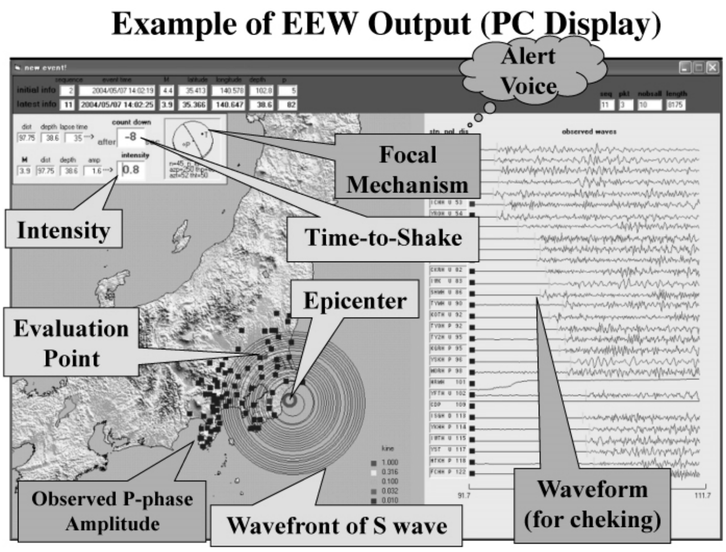


Fig. 3 Example of displayed information on EEW system. This window appear automatically just after receiving EEW information from EEW providing system via Internet, satellite broadcasting, or other kinds of communication line. Not only display but also sound and voice information is also provided.

16. Necessary process to implement

The processes can be divided roughly to three parts;
1) introduction and operation of EEW information generation system by seismic network system,
2) infrastructure of the information transmission, and
3) the system that inform alert to people and/or that control equipments automatically.

If dense and real-time seismic array already have been maintained and the communication network (e.g., Internet) is maintained widely, seismic network system is better for EEW since a lot of people and the enterprises can have the information at low cost.

17. Strength and limitations

Strength

1) The disaster mitigation effect is high because the alert provides before the strong motion and/or tsunami hits.
2) Since they know the earthquake information before the occurrence of network infrastructure damage, they can share important information and save and/or make back-up of their critical data. It is effective in the damage prevention of the business.
3) It is effective also in the factory that receives damage by the shake under operation.

Limitations:

1) It takes high cost for maintenance to put out EEW.
2) It is necessary to maintain the communication infrastructure in case of widely applying to a lot of people.
3) The education and the training to make it act promptly when the person is targeted are indispensable.

18. Lessons learned through implementation if any

During the pilot project by NIED (2002-2006), we had conducted the proving test for one local government (Fujisawa City, Kanagawa Prefecture) and one private company (Tokio Marie and Nichido Risk Consulting Co., Ltd.). This test clarified that this information is to contribute to not only saving human lives, but also saving properties of governments and companies, important data on computer system, Business Continuity Plan (BCP), and corporate value itself (Society's evaluation of taking anti-earthquake procedure). Please refer the attached paper (paper741.pdf) for details.

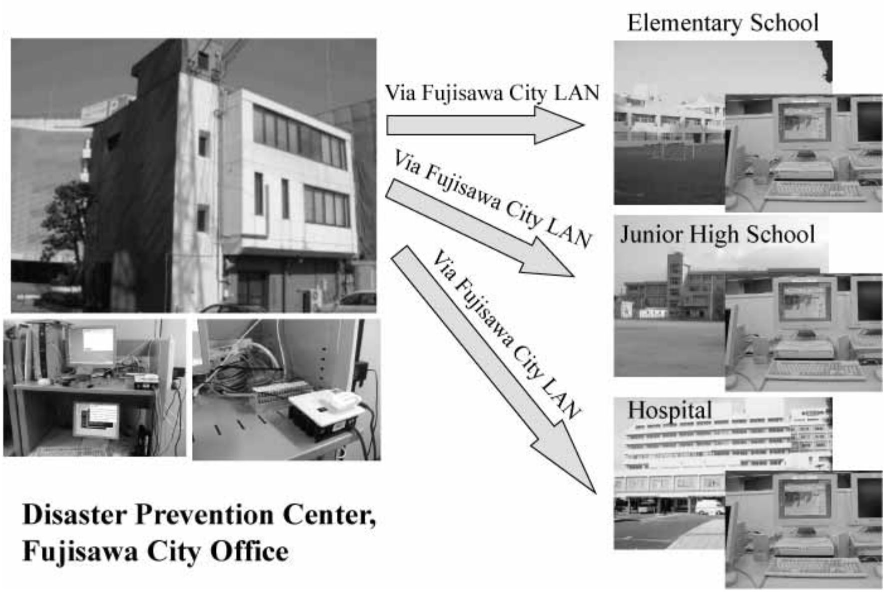


Fig. 4 Information providing of Earthquake Early Warning in Fujisawa City, Kanagawa, Japan.

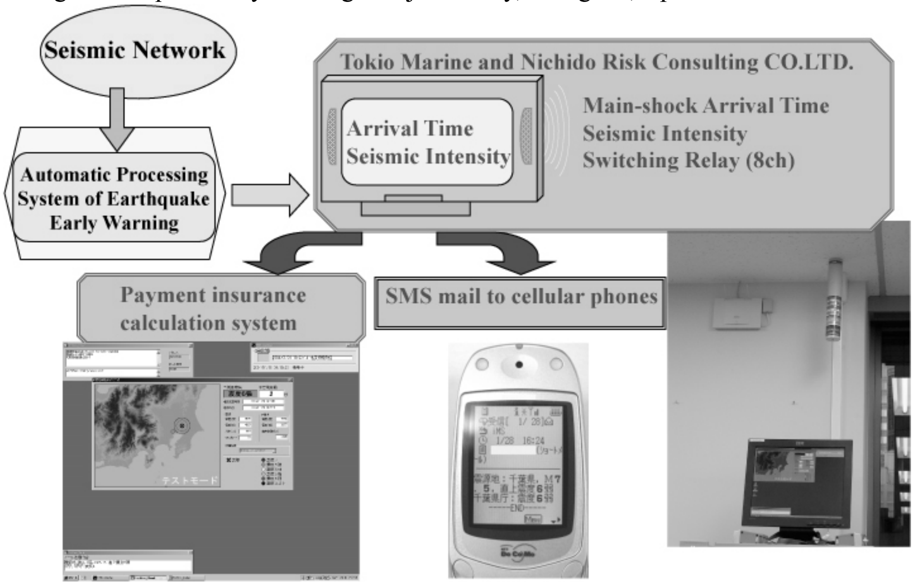


Fig. 5 The outline of the Earthquake Early Warning System in Tokio Marine and Nichido Risk Consulting Co. Ltd.

VI. Resources required

19. Facilities and equipments required

A real-time telemetered seismic network as wide and uniform as possible is needed. One or two personal computers (CPU power and memory-size depend on the traffic of the waveform data) is necessary to process the telemetered data at the data center. The program source run on the PCs (Fortran 77) can be provided free of charge (contact to H.N.). The EEW information will be provided to users via network (e.g., Internet and/or leased line). A PC (windows) that calculates and display the predicted intensity and time-to-shake should be placed at each user. The specification is open to the public, and users can code programs for it by themselves, or get Windows software developed by NIED. The Japan Meteorological Agency (http://www.jma.go.jp/jma/indexe.html) and Real-time Earthquake Information Consortium (http://www.real-time.jp/ ; Japanese) have disclosed a method of using the data in various fields and a content teaching to people (to our regret now only Japanese).

it is necessary to conduct the test operation for half or one year to tune the parameters of auto-process until stable operation. Sometimes false alarm might be given until operation is steady. It is better to have the data of ground amplification factor and/or the seismic data set (hypocenter, magnitude and seismic intensity at your objective place of several earthquakes) prior to its installation. However, even if those data doesn't exist, necessary data can be obtained with this device by the test operation for one or several years.

20. Costs, organization, manpower, etc.

Because it costs too much to establish a wide and dense seismic network only for this system, it is not realistic. Therefore, this is a method for the country that has already maintained a real-time seismological network. If such a network has already been maintained, however, a minimum system can be united only by buying some PCs stand for the analysis and a PC for the display and sound. If you would install the automatic control unit to your equipments, the additional cost for the unit should be needed.

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
Real-time earthquake disaster prevention system in LSI manufacturing factory

E1-2. Place
Miyagi Oki Electric Industry Col.Ltd., Miyagi Prefecture, Japan

E1-3. Year
Since 2005

E1-4. Investor
Miyagi Oki Electric Industry Col.Ltd.

E1-5. People involved
K. Yoshioka, President, Miyagi Oki Electric Industry Col.Ltd., Y. Fujinawa, Executive Director, Real-time Earthquake Information Consortium

E1-6. Monetary costs incurred
Because it costs too much to establish a wide and dense seismic network only for this system, it is not realistic. If such a network has already been maintained, a minimum system can be united only by buying some PCs stand for the analysis and a PC for the display and sound. If you would install the automatic control unit to your equipments, the additional cost for the unit should be needed.

E1-7. Total workload required
If real-time seismic network and information distribution infrastructure already exist, it takes about one week to setup PCs, install the software and tune-up and customize the parameters. Software installation and parameter tuning should be executed by the well-versed specialists.

E1-8. Evidence of positive result
Normal operation and effectiveness were shown at the earthquake occurred on August 16th, 2005. Please access the following PDF file for details on this project.
Reference: Earthquake Early Warning (EEW) Disaster Mitigation System Protecting Semiconductor Plant
http://www.oki.com/en/csr/report/2006/pdf/OKI_CSR2006e_6_7.pdf

No.2

E2-1. Project name if available
Assistance of shelter action at earthquake and education on disaster in elementary school

E2-2. Place
Nagamachi elementary school, Miyagi Prefecture, Japan

E2-3. Year
Since 2003

E2-4. Investor
M. Motosaka, Professor, Tohoku University

E2-5. People involved
M. Motosaka, Professor, Tohoku University, Japan
Y. Fujinawa, Executive Director, Real-time Earthquake Information Consortium
M. Saito, Japan Meteorological Agency

E2-6. Monetary costs incurred
This system used the information from the Earthquake Early Warning providing system (see No.2). Only one Windows PC (cheaper than 1,000 US$) is needed. The software is provided from some commercial companies and institutions. The Internet fee is different according to the country.

E2-7. Total workload required
It takes only a few hours to install the software. Everyone who is versed in Windows-PC can set it up.

E2-8. Evidence of positive result
The student came to be able to take shelter in about three seconds by several-time training. Time from the occurrence of the Off Miyagi Earthquake to the shake of this place is estimated to be 16 seconds. Even if the earthquake occurs, the danger that the trained student injures is low.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

This contents was revised to focus on the EEW alert system on network warning materials, instead of both of on-site warning and network warning simultaneously in the previous version. This is due to avoid the misunderstanding of the introduction methods and effects of EEW technology (September 29, 2010).

Attached files:
> paper741.pdf (PDF - 1720 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

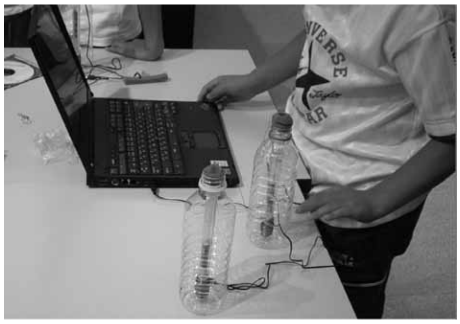
DRH-Asia Contents (DRH 2)

I. Heading

1. Title

Effective Disaster Reduction Education by Making Simple Equipments and Experimental Apparatus from Accessible Materials

ID:	DRH 2
Hazard:	Earthquake, Volcanic eruption, Other
Category:	Process Technology (PT)
Proposer:	Hiroaki Negishi
Country:	JAPAN;
Date posted:	07 January 2008
Date published:	09 June 2009



Experiment of PET-bottle seismometer

Contact
Hiroaki Negishi (Senior Researcher)
Yasuaki Nohguchi (Principal Senior Researcher)
Research Institute for Earth Science and Disaster Prevention (NIED)
3-1, Tenno-dai, Tsukuba, Ibaraki 305-0006, JAPAN
E-mail: negishi@bosai.go.jp (Negishi)
E-mail: nhg@bosai.go.jp (Nohguchi)

2. Major significance / Summary
Some kinds of experimental equipments (e.g., seismograph, liquefaction experiment bottle) can be made from accessible materials such as PET bottle, fine sand, copper wire, plastic tube, etc. It is possible to learn more effectively about mechanism of hazard and action to natural disaster by such handy-crafting and experiments than by only reading books and lecture.

3. Keywords
Experiment-based education, PET bottle, school education

II. Categories

4. Focus of this information
Process Technology (PT)

5. Anticipated Users
5-1. Practitioners: Community leaders (voluntary base), NGO/NPO project managers and staff, Teachers and educators
5-2. Other users: Local residents

6. Hazards focused
Earthquake, Volcanic eruption, Other (Liquefaction)

7. Elements at risk
Human lives, Urban areas, Coastal areas

III. Contact Information

8. Proposer(s) information (Writer of this template)

Hiroaki Negishi (Senior Researcher)
Yasuaki Nohguchi (Principal Senior Researcher)
Research Institute for Earth Science and Disaster Prevention (NIED)
3-1, Tenno-dai, Tsukuba, Ibaraki 305-0006, JAPAN
E-mail: negishi@bosai.go.jp (Negishi)
E-mail: nhg@bosai.go.jp (Nohguchi)

9. Place where the technology/knowledge originated

JAPAN;

10. Names and institutions of technology/knowledge developers

Hiroaki Negishi and Yasuaki Nohguchi, National Research Institute for Earth Science and Disaster Prevention

11. Title of relevant projects if any

12. References and publications

Nohguchi, Y. (2001) Liquefaction simulator "Licky" for science education, Report of the National Research Institute for Earth Science and Disaster Prevention, 61, 49-53 (in Japanese with English abstract)

13. Note on ownership if any

"Liquefaction bottle (Licky)" and "Bottled seismograph" are protected by the patent that Nohguchi and Negishi acquired respectively. However, there is no limitation in non-commercial use.

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

There have been occurred a lot of disasters by various hazards, such as earthquake, volcanic eruption, liquefaction, etc. It is subjacent to deal with disasters by them for people to know the mechanism and the factor of hazards. However reading books and/or classroom lecture bring only "knowledge" of hazards and disasters. In this document we introduce processes of educational experiments to know mechanism of hazard by using accessible materials and learning "knowledge related to actual action" from experiences.

In National Research Institute for Earth Science and Disaster Prevention (NIED), we have conducted various kinds of education activities on natural hazard, such as open-house to citizen, "Science Camp" for high school, junior high school, and elementary school students. Through those long-term educational activities we developed these teaching materials as a more effective natural disaster education method.

Now the outlines how to make these materials and the experimental methodology are introduced with the magazine for the teacher, and some companies are selling the materials as the kit for a school teaching materials.

V. Description

15. Feature and attribute

- Students make educational equipments (PET bottle seismograph, liquefaction bottle) with accessible materials under the lecture of lecturer and/or manual document.
- It is good for students to explain the meanings of structure and the relation to actual natural phenomena while crafting it.
- Students observe the waveform of ground motion, find the moment action when liquefaction occur by experimental equipments made by their own.
- The lecturer explains that these behaviors are the similar as natural phenomena, let them image they are inside the PET bottle, and let them realize their state objectively when they are in the disaster.
- As an application case, the lecturer teaches only a basic mechanism to students, and then they think about the structure of equipment based on the knowledge and make equipments by them. This is effective to high school and university students.

16. Necessary process to implement

- Refer to the attached documents for details of how to make PET bottle seismograph and Licky.
- Lecturer must understand the contents of equipments (both handicrafts type and what specialists are actually using) and analogies between them and actual natural phenomenon accurately.
- Students make it and experiment by themselves.
- The lecturer teaches not only experiments but also that the phenomena seen in PET bottle are as similar as in actual nature.
- The lecturer let the students imagine the situation they are in the hazard, and realize that the causes of the hazard seen in the model (e.g., moment phenomenon of liquefaction) is similar as in actual nature.

17. Strength and limitations

Strength:

- It is easy to understand the mechanisms for students because of making experimental equipments by them.
- The teaching material with movement catches students' interests.
- Handy introduction since a special material is not needed.

Limitation:

- There is an individual variation at the crafting pace, so smooth class progress might be difficult for the large number of people, such as in school class.
- Because the experiments are on the base and mechanism of hazards, it doesn’t relate directly to actual education of disaster mitigation.

18. Lessons learned through implementation if any

VI. Resources required

19. Facilities and equipments required

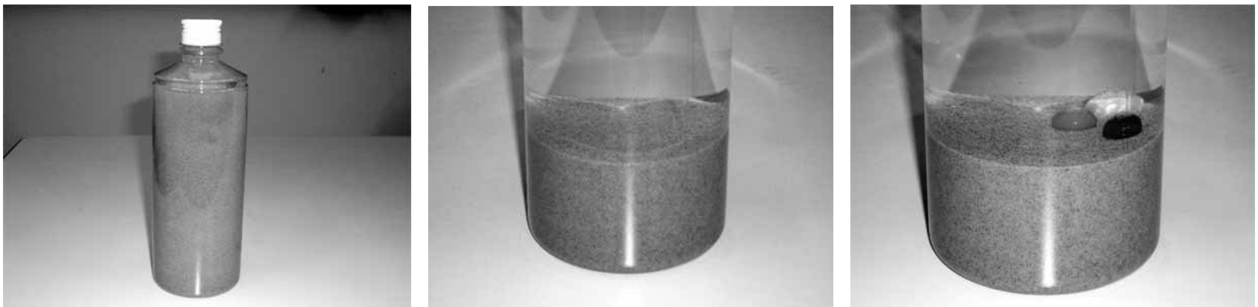
PET bottle seismograph:

PET bottle (500 ml), thin wire (about 10 m), vinyl chloride tube (one that enters mouth of PET bottle), earphone cable, vinyl tape, personal computer (or pen-recorder), software that displays waveforms of input signal to mike terminal. See the attached PDF file (PET-seismo_en.pdf) for details.

Liquefaction bottle (Licky):

PET bottle, fine sand (coast sand is better), map-pin (4 or 5 for one bottle), water.

Liquefaction simulation bottle ("Licky"). Put fine sand (approx. 100 ml for 500 ml size bottle) and ball-shaped map-pins (4 to 5) into 500 ml size PET-bottle and fill with water.



(left) Shake the bottle well and put it on flat place.
(middle) Wait quietly until sand precipitates. The map-pins are in sand.
(right) Snap the bottle lightly and the map-pins float to sand's surface because of liquefaction.

Change in height of sand before (left) and after (right) liquefaction. Water in sand is pushed out by liquefaction, and the surface of sand falls down.

20. Costs, organization, manpower, etc.

The cost of materials: about 200 to 500 yen (1.5 to 4.5 US$) for each. The student of the upper-grade of elementary school can craft them at short time (30-40 minutes in the seismograph, 5-10 minutes in Licky).

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
Understanding of seismic intensity and magnitude with PET bottle seismograph

E1-2. Place
Class intended for junior high school students and high school students in NIED

E1-3. Year
2003-2005

E1-4. Investor
Planning section, National Research Institute for Earth Science and Disaster Prevention

E1-5. People involved
Hiroaki NEGISHI, Senior Researcher, National Research Institute for Earth Science and Disaster Prevention
E-mail: negishi@bosai.go.jp

E1-6. Monetary costs incurred
Total: 41,600 yen (about 360 US$): 300 yen x 12 people = 3,600 yen (about 32 US$) for PET bottle seismograph materials, 14,000 yen (about 120 US$) for manufacturing cost of oil-drum that packs concrete, 24,000 yen (about 210 US$) for operation fee of truck crane.

E1-7. Total workload required
1. Craftwork guidance and explanation concerning seismograph by a lecturer (40-50 minutes).
2. All members move to the field in outdoor, and set the PET bottle seismographs that students nearby- and far-from the crane. The lecturer connects wires from the seismometers to personal computer or pen recorder. (5-10 minutes)
3. A special operator drops the drum from various heights, and students read the difference of the output amplitude from the screen of the personal computer or the pen recorder. (10-20 minutes)
4. The lecturer explains the relation between seismic intensity and magnitude by the analogy of output amplitude from their seismographs and the height in which the oil-drum dropped. (5 minutes)

Photo "Drum-drop Earthquake" experiments. The drum filled with mortar is dropped from various height, and the shake is recorded with PET-bottle seismograph. In this case, we have set not only PET-bottle seismographs but also Liquefaction bottles.

E1-8. Evidence of positive result
By these experiments, the students understood about the relation among "magnitude (height of mortar drum)", "epicentral distance (distance between drop point and seismographs)" and "seismic intensity (amplitude of seismograms)". They also found that liquefaction is not proportional to epicentral distance but all of the bottles within a certain epicentral distance has completely cause liquefaction. They understand that ground motion does not conduct all liquefaction process but shaking is "trigger" of the beginning of liquefaction phenomenon.
Almost all of the students realized the difference between seismic intensity and magnitude, in spite of the student more than half confused them before the lecture. Some students designed application experiments voluntarily after the lecture.

No.2

E2-1. Project name if available
Experience course of natural disaster understanding intended for civilian

E2-2. Place
The public event places that staged by governmental organizations, municipality, and institutions (NIED)

E2-3. Year
Since 2000

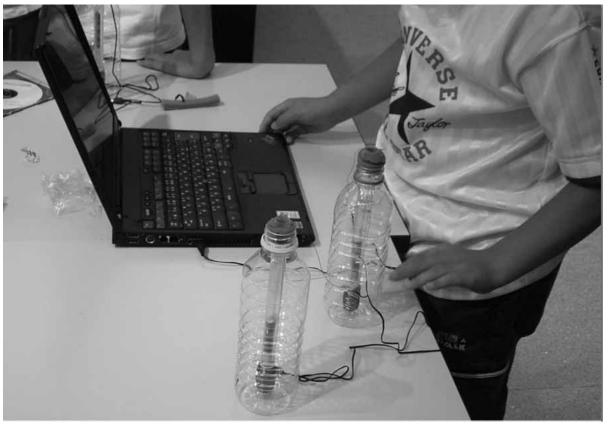
E2-4. Investor
Planning section, National Research Institute for Earth Science and Disaster Prevention

E2-5. People involved
Y. Nohguchi, Principal Senior Researcher (nhg@bosai.go.jp),
H. Negishi, Senior Researcher (negishi@bosai.go.jp)
National Research Institute for Earth Science and Disaster Prevention

E2-6. Monetary costs incurred
Each cost of materials is 200 to 500 yen (1.5 to 4.5 US$) for PET bottle seismograph, Liquefaction bottle (named "Licky").

E2-7. Total workload required
The time frame depends on participant's ability, but the person to whom it takes 15 minutes (50 minutes for PET bottle seismometer) to make them is rare. Ten or less of participants for one lecturer is preferable.

E2-8. Evidence of positive result
Participants realized the actual phenomena of liquefaction (liquefaction occurs not slightly but suddenly) and the observation of earthquake (the earthquake observation is to record ground motion, and complex calculations are necessary to determine hypocenter and seismic intensity).



X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:
> PET-seismo_en.pdf (PDF - 883 Kb)
> audacity-win-1.2.6.exe (2.6.EXE - 2177 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

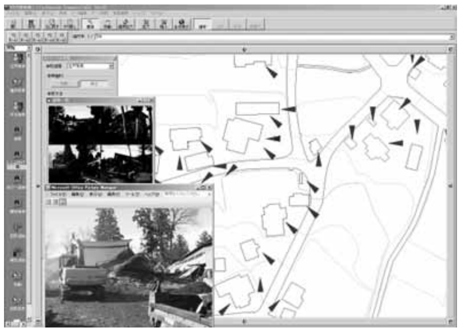
DRH-Asia Contents (DRH 3)

I. Heading

1. Title

Application of Spatial Temporal GIS for Earthquake Disaster Recovery Service

ID:	DRH 3
Hazard:	Earthquake, Multi-hazard
Category:	Implementation Oriented Technology (IOT)
Proposer:	Hiroyuki Yamada
Country:	JAPAN;
Date posted:	10 January 2008
Date published:	02 January 2009



Example of Spatial Temporal database.

Contact
Hiroyuki Yamada (Research Fellow), Takashi Furuto (Technical Staff) and Shigeru Kakumoto (Invited Research Fellow)
4th Floor, Human Renovation Museum, 1-5-2, Wakinohama-kaigan-dori, Chuo-ku, Kobe, Hyogo, 651-0073, JAPAN
yamada@edm.bosai.go.jp (Yamada), furuto@(Furuto), kaku@(Kakumoto)

2. Major significance / Summary

The aim of this activity was to improve efficiency of earthquake disaster recovery operation for victims' relief. Significant issue is to achieve the information processing required in recovery service by spatial-temporal GIS. Therefore, through the support of municipality, establishment and verification of the system was done and the system was identified to contribute to improvement of efficiency of recovery operation.

3. Keywords

Municipality, recovery operation, Spatial-Temporal GIS

II. Categories

4. Focus of this information

Implementation Oriented Technology (IOT)

5. Anticipated Users

5-1. Practitioners: Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.), Experts, Information technology specialists
5-2. Other users: Motivated researchers

6. Hazards focused

Earthquake, Multi-hazard

7. Elements at risk

Information and communication system

III. Contact Information

8. Proposer(s) information (Writer of this template)

Hiroyuki Yamada (Research Fellow), Takashi Furuto (Technical Staff) and Shigeru Kakumoto (Invited Research Fellow)
4th Floor, Human Renovation Museum, 1-5-2, Wakinohama-kaigan-dori, Chuo-ku, Kobe, Hyogo, 651-0073, JAPAN
yamada@edm.bosai.go.jp (Yamada), furuto@(Furuto), kaku@(Kakumoto)

9. Place where the technology/knowledge originated

JAPAN;

10. Names and institutions of technology/knowledge developers

Earthquake Disaster Mitigation Research Center (EDM) National Research Institute for Earth Science and Disaster Prevention (NIED)

11. Title of relevant projects if any

12. References and publications

Supporting Municipality Using Spatial Temporal GIS in 2004 Niigata-ken Chuetsu Earthquake, Hiroyuki YAMADA, Furuto TAKASHI, Naofumi SASAKI, Kaoru FUKUYAMA, Koji YOSHIKAWA and Shigeru KAKUMOTO, Proceedings of the 7th International Cooperative Seminar between KAGIS & GISA, pp.53-60, 2005.

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

The Niigata-Ken Chuetsu Earthquake was occurred in October 23 in 2004. The earthquake gave devastating damages on houses, lifeline, agriculture, and others related to livelihood. Recovery services of the municipality were not working properly. The reduction of human loss is more important. But rapid recovery can also reduce economic loss and it is a part of disaster reduction. Additionally, municipal service was not working well because of discrepancy between record of ledger and the state of the affected area. It caused the delay of recovery and reconstruction.

V. Description

15. Feature and attribute

Aim: Disaster reduction using information technology.
Key mechanism: Efficiency improvement of recovery operation
Information problem to be solved, which were identified from the support activity on the site were as below;
- reduction of information processing time relate to recovery operation
- register and referring of disaster situation
- discrepancy between map and the state of the affected areas
- man-machine interface of information checking up

For the resolution of this problem, it is considered that cooperating many RDB with common unique ID or incorporating spatial positional relation with GIS which define topology. The fundamental factors of information management of municipality are family unit code, house address, and the number of each house. Area which home addresses shows is just a site which has house(s), and the address does not indicate specific location of each house. In other words, size of house site (family unit code or taxpayer code) is ranged from tens of square meters to hundreds of square meters orders but house need accuracy of scale of several meters to tens of meters to be recognized. Therefore, the current information database could identify address of houses but not identify more specific location than space which address shows. To achieve prompt recovery, integration of information from different dissolution levels is necessary for municipality recovery operation.
The solution is spatial key (x, y, t: t is period of information) as DB index. In addition, adding information of location and time (period) is entered to DB. Spatial Temporal GIS enable the dynamic topology calculation. To achieve the proposed information processing, the elements of Spatial-temporal information processing, decentralized independence information processing, open and public data schema, and spatial-temporal database are required. **Fig. 1** shows procedures. Respective information is processed to be read out with spatial information of ID or attribute from each DB. Then, for calculating spatial topology, it is needed to sort out the correlation of space where attribute information exist. Consequently, attribute information is correlated in map (border of government such as street name, border of lot number, shape of house and so on) that border of space is previously described in time of attribute information exists. When using map, ID

of attribute is described on a map. Topology on a map is defined by this processing. Spatial Temporal GIS enable the dynamic topology calculation.

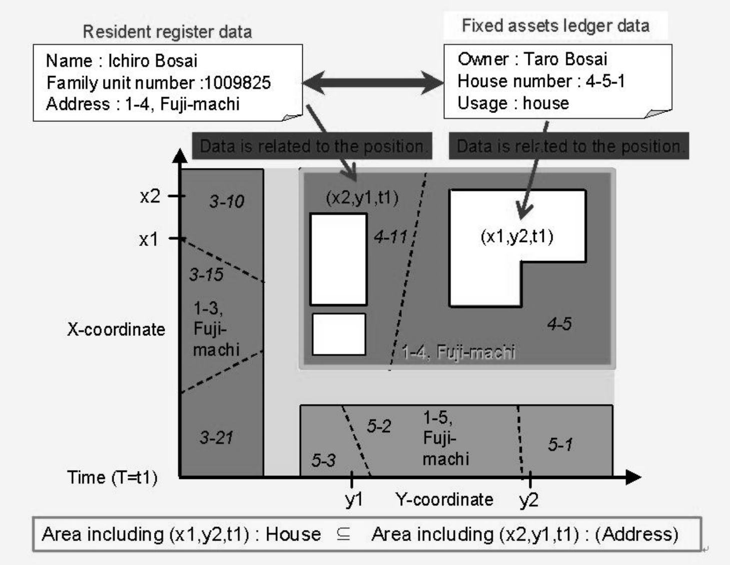


Fig.1 Spatial-temporal information processing procedures

16. Necessary process to implement

17. Strength and limitations

One example of strength:
Spatial-temporal photographic databases of disaster damage are constructed. Effectiveness of photographic data is shown below.
- It is useful as objectivity information on comparing.
- Making up of information difference at map and current state
- Record and reference to disaster situation

Limitation:
The map should be suited to the current status prior to disasters. Construction of Spatial Temporal data base (base map, fixed asset ledger data, etc.) is necessary before disasters.

18. Lessons learned through implementation if any

VI. Resources required

19. Facilities and equipments required

Spatial Temporal GIS and Laptop PC, (According to the situation: scanner, GPS unit, GPS camera) were required.

20. Costs, organization, manpower, etc.

Cooperation of local government is absolutely crucial.
Spatial Temporal GIS is developed by NIED. Software fee is free for non-commercial use.
The base map construction cost depends on the situation. (digitize from paper map, digitize from satellite image, etc.)
GPS digital camera: 80,000 yen (about 700 US$)
GPS unit: 20,000 yen (about 170 US$)
Scanner: 40,000 yen (about 350 US$)

VII. Message from the proposer if any

21. Message

"Applicability of world wide"

In 1999 Kocaeli Turkey Earthquake, DiMSIS applied disaster information management in Duze city. Afterwards, DiMSIS is used by routine work in the Duze city. In addition, system were customized to intended for the task. The initial cost and running cost can be cut down compared with conventional GIS. DiMSIS license managed consortium agreement and DiMSIS can be provided free of charge in case of non-commercial use. Cooperate with other systems is available, because DiMSIS employ open data structure and open API. The converter of shape and the DXF format were commercially available in general market. Disaster information management can be streamlined by managed with the position and time based on DiMSIS. Momentarily managed to handle information is required when the catastrophic disaster, and disaster information management based on address and the index is difficult to execute recovery operations at the municipality. DiMSIS contributed to the promotion of streamlining for recovery service at municipality in time of the Great Hanshin Earthquake in 1995 and the 2004 Niigata-ken Chuetsu Earthquake, etc.

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that is shown to be effective based on case studies/experiments in field sites.

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
Supporting Municipality Using Spatial Temporal GIS in 2004 Niigata-ken Chuetsu Earthquake.

E1-2. Place
Areas devastated by the Niigata-ken Chuetsu Earthquake.
(Tokamachi city, Kawaguchi town)

E1-3. Year
2004

E1-4. Investor
NIED, GIS Association of Japan

E1-5. People involved
Recovery services at the municipality after Niigata-ken Chuetsu earthquake has been assisted under the support of GIS Association of Japan. A GIS volunteer group was organized for the Spatial-temporal GIS-SIG and the Disaster GIS-SIG special activities.

E1-6. Monetary costs incurred
The base map construction cost is about 500,000 yen.
Staying cost of volunteer student is about 700,000 yen (About two months)

E1-7. Total workload required
Case example:
The Kawaguchi town recorded the maximum seismic intensity and house damage was extensive. In the whole area of the Kawaguchi town received extensive damage from the earthquake (house, road, and farmland). The photograph databases of the all houses (dwelling house and incidental house) were constructed. Six volunteers executed the registration of about 5,000 pieces photographs (about 1,600 family units) in five days. (**Fig. 2**)

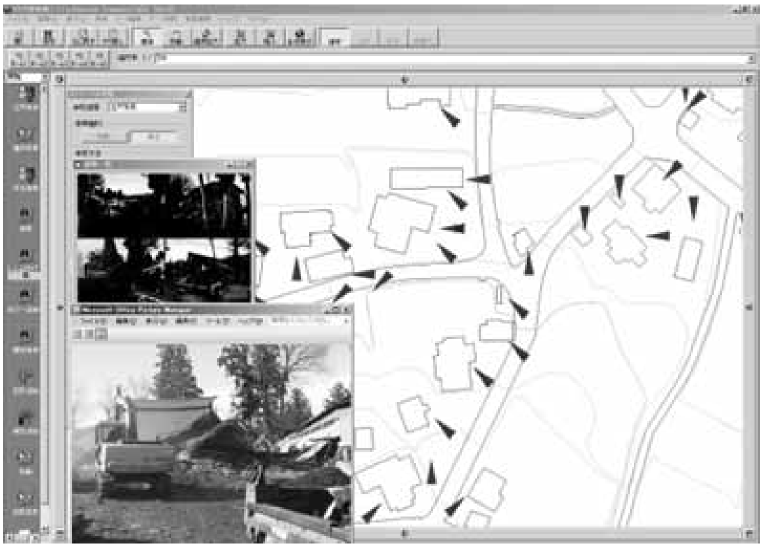


Fig. 2 Example of Spatial Temporal database

Fig. 3 Example of utilization for local government

Total workload Activity period:
About 150 man-day. (Activity period: About two months)

E1-8. Evidence of positive result
Spatial-temporal GIS was used for management of recovery services by municipality staff. The support activities in the municipality contribute to improve efficiency of recovery services.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

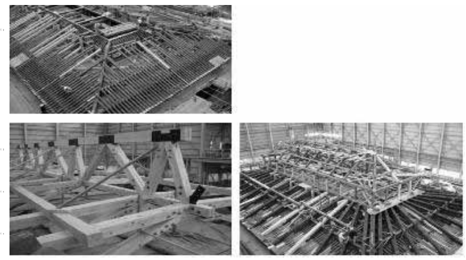
DRH-Asia Contents (DRH 4)

I. Heading

1. Title

Disaster Protection Technology of Traditional Wooden cultural Buildings

ID:	DRH 4
Hazard:	Earthquake, Cyclone/Typhoon
Category:	Transferable indigenous knowledge (TIK)
Proposer:	Yasuhiro Araki
Country:	JAPAN;
Date posted:	15 January 2008
Date published:	29 August 2008



Examples of repair with dismantlement.

Contact
Yasuhiro Araki
Research Fellow,
National Research Inst. for Earth Science and Disaster Prevention (NIED),
Earthquake Disaster Mitigation Res. Ctr. (EDM)
araki@edm.bosai.go.jp

2. Major significance / Summary

Japanese traditional wooden cultural buildings have been survived for long times.
The key technology for surviving may be “regular maintenances with appropriate intervals”, and this technology brings the sustainability of buildings.

3. Keywords

Sustainability of buildings; Regular maintenance with appropriate intervals

II. Categories

4. Focus of this information

Transferable indigenous knowledge (TIK)

5. Anticipated Users

5-1. Practitioners: Administrative officers, National governments and other intermediate government bodies (state, prefecture, district, etc.), NGO/NPO project managers and staff, Experts, Architects and engineers, Environmental/Ecological specialists
5-2. Other users:

6. Hazards focused

Earthquake, Cyclone/Typhoon

7. Elements at risk

Buildings, Cultural heritages

III. Contact Information

8. Proposer(s) information (Writer of this template)

Yasuhiro Araki
Research Fellow,
National Research Inst. for Earth Science and Disaster Prevention (NIED),
Earthquake Disaster Mitigation Res. Ctr. (EDM)
araki@edm.bosai.go.jp

9. Place where the technology/knowledge originated

JAPAN;

10. Names and institutions of technology/knowledge developers

11. Title of relevant projects if any

12. References and publications

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

Wooden cultural buildings like temples are one of the symbols of emperor's power in ancient times. These buildings are also the base of the believer’s belief. So these buildings are required to exist permanently. However, Japan suffers many strong earthquakes that might damage those buildings, and Japan has warm and humid climate, which might deteriorate members (= timber) of those buildings. These cultural and natural backgrounds developed the preservation and restoration technologies of wooden buildings in Japan. Today wooden cultural buildings like temples are still the bases of the believer’s beliefs. Moreover, these buildings have high cultural value. Therefore, wooden cultural buildings are required to continue to exist permanently. In addition, the development of the structural design technology that can quantitatively evaluate Japanese traditional structural elements is also required.

V. Description

15. Feature and attribute

(1) The preservation technology of wooden buildings The following two points are indispensable to the preservation technology of wooden building.

1) Regular maintenance with appropriate intervals. Almost all of the materials used for the construction of those cultural buildings are wood. These materials might deteriorate with the passage of time, since the climate is warm and humid in Japan. Therefore, all or several parts of the buildings are checked whether they need to be repaired. Generally, all parts of the cultural wooden buildings in Japan are dismantled and repaired approximately every 300 years, and meanwhile roofs are repaired approximately every 100 years (See **Chart 1**).

Chart 1 EX. of Toshio-dai-ji

		Events
	Latter half of 8C.	Construction
	1185	Earthquake(M 7.4)
about 100year		
	1370	repair the Kondo (frame reinforcement)
	1323	repair the Kondo
	1361	Earthquake(M=8.3)
	1596	Earthquake(M 7.5)
about 100year		
	1693	repair (change the system of the roof)
about 300year		
	1898	repair (change again the system of the roof)
about 100year		
	1998	repair (mainly repair roof)

2) Maximum reuse of members of buildings (= timber) and minimum replace of damaged members. At the time of maintenance, the members that have been damaged seriously are replaced with new ones. Usually most of the damaged members are such part as the roofing materials and the edge of the columns where these members suffered damages easily. On the other hand, other members located at other parts with good condition remain in use even if they have been used for hundreds of years. At the time of replacing materials, maximum reuse of members of buildings (= timber) and minimum replacement of damaged members are considered as much as possible. For example, when the inside of a column is found out damaged at the time of dismantlement, the inside part, where the member is damaged, will be removed, and a new material substitutes for the part removed. Therefore, outside of the columns don't change (**Fig.1**).

Fig.1 Examples of maximum reuse and minimum replacement

(2) Quantitative evaluation of Japanese traditional earthquake resistant elements Today, by using Earthquake-resistant design techniques such as "Limit Strength Method" and "earthquake response analysis", it is possible to quantitatively evaluate Japanese traditional earthquake resistant elements such as "restoring force for stabilizing made by column rocking", structural performances of "nuki" (= a kind of joint of column and beam), and "tuchi-kabe", which enable structural designers to evaluate quantitatively the structural performances of the buildings. Designers can evaluate earthquake resistant performances of those cultural wooden buildings as well as other modern architectures like Steel and RC buildings. They can reinforce the building if necessary. Designers can also evaluate the effect of past reinforcements which have not been evaluated quantitatively so far.

Although these technologies are the results of the development of the earthquake proof engineering in recent years, it should be noted that they are simply secondary technologies of the preservation technology that has a long history.

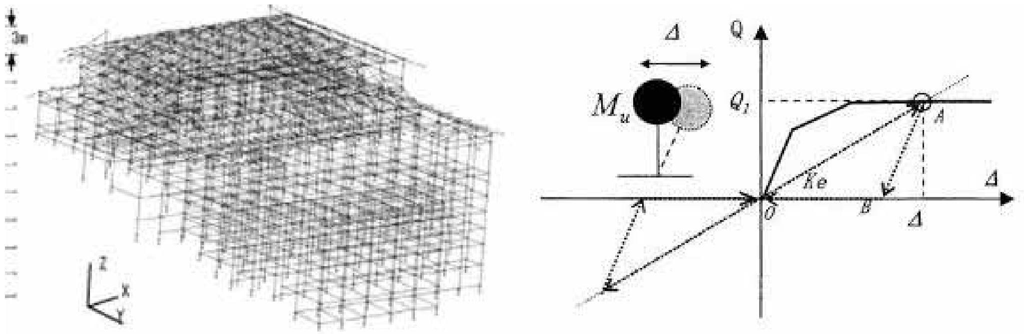


Fig. 2 Example of analysis models like "Limit Strength Method" and "earthquake response analysis"

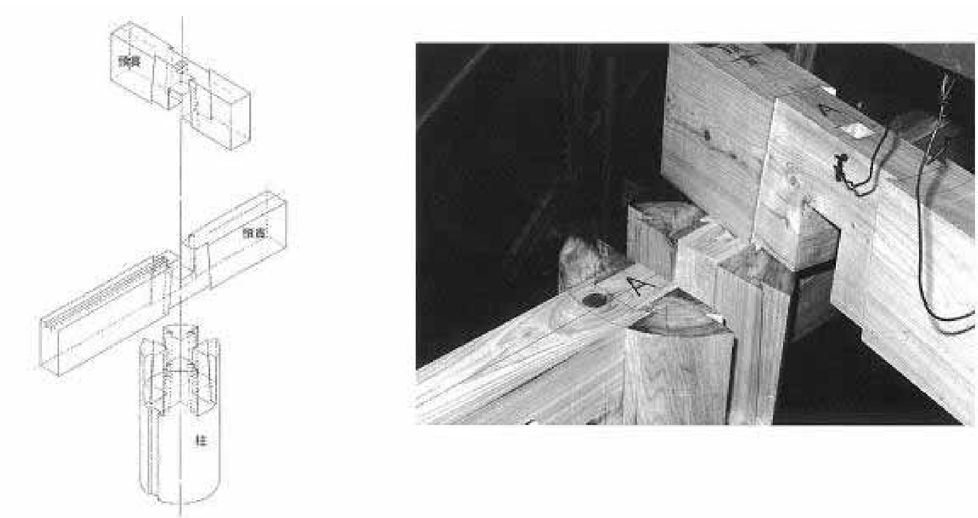


Fig. 3 Example of "nuki" (=a kind of joint of column and beam)

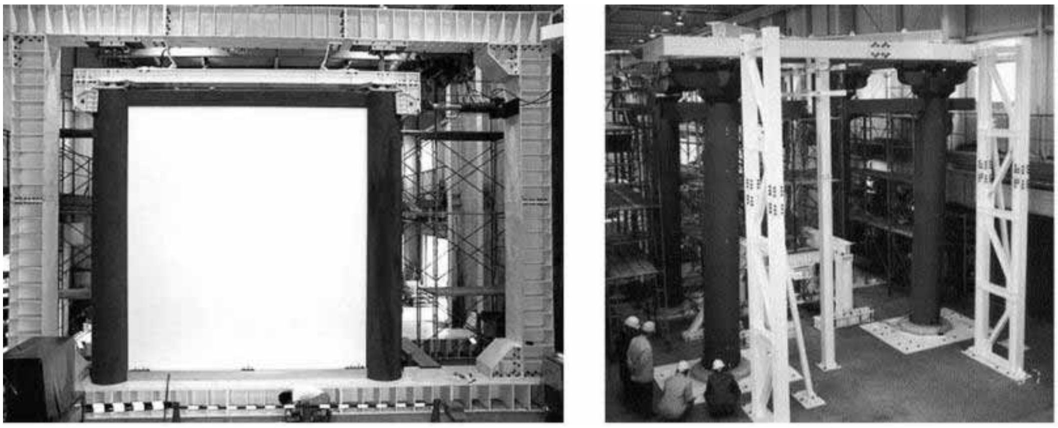


Fig. 4 Example of "tuchi-kabe"

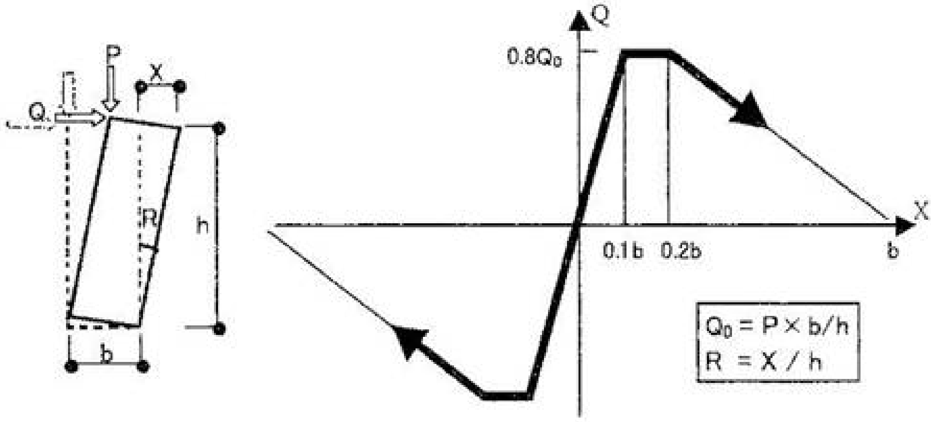


Fig. 5 Restoring force for stabilizing made by column rocking

1) Suo Kokubunji HP : http://www5.ocn.ne.jp/~suoukoku/index.html

2) Toshodaiji HP : http://www.toshodaiji.jp/

3) MORI Yusuke, SUZUKI Takashi, IZUNO Kazuyuki and TOKI Kenzo, Effect of Axial Force Fluctuation in Supporting Columns on Earthquake Response of Traditional Wooden Japanese Temple, Journal of JAEE, Vo1.7, No.1, 2007 (in Japanese)

4) Kiuchi Osamu, "Design technique of contemporary carpenters", Shin-kentikusha

5) Forestry and Forest products Research Institute HP, http://ss.ffpri.affrc.go.jp/labs/etj/setugo/setugo9804/9611Dento/9611Dento.html

16. Necessary process to implement

(1) The preservation technology of wooden buildings

1) (Structural and) Deterioration investigation of the buildings. At first, the levels of deterioration of members are investigated. By these investigations, designers estimate members that should be replaced at the time of dismantlement.

2) Planning for restoration considering maximum reuse of members and minimum replacement of damaged members. The repair plan is proposed based on the deterioration investigation. At the time of planning, maximum reuse of members and minimum replacement of damaged members are considered.

3) Checking the dismantled members during the dismantlement At the time of dismantlement, the deteriorations of the members which can't be found at the deterioration investigation are checked, and if necessary, these members are added to the repair plans.

4) Rebuilding: After the repair, the buildings are rebuilt.

(2) Quantitative evaluation of earthquake-resistant elements.

1) Structural investigation Structural performances are also investigated at the same time as investigating deterioration. In these investigations, the earthquake-resistant elements of the traditional building of Japan are picked up.

2) Modeling for applying to structural design techniques Earthquake-resistant elements which picked up are modeled. These modeled elements are applied to structural design techniques such as "Limit Strength Method" and "earthquake response analysis". Designers can evaluate earthquake-resistant performances quantitatively by using these methods.

Fig. 6 Toshodaiji Kyoto

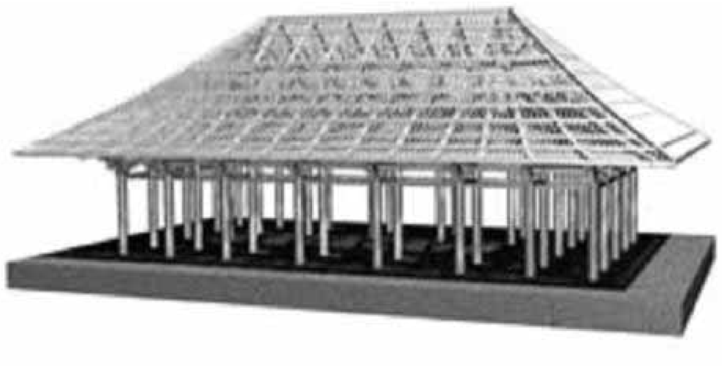


Fig. 7 Analysis model of Tosho-dai-ji

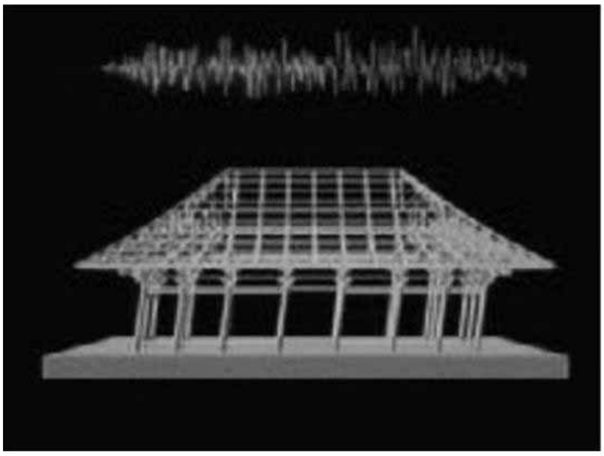


Fig. 8 Toshodaiji Kondo

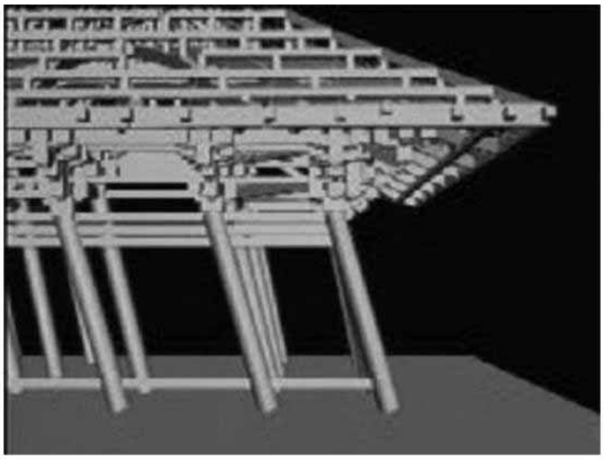


Fig. 9 Analysis model of Tosho-dai-ji

Takenaka Corporation HP http://www.takenaka.co.jp/syaji/daiji/daijitop.html

17. Strength and limitations

(1) The preservation technology of wooden buildings

1) "Regular maintenance with appropriate intervals" "Regular maintenance with appropriate intervals" enables buildings to survive for long time. Although they are damaged by the earthquake, if the buildings have the records about building plans, they can restore original form of buildings.

2) "Maximum reuse of members of buildings" "Maximum reuse of members of buildings" also enables buildings to restore original form of buildings.

These technologies are considered to be connected with sustainability of buildings.

(2) Quantitative evaluation of earthquake-resistant elements. The designer comes to be able to evaluate earthquake resistant performances for the assumed force of the cultural wooden building as well as other modern architectures. The designers can reinforce the buildings if necessary.

18. Lessons learned through implementation if any

VI. Resources required

19. Facilities and equipments required

Usually at the time of dismantlement of the buildings like temples, temporary housing is needed to protect the entire building from wind and rain (**Fig. 10**).

Fig.10 Examples of temporary housing

Moreover, spaces where the exchanged materials are processed and dismantled members are kept are needed.

New materials (Timber) are needed for replacing damaged members.

20. Costs, organization, manpower, etc.

In order to dismantle, repair and rebuild the building, the carpenters who are expert at building and repairing cultural buildings are needed. They are usually called “Miya-daiku” in Japan (**Fig.11**).

Fig.11 Miya-daiku

At the time of deterioration investigation and structural investigation, experts in deterioration of the timber and structure of the cultural wooden buildings are needed.

Organization in which carpenters, experts and parties concerned in the building discuss are also needed

1) Higashi Honganji HP : http://higashihonganji.jp/nikki/nikki.html

2) Suo Kokubunji HP : http://www5.ocn.ne.jp/~suoukoku/index.html

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that

23. Notes on the applicability if any

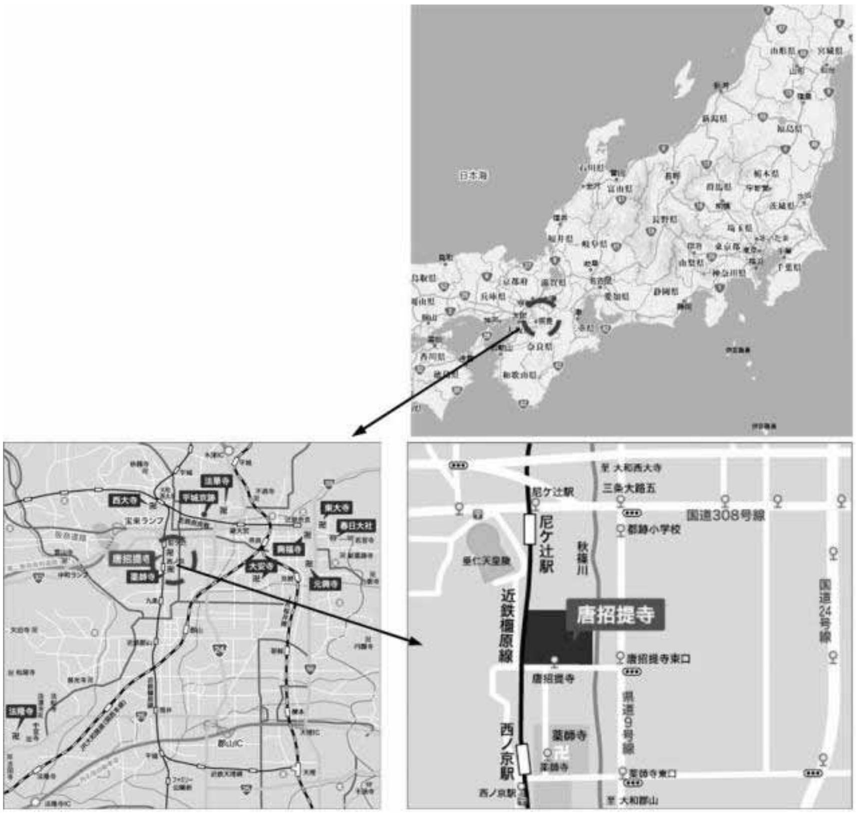
IX. Application examples

No.1

E1-1. Project name if available

"Toshodaiji Kondo Heisei Dai shuri"
(= Large Scale repair with dismantlement of Toshodaiji Kondo)

E1-2. Place
〒630-8032 13-46 Gojo mati, Nara city, Nara prefecture, Japan



E1-3. Year
1998〜2009

E1-4. Investor
Nara Prefectural Board of Education

E1-5. People involved
(1) The carpenters who are expert at building and repairing cultural buildings are needed.
(2) At the time of deterioration investigation and structural investigation, experts in deterioration of the timber and structure of the cultural wooden buildings are involved.
(3) Parties concerned in the building are also involved.
(4) Organization in which carpenters, experts and parties concerned in the building discuss are also needed.

E1-6. Monetary costs incurred

E1-7. Total workload required

Chart 2 is Schedule for repair. It takes about 10 years to complete.

Chart 2 Repairing schedule of Toshodaiji Kondo

1998	April	Start the investigation for the repair
	October	Special committee for repair was start
2000	January	Start the repair
	December	Construct tempary housings for covering the temple
2001	April	Start the investigation with dismantlement
2003	December	Finish the investigation
2004	January	Start the excavation investigation of the base
2005	January	Start the rebuilding the temple
2006	November	金堂上棟式
2007	Septmber	Complete the rebuiding (schedule)
2008	March	Complete the dismantlement of temporary housing (schedule)

E1-8. Evidence of positive result

(Tangible) Because of the damages of Hyogo-ken Nanbu Earthquake in 1995, this temple needs large scale of repairs with dismantlement and improvements of structural performances. This time the latest structural analysis technologies are applied to this temple.

The deterioration and structural investigation enable designers to evaluate deterioration and structural performances of the temple and propose the repair plans considering for maximum reuse of members and minimum replace of damaged members.

Earthquake-resistant design techniques enable structural designers to evaluate the structural performances of the buildings quantitatively.

Designers can also evaluate the effect of past reinforcements which have not been evaluated quantitatively so far.

Fig.12 Examples of deterioration and structural investigation

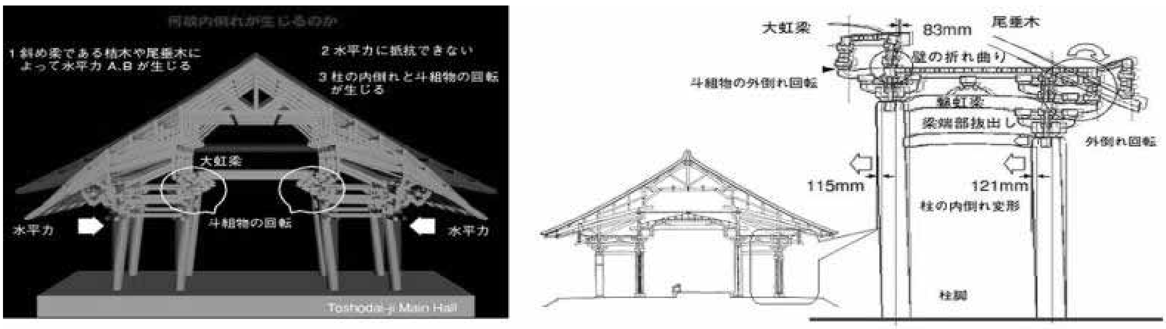


Fig.13 Examples of analysis of current structural performances

(intangible) Preservation technologies such as “Regular maintenance with appropriate intervals” and “Maximum reuse of members of buildings” are considered to be connected with sustainability of buildings (**Fig.14**).

Fig.14 Examples of repair with dismantlement (1)

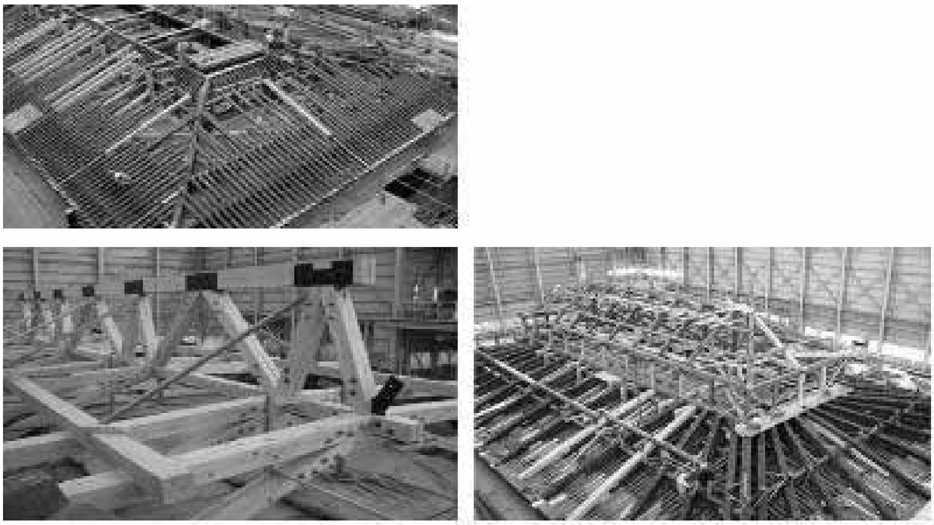


Fig.14 Examples of repair with dismantlement (2)

1) Takenaka Corporation HP http://www.takenaka.co.jp/syaji/daiji/daijitop.html

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) - **DRH-Asia Contents (DRH 6)**

I. Heading

1. Title

Proposal to Realize RARMIS (Risk Adaptive Regional Management Information System) Concept by Spatial Temporal Information System DiMSIS-EX and Some Case Studies -Toward Collaborative Realization of Common Software (System) Platform for Disaster Prevention (CSPDP)-

ID:	DRH 6
Hazard:	Earthquake, Flood, Multi-hazard
Category:	Implementation Oriented Technology (IOT)
Proposer:	Shigeru Kakumoto
Country:	JAPAN;
Date posted:	16 January 2008
Date published:	15 October 2009

Information system for disaster prevention and daily tasks of Kiyotake-cyou (local government).

Contact
Shigeru Kakumoto (Invited Research Fellow), Takashi Furuto (Technical staff), Hiroyuki Yamada (Research Fellow), Mitsuaki Sasaki (technical staff) and Koichi Shiwaku (Research Fellow)
4F, Human Renovation Museum, 1-5-2, Wakinohama-kaigan-dori,Cyuo-ku, Kobe-shi, Hyogo-ken, 651-0073, Japan
Kaku@edm.bosai.go.jp

2. Major significance / Summary

Researchers and developers have developed many software systems for disaster prevention such as database system, GIS, simulation, and so on, individually. However, these systems are not interoperable nor exchangeable, even functions are similar. Most of the systems are based on commercial based with lots of hidden functions which limit innovated system development. Expensive fee are requested for developing countries to use the system even most of the application part are free to use.
Common Software Platform which are open among researchers, every local language adaptable, and allow practical use according to the situation of each country.

3. Keywords

Common software platform for disaster prevention (CPDP), RARMIS concept, Spatial temporal information system, DiMSIS-Ex, Collaborative development

II. Categories

4. Focus of this information

Implementation Oriented Technology (IOT)

5. Anticipated Users

5-1. Practitioners: Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.), International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Commercial entrepreneurs, Financing and insurance business personnel, Experts, Information technology specialists, Urban planners, Rural planners, Environmental/Ecological specialists
5-2. Other users: Policy makers, Motivated researchers

6. Hazards focused
Earthquake, Flood, Multi-hazard

7. Elements at risk
Infrastructure, Buildings, Information and communication system

III. Contact Information

8. Proposer(s) information (Writer of this template)
Shigeru Kakumoto (Invited Research Fellow), Takashi Furuto (Technical staff), Hiroyuki Yamada (Research Fellow), Mitsuaki Sasaki (technical staff) and Koichi Shiwaku (Research Fellow)
4F, Human Renovation Museum, 1-5-2, Wakinohama-kaigan-dori,Cyuo-ku, Kobe-shi, Hyogo-ken, 651-0073, Japan
Kaku@edm.bosai.go.jp

9. Place where the technology/knowledge originated
JAPAN;

10. Names and institutions of technology/knowledge developers
Earthquake Disaster Mitigation Research Center, National Research Institute for Earth Science and Disaster Prevention (EDM-NIED)

11. Title of relevant projects if any

12. References and publications

13. Note on ownership if any
Patent (Japan): Hiroyuki Kameda, Shigeru Kakumoto and Michinori Hatayama
Patent Management (Japan): TLO Hyogo (http://www.niro.or.jp/n_prog_tlo/index.html)

Commercial uses in Japan: Charged (contact TLO Hyogo)
Non-profit uses in Japan and other overseas uses outside Japan: Free of charge (Contact Shigeru Kakumoto (kaku@dimsis.jp), Michinori Hatayama (hatayama@imdr.dpri.kyoto-u.ac.jp) or Hiroyuki Kameda (kameda@rarmis.jp)

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice
General disaster events: Great Hanshin-Awaji Earthquake (1995), Nigata-ken Chuetsu Earthquake (2004), Sendaigawa river Flood (2006), Kiyotake-cyou HPAI (2007) and other disasters. Spatial temporal information system are proposed as suitable software system to support local government for countermeasure disasters. RARMIS concept is proposed, considering a cost of system in practical use and guarantee the system to be used in certainty under various of unknown situation. Information sharing between independent organizations and local language adapt (allow different terms and different language) are also considered in standalone basis information with information exchange.

V. Description

15. Feature and attribute
Disaster reduction and prevention are common topics for all country, even constitution, language and culture is different. Common Software (System) Platform for Disaster Prevention (CSPDP) is proposed to get a solution for disaster prevention using information technology.

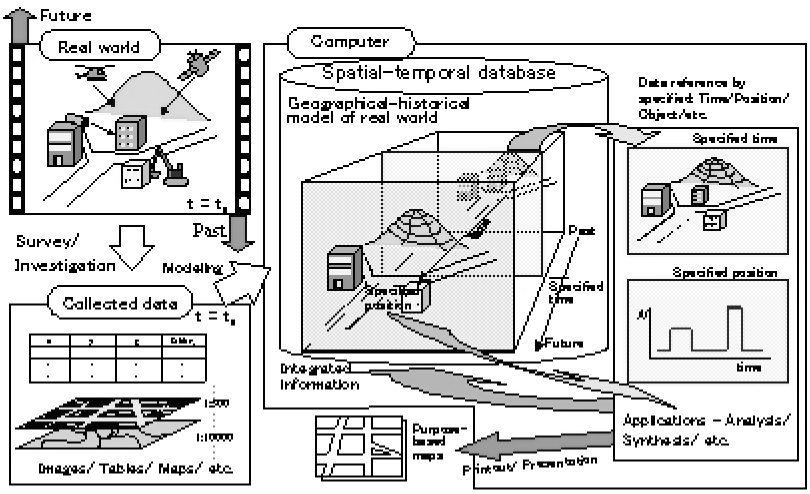
Position (geographical and temporal) are also common even language is different. Therefore, proposed CSPDP has a possibility to be realized by spatial temporal position base database handling.

Spatial temporal information handling means management of information related to position and also changes which can be operated as temporal position information. Advantage of this idea is a possibility of combination of Geographic Information System (GIS) and database management system (DBMS).

Generally any information system including conventional GIS with RDBMS has a possibility to process information handling by STIS, if all information to handle is predetermined like daily task such as tax management of local government and database handling schemer is prefixed. These characteristics come from by using unique numbers for keys to represent relations in database.
However, disaster information is not easy to be predetermined, because unexpected events happen. The system for disaster information processing has to be flexible enough to adaptive handling any information. STIS use a position and period (temporal position) for specifying every object in database. Therefore new information can be added without any influence to stored database. Relation is calculated when using the database and specified according to the usage. Kiyotake town did not have a system for countermeasure H5Ni bird influenza. They only could use STIS for preventing this disaster. Item free means term free, which has a possibility to realize language free system by single program. There is a possibility to organize common system for different country by STIS, because spatial position and temporal position is same in everywhere on the earth. This means there is a possibility to organize common disaster prevention application system on STIS integrating knowledge of researchers.

This system is developed focusing on disaster prevention but also adaptive to daily tasks for normal duties of local governments. Another way of saying, this system has a possibility to cover almost of local government tasks as a platform.

Here, this spatial temporal information system has a possibility to become information-processing platform for local government applications and disaster preventions. Moreover this system has a possibility to contribute to worldwide use because tasks of local government are different but similar in each countries and no difference in disasters.



Overall concept of spatial-temporal GIS named DiMSIS

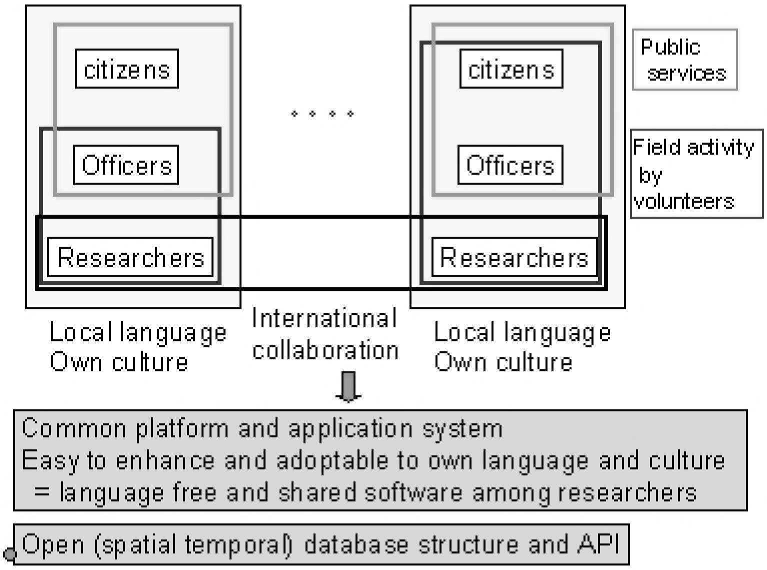
16. Necessary process to implement

Using DRH which is software platform for exchange and sharing knowledge, develop common software platform for practical system for local government and others together under the collaborative researchers and development among researchers and adapt the system to each countries.

Integrating experiences in each county are shared as common knowledge and can be implemented into common system which can be used another counties as well.

Requirement to disaster prevention system is not same for different country because regional management method is different. But map information is similar. House, road, river and so on are described on a map. STIS also can accept illustration map in which accuracy is not guaranteed. First step for implementation is making map database. Even if survey map is not available illustration map can be used. Then attribute data representing information of disaster and others can be connected to proper position and period.

Advantage to use this system is easy to combine databases organize by different group or different organization independently. Each organization can organize most suitable database for them. They do not need to consider any regulation to shire database of others.



17. Strength and limitations

Practical system can be used with free in each county including core system developed already. Commercial base systems also allow developing for each country. One regulation is every company has to obey Japanese local rule when one try to join Japanese market.

Some rules for development would be necessary in future which makes improve collaborative research and implementation.

It is not easy to make compatibility to other system which database architecture and format is closed such as commercial GIS. But STIS can use their map data by extract to exchange format using tool software. It is still hard to keep compatibility in a system if the system is closed and manufacturer hide database information. Database can be used in DiMSIS-EX by organizing database again using print out.

It is possible for others to get compatibility to DiMSIS-EX, because DiMSIS-EX database format is open. Programmer can write program to read and write DiMSIS-EX database and make a bridge system.

Common bridge system named DATABASE-HUB (GIS-HUB or STIS-HUB) is proposed and finished feasibility study. But not implemented yet because of financial limitation.

18. Lessons learned through implementation if any

Technologies can be improved seriously through applying to practical use even takes a time and efforts for researchers.

Field study and/or implementation are a basis of innovation.

VI. Resources required

19. Facilities and equipments required

Windows PC (Not windows-Vista and before windows95)

20. Costs, organization, manpower, etc.

Cost for developing additional application functions or systems which is not cover in DiMSIS-Ex and its applications now.

Cost for developing conversion language table for new language which is not developed.

Software design to adapt requirement of the country.

Visual Basic and/or C++ software development ability.

Cost for using DiMSIS-Ex is free, however, additional fee is necessary for new functions. Spatial data (map based database) is also necessary which is expensive if include measurement. If paper map or digital data is available, it become small or zero (researchers few days or weeks effort is good enough).

DiMSIS-EX is not matured yet. But it has a possibility to be common platform, because it is adaptive to Multi-language and common flexible interface has a possibility to adapt different requirement by definition without changing program. It also has a possibility to implement simulation functions related to disaster prevention such as earthquake damage and so on by expert researchers. Cost is not increase when use implemented function realize by other country.

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?
It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

IX. Application examples

No.1
E1-1. Project name if available
Information system for disaster prevention and daily tasks of Kiyotake-cyou (local government)

E1-2. Place
Kiyotake-cyou Miyazaki-pref.

E1-3. Year
2006, 2007

E1-4. Investor
EDM/NIED

E1-5. People involved
Officers of Kiyotake-cyou municipality

E1-6. Monetary costs incurred
5M yen: for developing map based database (not include survey)
1M yen: for additional functions for correcting damage information

E1-7. Total workload required

E1-8. Evidence of positive result
DiMSIS-EX was used effectively and adaptively to countermeasure of HPAI (bird influenza, H5N1 type) which happened unexpectedly and mayor and officers had not been prepared. Analysis of area by distance is important in this case (Figure shows Map displayed).

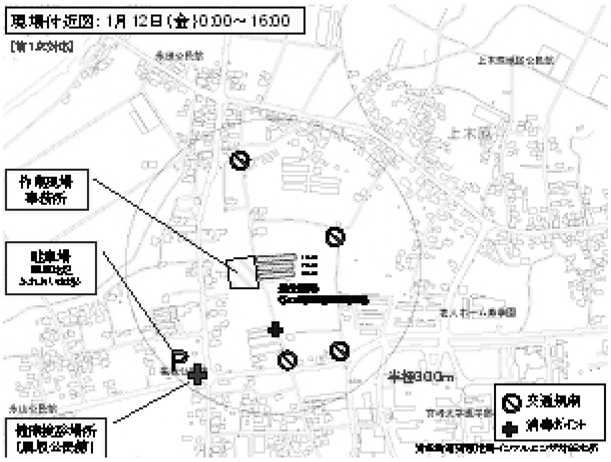


Fig. 1 Damage data collection

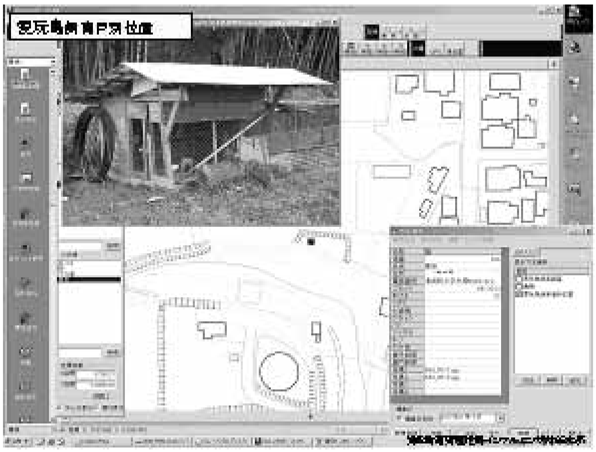


Fig. 2 Analysis of house damage

Land ownership data is managed by DiMSIS-Ex has been developing.
Land ownership and Building data will be a basis of disaster data handling. DiMSIS-Ex provide flexible interface according to the demand by managing all information connecting to geographical location and temporal location.

No.2

E2-1. Project name if available
Turkish case studies
1) Damage data analysis of Ducze earthquake
2) Land ownership and tax (tapu and cadastro) management

E2-2. Place
Duzce (earthquake 1999) and Maltepe (part of Istanbul) in Turkey

E2-3. Year
(1999-)2006

E2-4. Investor
EDM/NIED

E2-5. People involved
1) Prof. Michinori Hatayama, Prof Koji Yoshikawa, Prof. Hiroyuki Kamaeda

E2-6. Monetary costs incurred

E2-7. Total workload required

E2-8. Evidence of positive result
System was used to summarize damage of houses after Duzce earthquake and analyzed to find out damage ratio change according to the story of building. One of a advantage of the system is multi language adapt which allow Turkish interface.

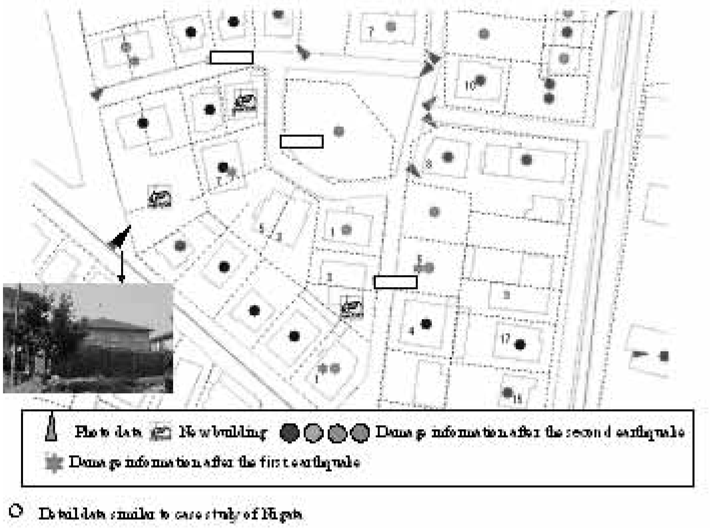


Fig. 3 Damage data correction

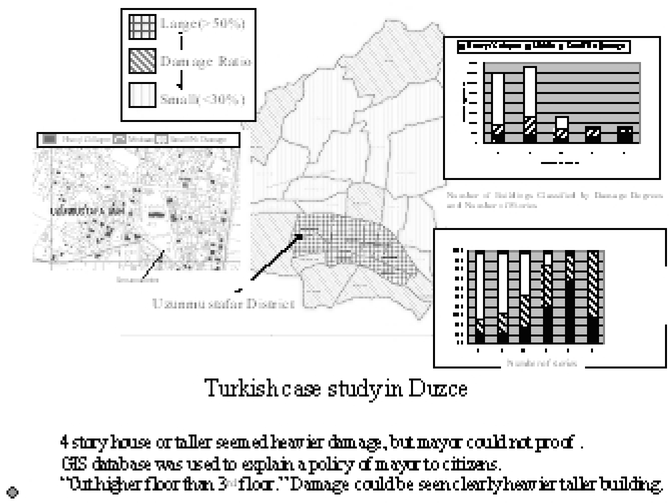


Fig. 4 Analysis of house damage

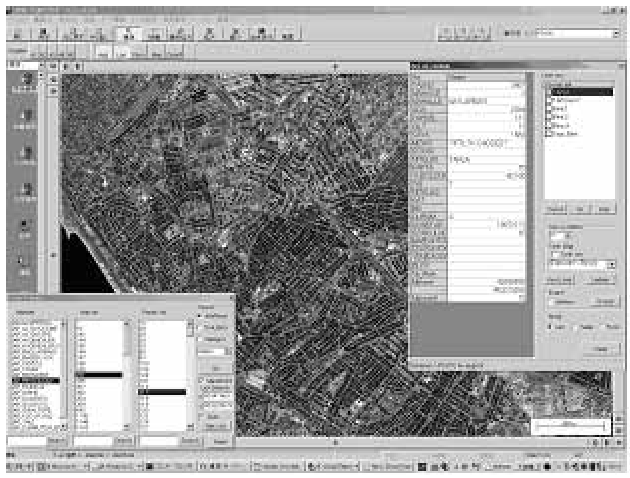


Fig. 5 Land ownership management system of Maltepe

Land ownership data is managed by DiMSIS-Ex has been developing.
Land ownership and Building data will be a basis of disaster data handling. DiMSIS-Ex provide flexible interface according to the demand by managing all information connecting to geographical location and temporal location.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

<u>Attached files:</u>

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

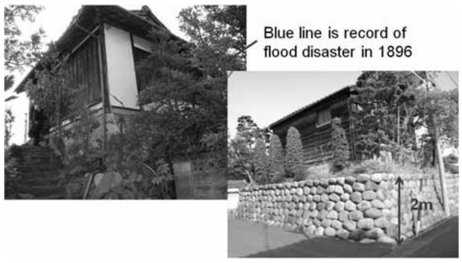
DRH-Asia Contents (DRH 8)

I. Heading

1. Title

Indigenous Knowledge from Japan Experience: Prevention, Damage Reduction and Erosion Control by Flood Disaster

ID:	DRH 8
Hazard:	Flood
Category:	Transferable indigenous knowledge (TIK)
Proposer:	Yukiko Takeuchi
Country:	JAPAN;
Date posted:	30 January 2008
Date published:	27 December 2008



This house (Mizuya) has been uplifted by about 2~5 m in height compared to the main house.

Contact
Yukiko TAKEUCHI, Hiroyuki KAMEDA, Rajib SHAW and Naho IKEDA
KU-NIED Survey Team
y.takeuchi@fw7.ecs.kyoto-u.ac.jp

2. Major significance / Summary

Three kinds of Indigenous Knowledge and Technology for flood disaster can be observed in the Noubi plains area of central Japan. These are: (1) Flood prevention; Waju (Inside Ring)=communities protected by ring dikes. (2) Erosion control; Hijiri-Ushi (Grand OX)=control water force. (3) Damage reduction; Mizuya (Flood House)=evacuation house.

3. Keywords

Flood disaster, Flood Prevention, Erosion Control and Damage Reduction

II. Categories

4. Focus of this information

Transferable indigenous knowledge (TIK)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.), Experts, Teachers and educators, Urban planners, Rural planners
5-2. Other users: Policy makers, Local residents

6. Hazards focused

Flood

7. Elements at risk

Human lives, Buildings, Rural areas, River banks and fluvial basin

III. Contact Information

8. Proposer(s) information (Writer of this template)

Yukiko TAKEUCHI, Hiroyuki KAMEDA, Rajib SHAW and Naho IKEDA
KU-NIED Survey Team
y.takeuchi@fw7.ecs.kyoto-u.ac.jp

9. Place where the technology/knowledge originated

JAPAN; Gifu prefecture

10. Names and institutions of technology/knowledge developers

Unknown. But has been practiced since 17th century by community person.

11. Title of relevant projects if any

Nothing

12. References and publications

Nothing

13. Note on ownership if any

Unknown

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

Noubi Plains, located in the Gifu Prefecture of central Japan, constitute alluvial plains formed by three major rivers (Ibi River, Ngara River and Kiso River). Due to strong meanders of these rivers, Noubi Plains experienced many serious flood disasters. Communities living in Noubi Plains have developed knowledge and technologies to cope with flood disasters, which are described below.

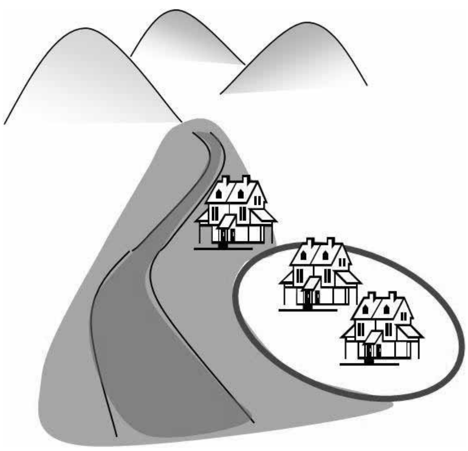
V. Description

15. Feature and attribute

Three Categories Knowledge and Technology

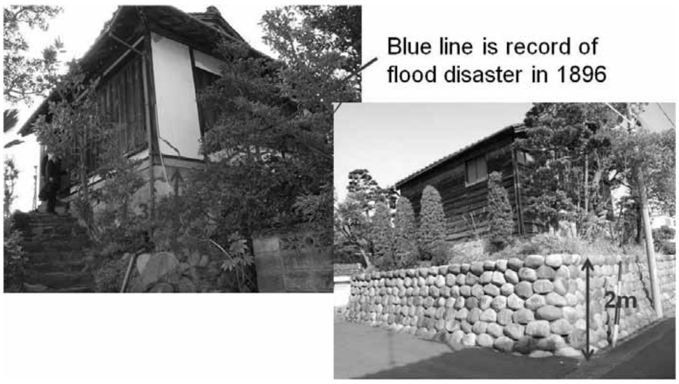
+Flood Prevention: *Waju* (Inside Ring): *Communities protected by Ring Dike*

Communities living in lowland areas suffered from many flood disasters from several centuries. In the 14th century, communities built a ring dike to protect its people. Those dikes were managed by local groups of people aimed at flood control. Seeing the effectiveness of these ring dikes, many communities copied the method. These dikes not only represented the physical structures, but also helped in developing community ties and ethical values through participatory decision making in maintenance and upgrading. As the results of physical countermeasures taken by the government in the Kiso, Nagara and Ibi Watershed Areas in 18th century, the frequency of flood in those areas has been reduced than before. Consequently, importance of the ring dikes became low, and in some cases were broken in order to renew the land use patterns.



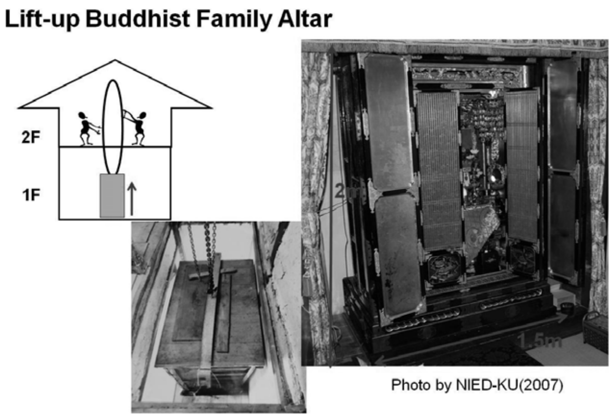
+Damage Reduction: *Mizuya* (Flood House): *Evacuation House*

This house has been uplifted by about 2~5 m in height compared to the main house. Ordinarily *Mizuya* is used as a storage room. When flood happens, this house is used for evacuation. Possession of these houses are limited to rich land owners.



Age-fune (Preparedness Boat) House owners prepared boats for emergency needs at the time of flood.

Age-Butsudan (Lift up Buddhist Family Alter) Buddhist Family Alter is important item in this area. This system lifts up alters in order to protect them from submerging.



+Erosion Control: *Hijiri-Ushi* (Grand OX)

Grand OX is erosion control tools for controlling water force.

Grand OX is used in the areas where rapid rivers meander.

16. Necessary process to implement

Waju (Inside Ring)=Community Protected by Ring Dike-Agreement of Community-Make management team Damage Reduction: *Mizuya* (Flood House)=Evacuation House- Agreement of Family- Need to research type of floods with depth of water using previous disaster records. Erosion Control: *Hijiri-Ushi* (Grand OX)=Control water force- Decide where to install it.- Decide the material for the construction

17. Strength and limitations

Strength: This technology can use local material. Therefore, can easy implement it. Limitation: This technology can not protect all scale floods. Need assessment to implement place for Erosion control technology.

18. Lessons learned through implementation if any

They can develop strong community through the ring dike. Ring dike need agreement and management by community.

VI. Resources required

19. Facilities and equipments required

Flood Prevention: Soil, Tree and measurement technology Erosion Control: Wood or Concrete, Wire or Creeper and sand bag Damage Reduction: Another House and Carpenter

20. Costs, organization, manpower, etc.

Dikes were management by local flood control team.

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

IX. Application examples

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 10)

I. Heading

1. Title

Application of Mangrove Forest for Countermeasure Against Tsunami Disaster

ID:	DRH 10
Hazard:	Tsunami, Storm surge
Category:	Implementation Oriented Technology (IOT)
Proposer:	Dinar Istiyanto
Country:	JAPAN; INDONESIA;
Date posted:	31 January 2008
Date published:	05 January 2009

Avicena Apiculata Mangrove forest_at the Grajagan Coast_East Java.

Contact
DINAR CATUR ISTIYANTO
Senior Research Engineer, Coastal Dynamic Research Center (CDRC), Agency for The Assessment and Application of Technology, Indonesia.

Present position: Research Specialist Fellow, International Center for Water Hazard and Risk Management (ICHARM, under the auspice of UNESCO, Public Works Research Institute (PWRI), Japan.

1. Coastal Dynamic Research Center BPPT, Jl. Grafika No.2, Sekip, Yogyakarta 55281, Indonesia.
Telp. 62-274-586239; Fax. 62-274-542789, e-mail: pakdinar@yahoo.com; dinar@webmail.bppt.go.id.

2. International Center for Water Hazard and Risk Management (ICHARM), Public Works Research Institute (PWRI), 1-6 Minamihara, Tsukuba, Ibaraki 305-8516, Japan; Phone: +81-29-879-6809; Fax: +81-29-879-6709; e-mail: dinar55@pwri.go.jp;

2. Major significance / Summary

This implemented orientation technology has been developing to provide a tool for planning effective mangrove forest as tsunami damper at the beach.
A set of procedure is provided for the calculation of possible reduction of tsunami wave height and energy by the existing mangrove forest at certain area. On the other hand, the procedure is made enable for designing effective mangrove forest to reduce predicted tsunami conditions.

3. Keywords

Mangrove forest, tsunami, disaster reduction, design

II. Categories

4. Focus of this information

Implementation Oriented Technology (IOT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, Municipalities , National governments and other intermediate government bodies (state, prefecture, district, etc.), NGO/NPO project managers and staff, International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Commercial entrepreneurs, Financing and insurance business personnel, Experts, Teachers and educators, Architects and engineers, Sociologists and political economists, Urban planners, Rural planners, Environmental/Ecological specialists

5-2. Other users: Policy makers, Motivated researchers, Local residents

6. Hazards focused

Tsunami, Storm surge

7. Elements at risk

Human lives, Human networks in local communities, Business and livelihoods, Infrastructure, Buildings, Urban areas, Coastal areas, River banks and fluvial basin, Agricultural lands

---

III. Contact Information

8. Proposer(s) information (Writer of this template)

DINAR CATUR ISTIYANTO
Senior Research Engineer, Coastal Dynamic Research Center (CDRC), Agency for The Assessment and Application of Technology, Indonesia.

Present position: Research Specialist Fellow, International Center for Water Hazard and Risk Management (ICHARM, under the auspice of UNESCO, Public Works Research Institute (PWRI), Japan.

1. Coastal Dynamic Research Center BPPT, Jl. Grafika No.2, Sekip, Yogyakarta 55281, Indonesia.
   Telp. 62-274-586239; Fax. 62-274-542789, e-mail: pakdinar@yahoo.com; dinar@webmail.bppt.go.id.

2. International Center for Water Hazard and Risk Management (ICHARM), Public Works Research Institute (PWRI), 1-6 Minamihara, Tsukuba, Ibaraki 305-8516, Japan; Phone: +81-29-879-6809; Fax: +81-29-879-6709; e-mail: dinar55@pwri.go.jp;

9. Place where the technology/knowledge originated

JAPAN; INDONESIA;
JAPAN: Southern islands, e.g. Okinawa.
INDONESIA: e.g. Banyuwangi (East Java)

10. Names and institutions of technology/knowledge developers

1. Dinar Catur Istiyanto, Coastal Dynamic Research Center, Agency for The Assessment and Application of Technology, Indonesia.
2. Satrijo Karuniadi Utomo, Civil Engineering Department, State University of Semarang, Indonesia.
3. Widjo Kongko, Coastal Dynamic Research Center, Agency for The Assessment and Application of Technology, Indonesia.

11. Title of relevant projects if any

Research On Tsunami Hazard and Its Effects on Indonesia Coastal Region, 2001-2004

12. References and publications

1. Dinar C. Istiyanto, Widjo Kongko, Application of Mangrove Forest for Countermeasure Against Tsunami Disaster, Presented at DRH Content Meeting, EDM-NIED, Kobe, 2007.
2. Dinar C. Istiyanto, Implementation of Greenbelt Technique As Coastal Protection Against Tsunami: Experience With EqTAP Implementation Strategy and Expectation on DRH-Project, Presented at Asian Disaster Reduction Science and Technology Forum, EDM-NIED, Jakarta, 2006.
3. Dinar C. Istiyanto, Utomo, K.S., Suranto, Jauzi, M.Z., The Influence of Rhyzopora-Shrub on Tsunami Propagation at The Beach, Proceeding of National Seminar on Tsunami, JICA-CDRC, Indonesia, 2006, pp. 311-322 (in Indonesian language)
4. Utomo, K.S., Dinar C. Istiyanto, Suranto, Triatmadja, R., Yuwono, N., Hydraulic Characteristics of Mangrove Forest in Reducing Tsunami Energy, Proceeding of National Seminar on Tsunami, JICA-CDRC, Indonesia, 2006, pp. 323-340. (in Indonesian language)
5. Dinar C. Istiyanto, Suranto, Shadikin, A., Physical Hydraulic Modeling of Tsunami Runup Over Various Coastline Geometric, Proceeding of National Seminar on Tsunami, JICA-CDRC, Indonesia, 2006, pp. 81-92. (in Indonesian language)
6. Dinar C. Istiyanto, Investigating Tsunami Propagation at the Beach by Using Physical Model, Presented at National Workshop on Disaster Mitigation at Coastal Area, Ministry of Marine and Fisheries, Jakarta, Indonesia, 2003. (in Indonesian language)
7. Dinar C. Istiyanto, First Year Activities, Research on Tsunami Hazard and Its Effects on Indonesia Coastal Region, Proceeding of the 5th Multi-Lateral Workshop on The Development of Earthquake and Tsunami Disaster Mitigation Technologies and Their Integration for Asia-Pacific Region, Bangkok, Thailand, 2002

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

Asian countries, especially those are laid along "ring-fire" of Western Pacific Ocean (i.e. Japan, Korea, Philippines, Indonesia, Papua New Guinea, Pacific Islands) and Indian Ocean (i.e. Indonesia, India, Sri Lanka, Bangladesh), are the most tsunami prone areas. Between the years of 1600 to 2004 (ITDB, 2004), 282 events of tsunami were recorded by which more than 361,000 death toll are sentenced. The biggest death toll contributions are from the tsunami event of 2004' Indian Ocean (about 230,000) and 1883' Krakatau eruption (36,000).

In order to reduce the risk of tsunami disaster, comprehensive tsunami disaster countermeasure is urgently necessary in these region. Among many complementing countermeasures, the idea of utilizing greenbelt as coastal protection against tsunami has been widely spread among engineers during last fifteen years, especially in the region where various beach trees well grown up naturally. Many post-tsunami site investigations howed that mangrove forest and other types of beach tree were found at many coastal areas where its shaded inland has less damage after tsunami attack. It is known that coastal forest stops driftwood and other floatages, reduces water flow velocity and inundation water depth and provides a live-saving means by catching persons carried out off by tsunami (Shuto, 1987).

Mangrove forest is not as expensive as hard structure like seawall or breakwater. Mangroves forest also have advantages on its environmentally friendly and its relatively economical cost of implementation. And, many coastal areas in the above mentioned region are appropriate for mangrove habitation.

Avicena Apiculata Mangrove forest_at the Grajagan Coast_East Java

V. Description

15. Feature and attribute

This technology has been developing to provide engineering tool for planning coastal protection by using mangrove-forest or to appraise the effectiveness of existing mangrove forest in reducing potential tsunami wave height and energy.
The main required inputs are tsunami wave height and length as well as the expected inland reduced wave height. Tsunami wave height and length, along with the existing geomorphology of the objective beach, are the fix input parameters, whereas the expected inland reduced wave height is a variable according to the data of designed mangrove-forest density, mangrove-forest width (perpendicular to the coast line), and mangrove tree's height.
Tsunami wave height and length are determined based on statistical analysis of historical event or numerically simulated one. Numerical simulation calculation must be conducted in advance by person or institution who is expert in this field.
Design parameters in this proposed technology are called together as hydraulic dimension of mangrove forest, which include ***hydraulic height of mangrove forest*** (δ), ***hydraulic width of mangrove forest*** ($\boldsymbol{B}_{\mathrm{L}}$) and ***hydraulic density of mangrove forest*** (ε). Determination of each parameter shall be referred to the following procedure.

1. Hydraulic height of mangrove forest (δ)

$$\delta = (d + [1/(1-K_{\mathrm{R}})]H)/t_{\mathrm{B}} \qquad (1)$$

where: d is water depth just at the seaward line of mangrove forest, K_{R} is reflection coefficient of mangrove forest, H is design tsunami wave height just before interacts with mangrove forest and t_{B} is average height of the trees in mangrove forest. See **Fig. 1**.

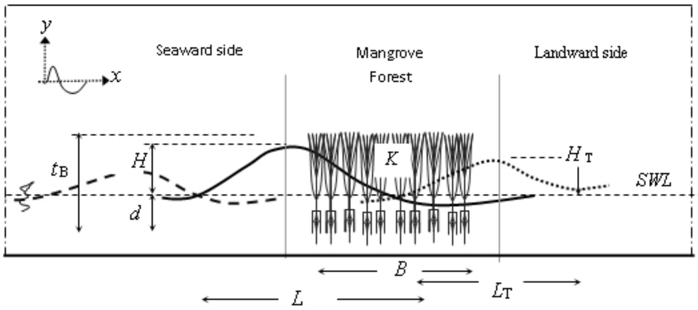


Fig. 1 Diagram of variables related to the determination of δ

The value of δ will contain K_R variable as K_R value is not yet determined.

2. Mangrove forest density (K)

Mangrove forest density (K) expresses parts of trees occupation in a space volume of mangrove forest. This is the total volume of the trees (including roots, trunk, branches, and leafs if possible) divided by the total volume of space in which the total volume of the trees were measured.

$$K = \frac{\text{(total volume of trees in the measured area)}}{\text{(total volume of space in which the total volume of the trees were measured)}} \quad (2)$$

Example: if the average height of mangrove trees is 5 m, and the unit area of mangrove forest is 5m by 5m, hence the total volume of space in which the total volume of the trees is measured is 5 m x 5 m x 5 m = 125 m^3. If the measured total volume of the trees within this space is 5 m^3, hence the forest density K is = 5/125 = 0.04.

3. Hydraulic density of mangrove forest (ε)

Hydraulic density of mangrove forest (ε) is determined according to the value of mangrove forest density (K) and hydraulic height of mangrove forest (δ).

The δ value shall be calculated by equation (1), whereas K is by equation (2).

Based on the results of laboratorium experiment, the relations between ε and δ are provided for K equal to K_1 = 0.0125 and K_2 = 0.05 as in the equation (3) and (4). Linier interpolation shall be conducted for the K value between K_1 = 0.0125 and K_2 = 0.05. However, solutions for K < K_1 and K > K_2 are still not available at present.

For $K = K1$ = 0.0125,

$$\varepsilon = \begin{cases} 0{,}042\delta & ;\ 0 < \delta \le 0{,}15 \\ 0{,}7021\delta^5 - 2{,}2458\delta^4 + 2{,}4886\delta^3 - 1{,}0992\delta^2 + 0{,}2126\delta - 0{,}0084 & ;\ 0{,}15 < \delta < 1 \\ 0{,}05 & ;\ \delta \ge 1 \end{cases} \quad (3)$$

For $K = K2$ = 0.05,

$$\varepsilon = \begin{cases} 0{,}0105\delta & ;\ 0 < \delta \le 0{,}15 \\ 0{,}1755\delta^5 - 0{,}5615\delta^4 + 0{,}6222\delta^3 - 0{,}2748\delta^2 + 0{,}0532\delta - 0{,}0021 & ;\ 0{,}15 < \delta < 1 \\ 0{,}0125 & ;\ \delta \ge 1 \end{cases} \quad (4)$$

The above relation is derived from the following graphics in **Fig. 2**.

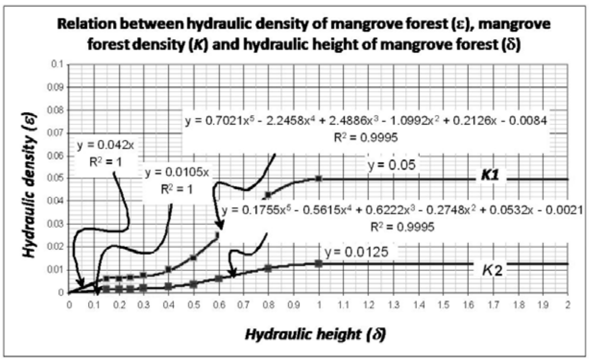


Fig. 2 Graphics of relation between hydraulic density of mangrove forest (ε), mangrove forest density (K) and hydraulic height of mangrove forest (δ)

4. Hydraulic width of mangrove forest (B_L)

$$B_L = B/L \quad (5)$$

where: B is the width of mangrove forest in the direction perpendicular to the coastline and L is tsunami wave length.

5. The resulted value of ε and B_L are then inputted into equation (6), which is the correlation equation of K_R and ($\varepsilon.B_L$) as it is also shown in the graphics of **Fig. 3**.

$$K_R = 0.0872 \ln(\varepsilon.B_L) + 0.782 \quad (6)$$

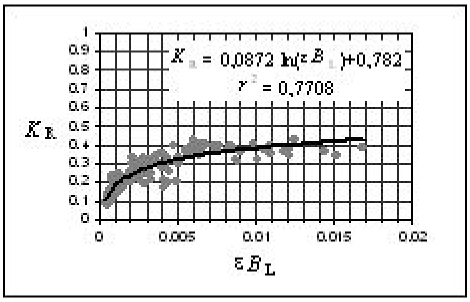


Fig. 3 Graphics of correlation between K_R and ($\varepsilon.B_L$)

Accordingly, an equation with K_R variable both in the left and right side will be derived.
This equation shall be solved by carrying out iteration procedure or trial and error calculation. K_R shall be given initial value of $0 \le K_R \le 1$.

6. Once K_R is determined, the definite value of δ and ε could be calculated.

7. Further, the value of transmission coefficient (K_T) and transmitted wave height (H_T) shall be calculated by referring to the equation (7), that is related to **Fig. 4**, and equation (8) consecutively.

$$K_T = -0.1644 \ln(\varepsilon.B_L) - 0.4601 \quad (7)$$

$$H_T = K_T.H_{IR} \quad (8)$$

where: $$H_{IR} = [1/(1 - K_R)]\, H \quad (9)$$

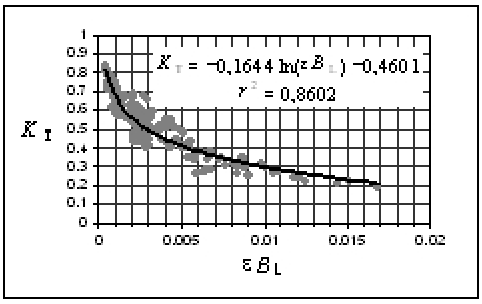


Fig. 4 Graphics of correlation between K_T and ($\varepsilon.B_L$)

16. Necessary process to implement

The provided simple diagrams and equations shall be used directly to appraise the capacity of existing mangrove forest in reducing tsunami wave height or energy that passing through the forest into the shaded inland.
The provided diagrams and equations are also made enable to design mangrove forest width and density for preliminary planning of coastal protection against tsunami.
Any body has capability of reading graphics and diagrams and carrying out graphics interpolation will be able to make preliminary calculation for mangrove forest dimension and or prediction of mangrove forest capacity in reducing tsunami wave height. However a local multi-stakeholder workshop related to the application of this method (methodology, possibility, etc) is necessary before its implementation.
The result of calculation or prediction is implemented only for a unit length of mangrove in the transverse direction parallel to the coast. In order to get more detail picture of tsunami inundation over wide coastal area, the users are suggested to use numerical simulation tools provided by other researchers or make further consultation with the relevant experts.
To determine the appropriate distance between the trees, experts in mangrove plantation must be involved in the design processes.

17. Strength and limitations

Once the tsunami wave inputs, the mangrove forest parameters, and the expected wave height reduction is determined this method is straightforward utilized.
The application of the proposed design' diagram is limited to the field conditions that are agree with the laboratory investigation conditions.
The present technology shall be implemented by assumptions that:

1. The trees, individually or as a group, have enough resistance against tsunami wave forces. In other words, the trees never collapse under possible range of the design wave height.

2. The diagrams and equations are empirically derived from laboratory investigation. No comparison or calibration have been conducted against field data observation.
3. The investigated tree's height were not higher than 5 m.
   Further investigations are necessary to find out solution of the problem that out of present range of application.

18. Lessons learned through implementation if any

VI. Resources required

19. Facilities and equipments required

Facilities and equipments for design and planning of mangrove forest dimension:

1. A personal computer or calculator that has capability for doing general calculation, iteration calculation or "trial and error" calculation process. At least has worksheet for database works.
2. Meter-wire or any practical tools for measuring the dimension of the trees to calculate its volume as well as mangrove forest density calculation.

Facilities and equipments for mangrove plantation:

Please refer to the commonly available guidance of mangrove plantation

20. Costs, organization, manpower, etc.

Costs: Budget are required for the following action:

1. purchasing personal computer or calculator, tools for measuring trees dimension.
2. labour fee for the mangrove forest measurement activities.

Organization: The best result will be achieved if cooperation and coordination among stakeholders is conducted.

1. Experts from university or research institution provide their suggestion on the potential of tsunami wave height in the designated area, and also technology of mangrove plantation.
2. Local government or municipality provide support or guarantee on the continuous supply of mangrove seeds; Local government officer, under expert advisory, design and planning the mangrove forest; Local government officers, together with residents group, regularly make inspection and advise on the mangrove maintenance.
3. Local people (community) do cooperation and participate in mangrove planting action as well as its maintenance under coordination of community leader; it will be helpful if the residents living surrounding the area are divided into groups and each group take responsibility for planting and maintaining mangroves.

Manpower: No sophisticated skills are necessary; the most important provision are understanding about the danger of tsunami disaster and the urgency of initiating action of reducing tsunami disaster risk in their own area by self-help and mutual-support.

VII. Message from the proposer if any

21. Message

This study results have not yet been applied to any specific project. Whereas many of the mangrove plantation projects are implemented not directly for tsunami issues but with more emphasize on environmental enhancements, these two aspects are effective simultaneously. It is believed that, if not direct application, the research output presented herein should be very useful for assessment of the effects of mangrove forests for tsunami disaster reduction.

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that is shown to be effective based so far only on scientific experiments in laboratory.

23. Notes on the applicability if any

This technology is derived from laboratory experiment results with many limitations related the laboratory experiment conditions. However, this calculation method is considered reliable for preliminary design of mangrove forest for tsunami protection at coastal area. Mangrove forest habitat is within tidal area with muddy or silty soil. It is usually hard to grow the seeds in the coastal area attacked by severe wave. Semi-permanent protection must be provided until the trees strong enough to stand against wave force (usually until about two years old).

IX. Application examples

X. Other related parallel initiatives if any

Hamzah, Harada, and Imamura (1999), Tohoku University, Japan
Harada and Imamura (2000), Tohoku University, Japan
Hiraishi and Koike (2002), Port and Airport Research Institute, Japan
Widjo and Sakai (2003), Iwate University, Japan
Harada & Kawata (2004), Tohoku University, Japan

XI. Remarks for version upgrade

Attached files:

> Rhizopora_mangrove_forest_at_Sinjai_Sulawesi.png (PNG - 382 Kb)
> Figure-1-1.jpg (JPG - 22 Kb)
> Figure-2.tif (TIF - 111 Kb)
> Mangrove_forest_outside_view_1.jpg (JPG - 41 Kb)
> mangrove_view_from_seaside.jpg (JPG - 49 Kb)
> Mangrove_forest_at_the_coastline_tip_1.jpg (JPG - 37 Kb)
> Figure-3.bmp (BMP - 101 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) - DRH-Asia Contents (DRH 11)

I. Heading

1. Title

Rediscovery and Revival of Traditional Earthquake-Resistant Techniques in Algeria: The Casbah of Algiers (Algeria).

ID:	DRH 11
Hazard:	Earthquake
Category:	Transferable indigenous knowledge (TIK)
Proposer:	Amina Aicha Abdessemed-Foufa
Country:	Algiers, Algeria. Since 18th century, after the 1716 Algiers earthquake
Date posted:	31 January 2008
Date published:	22 December 2008

The Horseshore-pointed arches (Arcads).

Contact
Dr. Amina Aicha Abdessemed-Foufa (Architect, Senior Researcher)
Department of Architecture, Faculty of Engineers Sciences, University "Saad Dahleb" of Blida, (USTB) , Route de Soumaa, BP 270 Blida. Algeria.
E-mail: foufa_a_dz@yahoo.fr
Tel/fax: +213 25 438 434
Cell phone +213 771 309 595

Dr. Djillali Benouar (Professor)
University of Bab Ezzouar (USTHB): BP 32 El-Alia, Bab Ezzouar, Alger 16111, Algeria
E-mail: dbenouar@yahoo.com
Tel: +213 21 24 79 14

2. Major significance / Summary

Contributed effectively in reducing human live losses and damage to properties. Easy and cheap to put in place. These techniques which have been in place for more three centuries have had the time to be tested during several destructive earthquakes which affected the site and thus proven their efficacy in reducing seismic risk. These techniques should be again promoted among the political authorities, the decision makers and the civil society in Algeria.

3. Keywords

Traditional preventive techniques, Casbah of Algiers, Algeria

II. Categories

4. Focus of this information

Transferable indigenous knowledge (TIK)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.), Commercial entrepreneurs, Financing and insurance business personnel, Experts, Teachers and educators, Architects and engineers, Urban planners
5-2. Other users: Policy makers, Motivated researchers, Local residents

6. Hazards focused
Earthquake

7. Elements at risk
Buildings, Urban areas, Coastal areas, Cultural heritages

III. Contact Information

8. Proposer(s) information (Writer of this template)
Dr. Amina Aicha Abdessemed-Foufa (Architect, Senior Researcher)
Department of Architecture, Faculty of Engineers Sciences, University “Saad Dahleb” of Blida, (USTB) , Route de Soumaa, BP 270 Blida. Algeria.
E-mail: foufa_a_dz@yahoo.fr
Tel/fax: +213 25 438 434
Cell phone +213 771 309 595

9. Place where the technology/knowledge originated
Algiers, Algeria. Since 18th century, after the 1716 Algiers earthquake
North Africa/ Mediterranean Basin

10. Names and institutions of technology/knowledge developers
ancient communities,
USTB of Blida
USTHB of Algiers, Pr. Djillali Benouar Civil Engineer, Built Environment Laboratory (LBE), Faculty of Civil Engineers. University “Houari Boumediene”, of Bab Ezzouar, (USTHB), Algiers. Algeria
BP 32 El Alia, Bab Ezzouar, Alger 16 111, Algeria.
E-mail: dbenouar@gmail.com
Cell phone: +213 771 842 428
Tel / fax : +213 21 247 914/247 992

11. Title of relevant projects if any

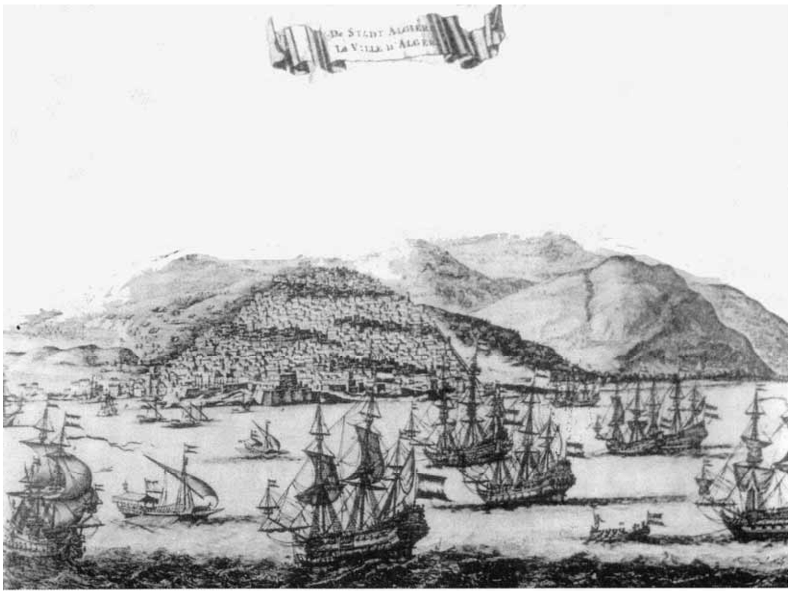
12. References and publications
04/2000- “Reducing Risk to Cultural Heritage (Medinas and Casbah) in the Maghreb Countries“, Archeoseismicity and historic seismicity, France.
05/2001 - “ Introduction to the local seismic culture in the old cities of the Maghreb”. Second Workshop on Seismic Risk in North Africa, Tetouan. Morocco.
08/2001- “Reducing the geo-environmental effects on historical and archeological monuments and sites. Theme A: living with natural and environmental hazards. Topic 11/ Reducing risk to Cultural Heritage”, International workshop on disaster reduction. American Society of Civil Engineers. Reston, Virginia, an Activity of the alliance for disaster reduction, USA.
08/2001- “Local Seismic Culture in the Old Cities in North African Countries. Topic 11: Reducing Risk to Cultural Heritage”, International workshop on disaster reduction. American Society of Civil Engineers. Reston, Virginia, an Activity of the alliance for disaster reduction, USA.
05/2005- “Contribution for a Catalogue of Earthquake-Resistant Traditional Techniques in Northern Africa: the Case of the Casbah of Algiers (Algeria)”, European Earthquake Engineering Journal, 02/05, pp23-39.
08/2007- Investigation on the 1716 Algiers (Algeria) earthquake from historical documentary sources. Proceeding of IDRC. Harbin, China.
03/2007- “ Damage Survey of the Old Nuclei of the Casbah of Dellys (Algeria) and Performance of Preventive Traditional Measures in the Wake of the Boumerdes 2003 earthquake”. European Earthquake Engineering Journal, 03/07, pp10-20.

13. Note on ownership if any
Public

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice
The Algiers 1716 destructive earthquake whose intensity was estimated at IX (MSK) caused the loss of about 20,000 human lives and considerable damage to the Casbah of Algiers and its surroundings. It was reported that about 200 houses collapsed and several other were

seriously damaged; the Great Mosque was fissured and even then countryside houses suffered considerable damage and some of them where thrown to the ground, in a distance of about 3 km of the city centre. The ground has also presented large opening. Following this event, it is reported that the public authority at that time, in fact the Dey Ali Shaush imposed to the inhabitant of Algiers (Casbah) preventive measures.

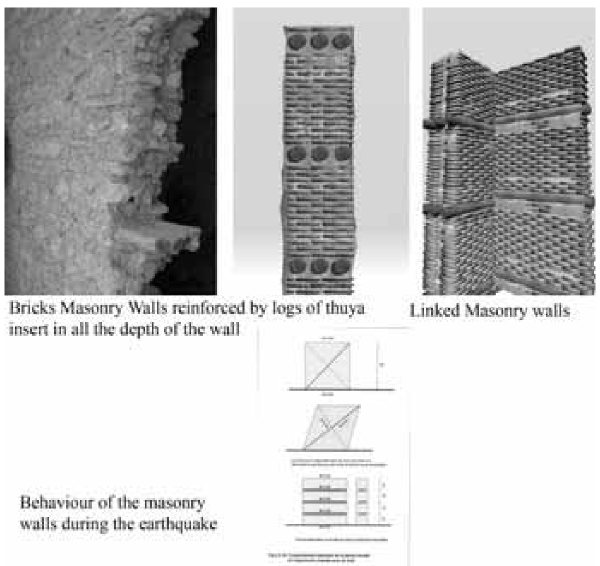


V. Description

15. Feature and attribute

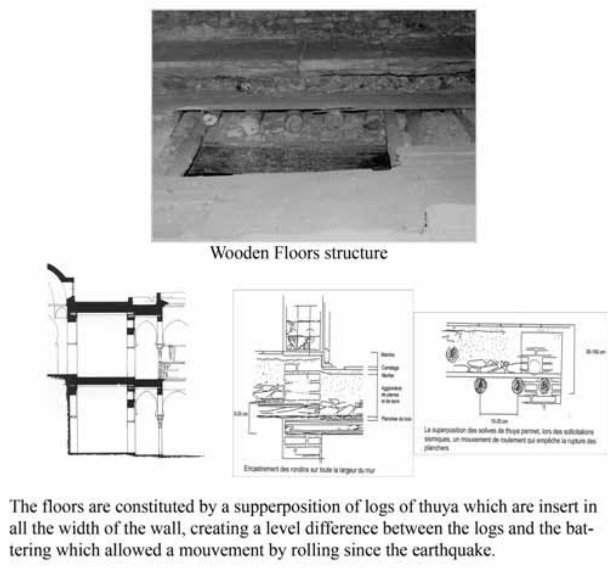
The Casbah of Algiers, which was rebuilt after the Algiers 1716 earthquake by the Ottoman, is classified as a world cultural heritage by UNESCO and where there are still people living in these houses. Theses traditional earthquake-resistant techniques have played a great role in protecting the Casbah of Algiers from earthquake which affected the site of Algiers during the last three centuries. These techniques should be enhanced and used for the preservation of historical site and monuments, not only, in Algiers but in other historical cities in North Africa and in the Mediterranean Basin where the old constructions have similar characteristics. This earthquake-resistant system concern the urban scale as a whole as well as the house unit by using constructive procedures adapted to the architectural typology developed during the 18th century. This construction system contributed to the perennially of this historical cultural heritage for the humanity.

Wall Structures

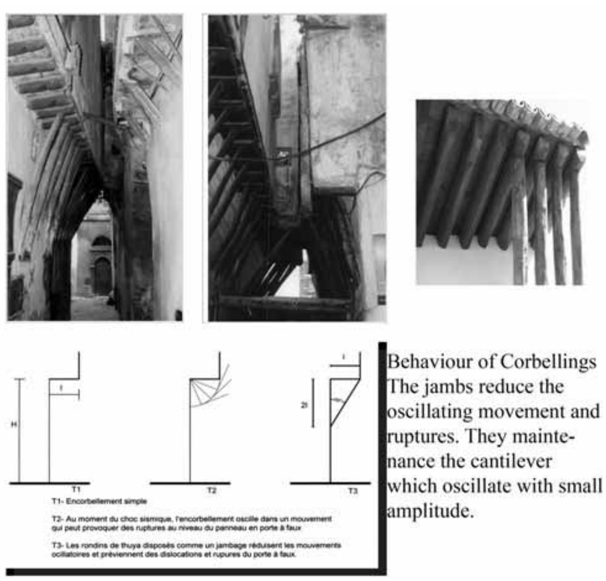


Arch-Column system

Floors structure



Corbellings



16. Necessary process to implement

First, this earthquake-resistant system should be promoted to the public authorities, decision makers, local authorities, researchers, design offices, contractors, and general public. The following strategic process for implementation is proposed: (1) Politically, accept that historical buildings are not only object to preserve but they also constitute a national and regional scientific resource. (2) Promote these traditional seismic protective measures rediscovered in historical sites. (3) Contribute to the understanding of these arrangement or constructions tips that have protected the historical monuments and sites. (4) Analysis and study of the evolution of the constructions procedures during the last centuries (typology, morphology). (5) Characterization of the seismic source parameters on the region under consideration. (6) Integration of these techniques into national building codes. (7) Revival of old professions capable of dealing with historical buildings. (8) Study the effects of an expected seismic event (i.e., a scenario event) on the site containing a relevant historical structure, using the scenario to characterize the behavior of different structural typologies, including local seismic culture elements. (9) Identify the main historical monuments and sites at risk, in order to take reinforcement actions of the relevant structure by implementing these traditional techniques. (10) Transmit the traditional seismic preventive techniques to decision makers and end users. (11) Provide end users (engineers, architects, decision makers, politician, civil protection, etc.) effective and comprehensible description of the procedure. The above propositions constitute the starting point for the development of an efficient and cost effective preservation strategic plan for cultural heritage. (12) Training skilled builders.

17. Strength and limitations

In this position, we note the facility to implement theses traditional techniques and also the cost they involve. In the negative side, what type of materials (wood, mortar, bricks, etc.) we have to use. Also, it will take some of making these techniques accepted by decision makers, design offices, contractors, general public, etc.

18. Lessons learned through implementation if any

Not yet newly implemented. Theses techniques were used and in place since 1716. Possible lessons can be:

Diffusion of knowledge acquired by the training of qualified workers (masons, builders).

Vulgarizing the research of the earthquake resistant technics trough Universities and Official Authorities.

Concentrating on coast effective of technology and social impact in the field of preservation of cultural heritage.

VI. Resources required

19. Facilities and equipments required

Really, there no much need in large and equipments. What is really needed is training and also the adequate building materials satisfying certain conditions for this type of work. Experts and consultants having a good experience in historical construction are required. Lobbying is also important to revive these traditional techniques.

20. Costs, organization, manpower, etc.

1. Developing a sound culture of preservation by incorporating local seismic culture through universities and official authorities.
2. Developing an intervention methodology for the preservation of historical monuments and sites based on science.
3. Producing an exhaustive traditional preventive techniques catalogue including their role and their use as a practical tool.
4. Diffusing knowledge acquired by the training of qualified workers in the field of preservation.
5. Concentrating on cost effective and social impact of the preservation actions.

The budget per building/project will depend on size and complexity, availability of information, accessibility, and the existence of local resources as qualified manpower and facilities, such as workshops.

VII. Message from the proposer if any

21. Message

These Traditional-Resistant Techniques have contributed effectively in reducing damage on old constructions since their adoption and allowed tomorrow similar effects if an earthquake occurs in the site of the Casbah of Algiers.

The majority of Cultural Heritage in Region Algeria is located in urban and coastal areas which are also located in the seismic zone.

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that is shown to be effective based on case studies/experiments in field sites.

23. Notes on the applicability if any

The techniques are applicable in the remaining houses in the Casbah of Algiers which is classified as UNESCO World Cultural Heritage (since 1992)

IX. Application examples

No.1

E1-1. Project name if available
The Casbah of Algiers (Algeria) and several other historical cities in North Africa as well in Turkey and Syria (Not new projects but original constructions)

E1-2. Place
Algiers, Fez (Morroco), Tunis (Tunisia), Damascus (Syria), etc.

E1-3. Year
18th century

E1-4. Investor
The government at that time according to the Ottoman archives

E1-5. People involved
We have to go back to the Ottoman archives to find out.

E1-6. Monetary costs incurred
Not available today.

E1-7. Total workload required
Need a study according to today's standard.

E1-8. Evidence of positive result
The constructions of the Casbah of Algiers built in 1520's are still there today after surviving several destructive earthquakes that have affected the site of Algiers in the past.

No.2

E2-1. Project name if available
Casbah of Dellys (Algeria)

E2-2. Place
Dellys (Algeria)

E2-3. Year
10th century

E2-4. Investor
Government at that time.

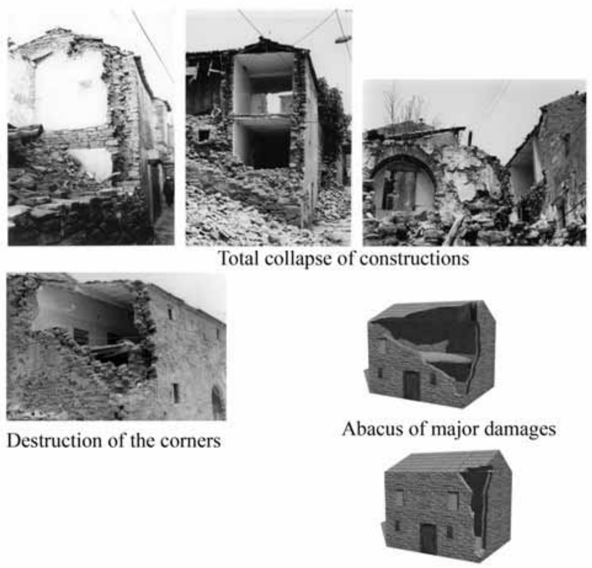
E2-5. People involved
Inhabitants

E2-6. Monetary costs incurred
Not available today, needs some research in Arabic and Ottoman archives.

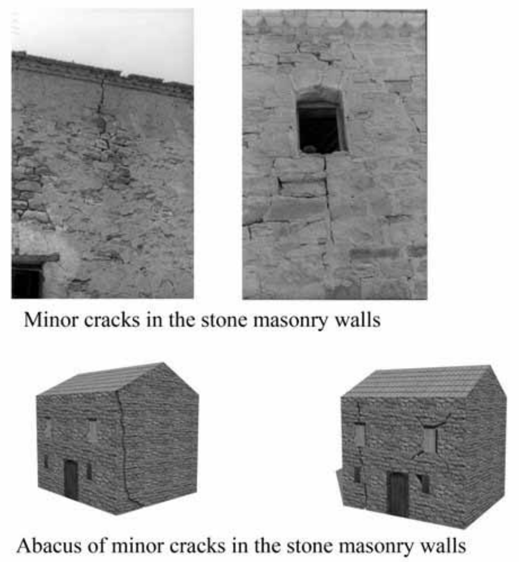
E2-7. Total workload required
Not available today, needs research

E2-8. Evidence of positive result
The old nuclei of the site of Dellys is still standing and thus surviving several destructive earthquakes in the past centuries (1632) and after the 21st century (2003 Boumerdes (Algeria) earthquake).

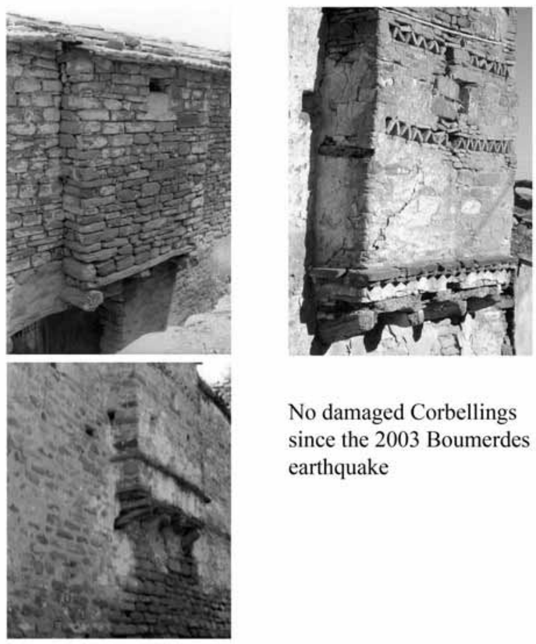
Major Damages



Minor Damages



Corbelling



No damaged Corbellings since the 2003 Boumerdes earthquake

X. Other related parallel initiatives if any

More of others old cities in Algeria (Constantine, Oran, etc.) Morocco (Fez, Meknez, ect.) and Tunisia (Tunis, etc.).

XI. Remarks for version upgrade

Attached files:
> Total_collaps_Dellys_2003.jpg (JPG - 346 Kb)
> Arch-Column_departure_2.jpg (JPG - 27 Kb)
> Minor_Damages_Dellys_2003.jpg (JPG - 373 Kb)
> 8_TIK1_P1.pdf (PDF - 510 Kb)
> 8_TIK1_P2.pdf (PDF - 1113 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 12)

I. Heading

1. Title

Tsunami Disaster Mitigation Technique by Coastal Greenbelt

ID:	DRH 12
Hazard:	Tsunami, Storm surge, Flood
Category:	Implementation Oriented Technology (IOT)
Proposer:	Tetsuya Hiraishi
Country:	INDONESIA; PAPUA NEW GUINEA; JAPAN;
Date posted:	31 January 2008
Date published:	01 September 2008

Japanese traditional forest barrier Discussion note in PNG.

Contact
Tetsuya Hiraishi
Head, Wave Division, Port and Airport Research Institute
Nagase 3-1-1, Yokosuka, Japan 239-0826
Tel 81-46-844-5036, Fax 81-46-844-1274
e-mail hiraishi@pari.go.jp

2. Major significance / Summary

Coastal greenbelt composed of mangrove, coconuts, mango etc has an effect to reduce the tsunami flow velocity when its density and width becomes appropriate. The suitable arrangement of greenbelt is necessary to mitigate the coastal tsunami disaster especially in the Asia and Pacific area where the implementation of hard barriers like breakwaters is difficult.

3. Keywords

Tsunami force, Disaster mitigation, Greenbelt, Evacuation support tool, Tsunami countermeasure, Numerical simulation

II. Categories

4. Focus of this information

Implementation Oriented Technology (IOT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, NGO/NPO project managers and staff, Environmental/Ecological specialists, Others
5-2. Other users: Motivated researchers

6. Hazards focused

Tsunami, Storm surge, Flood

7. Elements at risk

Human lives, Human networks in local communities, Infrastructure, Coastal areas

III. Contact Information

8. Proposer(s) information (Writer of this template)

Tetsuya Hiraishi
Head, Wave Division, Port and Airport Research Institute
Nagase 3-1-1, Yokosuka, Japan 239-0826
Tel 81-46-844-5036, Fax 81-46-844-1274
e-mail hiraishi@pari.go.jp

9. Place where the technology/knowledge originated

INDONESIA; PAPUA NEW GUINEA; JAPAN;

10. Names and institutions of technology/knowledge developers

Port and Airport Research Institute

11. Title of relevant projects if any

This technology employs local plants according the regional condition. The technique is applicable to any coastal area with several coastal tree plants.

12. References and publications

Greenbelt Tsunami Prevention in South-Pacific Region, Report of Port and Airport Research Institute, Vol.42, No.2, 2003.

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

The Papua New Guinea Earthquake in 1998 caused a heavy damage at the northern coast in the country. After the damage, a regional meeting to discuss on the countermeasures against tsunami hazard was held in Madan city in Papua New Guinea. The greenbelt countermeasures were proposed in the meeting because the cost for hard barriers was very large. Several physical and numerical works were done to evaluate the effect of greenbelt against tsunami. The experimental results in the Port and Airport Research Institute demonstrated that at least 15 trees per 100 m^2 might be necessary to reduce the tsunami force to the level safe to wooden houses.

1998 Tsunami hazard in Papua New Guinea

Japanese traditional forest barrier Discussion note in PNG

V. Description

15. Feature and attribute

A vertical column in the flow becomes an obstacle to reduce a flow velocity. The effect of resistance is evaluated by the drag coefficient term of a column in a steady flow. In the experiment, the drag force reduction in the greenbelt were studied.

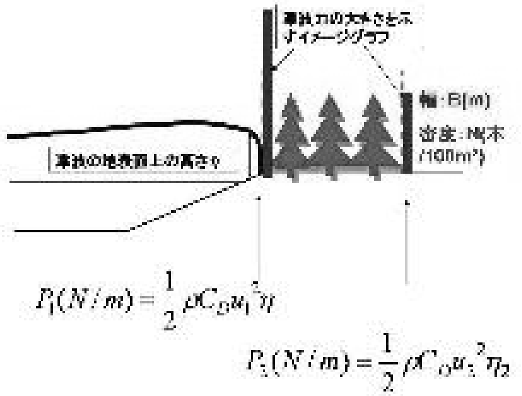


Image of greenbelt

16. Necessary process to implement

Costal greenbelt can be planted in an appropriate area facing to tsunami hazard risk. In the first year the plant is very weak so the protection from sea wave and current is necessary.

Plantation of Pandung in Java

17. Strength and limitations

The dense coastal forest is effective to reduce the tsunami force and tsunami hazard. But the flow velocity in a access road between greenbelts units may become very fast. The evacuation along the access road becomes difficult.

18. Lessons learned through implementation if any

Plantation can be done by the local residence. The regional meeting to unite the local opinion is very important.

VI. Resources required

19. Facilities and equipments required

Appropriate vegetation in the target area and enough space in front of coastal villages.

20. Costs, organization, manpower, etc.

Coat is not so large.

VII. Message from the proposer if any

21. Message

The risk due to tsunami, storm surge and high wave increases rapidly in the recent years. The hard prevention like breakwater needs a lot of costs and construction time. The greenbelt coastal prevention technique becomes one of the most effective countermeasures done in few cost and relatively short time.

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has fair applicability demonstrated by implementation in one or more field sites.
The experiment was done in the Port and Airport Research Institute.

23. Notes on the applicability if any

Any coastal trees are applicable to the greenbelt (Dense Coastal Forest). For example, a local plant (named BUNI) had an effect to reduce tsunami force. It was revealed in the field survey in Solomon Island (2007).

IX. Application examples

No.1

E1-1. Project name if available
East coast tsunami prevention project in Indonesia

E1-2. Place
East coasts in Indonesia Example of Mangrove plantation

E1-3. Year
2004-

E1-4. Investor
Indonesia Government

E1-5. People involved
Local residence

E1-6. Monetary costs incurred
None

E1-7. Total workload required
Two years

E1-8. Evidence of positive result
Several hazards were prevented.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:

> 6.jpg (JPG - 8 Kb)
> 3.jpg (JPG - 5 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

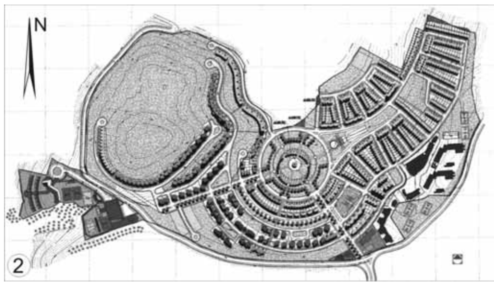
DRH-Asia Contents (DRH 13)

I. Heading

1. Title

Integrated Natural Risk Reduction through a Sustainable Cities Programme

ID:	DRH 13
Hazard:	Earthquake, Tsunami, Volcanic eruption, Landslide, Mudflow, Cyclone/Typhoon, Storm surge, Flood , Flash flood , Snow avalanches, Drought, Multi-hazard
Category:	Process Technology (PT)
Proposer:	Julio Kuroiwa
Country:	ln Peru, South America. On going since 1998
Date posted:	04 February 2008
Date published:	09 November 2008



General Plan of El Pinar by Miguel Romero, architect and urban developer.

Contact
Prof. Julio Kuroiwa
Chief technical advisor (CTA) of the SCP. Professor Emeritus National University of Engineering (UNI). Lima, Peru
Av. Del Parque Sur 442. Lima 27. PERU
E-mails: jkuroiwah@infonegocio.net.pe / editnsg@speedy.com.pe
Telefax (511) 719-3555 Phone office (511) 719-3554 Phone home (511) 476-4834

2. Major significance / Summary

Great impact in reducing human lives and material losses. Easy and cheap to implement.
Widely accepted by communities and local authorities. Expanding. Action Plan for 2007-2011 approved. Productions being used to consolidate Peru's National System for Disaster Reduction. Needed to safely settle new inhabitants. Recognitions: UN/ISDR, World Bank, Johannesburg Action Plan. Good Governmental Practice 2006 Award in Peru. Applied in the reconstruction of cities affected by the Peru 2007 earthquake.

3. Keywords

Sustainable city, hazard map, land use plan, disaster mitigation project, implementation, municipal ordinance and reconstruction of affected cities.

II. Categories

4. Focus of this information

Process Technology (PT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.), NGO/NPO project managers and staff, International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Financing and insurance business personnel, Experts, Teachers and educators, Architects and engineers, Sociologists and political economists, Information technology specialists, Urban planners
5-2. Other users: Policy makers, Motivated researchers, Local residents

6. Hazards focused
Earthquake, Tsunami, Volcanic eruption, Landslide, Mudflow, Cyclone/Typhoon, Storm surge, Flood, Flash flood, Snow avalanches, Drought, Multi-hazard

7. Elements at risk
Human lives, Human networks in local communities, Business and livelihoods, Infrastructure, Buildings, Urban areas, Coastal areas, River banks and fluvial basin, Mountain slopes, Agricultural lands, Cultural heritages

III. Contact Information

8. Proposer(s) information (Writer of this template)
Prof. Julio Kuroiwa
Chief technical advisor (CTA) of the SCP. Professor Emeritus National University of Engineering (UNI). Lima, Peru
Av. Del Parque Sur 442. Lima 27. PERU
E-mails: jkuroiwah@infonegocio.net.pe / editnsg@speedy.com.pe
Telefax (511) 719-3555 Phone office (511) 719-3554 Phone home (511) 476-4834

9. Place where the technology/knowledge originated
ln Peru, South America. On going since 1998
130 Peruvian cities, located all over the country.

10. Names and institutions of technology/knowledge developers
Julio Kuroiwa, Alfredo Perez and Alfredo Zerga, members of SCP Task Force. Peru's Civil Defense. Peruvian Government. Ciro Mosqueira SCP National Director.

11. Title of relevant projects if any
Safer homes for the poorest. Included in the SCP-1S for the period 2007-2011, and route map for Peruvian municipalities for the period 2008-2021

12. References and publications
Idriss, I. M. (1991). Earthquake Ground Motions at Soft Soil Sites. Proc. 2nd Intern. Conf. on Recent Advances in Geotech. Earthq. Engg. And Soil Mechanics. Pp 2265-2273. St. Luis. MO. USA.

Seed, R. B. et al. (2001). Recent advances in soil liquefaction engineering and seismic site response evaluation. Proc. 4th Intern. Conf. on Recent Advances in Geotech. Earthq. Engg. and Soil Mechanics. Paper No SPL-2, 45p. San Diego, CA. USA.

Kuroiwa, Julio. Disaster Reduction. Living in Harmony with Nature. Book in English 512 p. Editorial NSG S.A.C. Lima. Officially presented during the UN World Conference on Disaster Reduction Kobe, Hyogo, January, 2005.

Kuroiwa, Julio. Sustainable Cities, a Regional Seismic Scenario, and the 2001-06-23 Arequipa Peru Earthquake. Natural Hazard Review, Vol. 3, No 4, Nov. 1, 2002. An ASCE publication.

Kuroiwa, J. & Alva, J. (1991) Microzonation and its Application to Urban & Regional Planning in Peru. Proc. 4ICSZ. Vol. I, pp 771-794. Stanford. CA. USA.

Podesta, J. L. & J. Kuroiwa (2006). "Risk Governance of Natural Disaster Reduction for Sustainable Socio-Economic Development". International Disaster Reduction Conference. IDRC Davos 2006. Davos, Switzerland Aug. 27-Sep. 1, 2006.

13. Note on ownership if any
Free use. Belong to the public domain

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice
In November 1998, there was a need to reconstruct the Peru's NW cities severely affected by El Niño 1997-98. The author proposed to the then Prime Minister of Peru and Head of El Niño Reconstruction Committee (CEREN) to safely reconstruct the cities according to the attributes of a Sustainable City, just defined by him. His ad-honorem services were immediately accepted. In 2001 the SCP was transferred

from CEREN to Peru's Civil Defense (INDECI) and the Arequipa earthquake occurred. So the SCP was expanded to the S-W region, the macroseismic area. INDECI evaluated the results of the application of the SCP in Peru's NW and SW regions and it was expanded countrywide. The key tool is the hazard map based on microzonation studies, which was developed in Peru after the 1970 earthquake. In the early 1980s it reached the state-of-the-art. The microzonation methods and techniques were simplified to be of practical use and affordable cost. At the end of 2006, the new top decision-making authorities of INDECI approved the Action Plan for 2007-2011.

V. Description

15. Feature and attribute

As population and values are concentrated in the cities, in intense events the loss of lives in developing countries and the material losses in industrialized nations may be very high. For example, in the Indian Ocean 2004 tsunami, 230,000 victims; Peru 1970 EQ 67,000; and Pakistan 2005 EQ 95,000. In the New Orleans 2005 "Katrina" and Kobe 1995 EQ, losses surpassed US$ 100 billion, unacceptable even by rich countries. According to the UN, 2 billion people will be added to the world population in the next three decades. So a global effort is necessary to reduce losses in urban areas. The Sustainable Cities Programme (SCP), focusing on the first attribute of a SC, its physical safety (PCS-1S), is one of the ongoing programmes in that direction. In the SCP-1S the key tool is the hazard map based on microzonation studies.

Population densification and city expansion take place in sectors of low to medium hazard. High-hazard sectors are used with restriction and very high- hazard sectors are not permitted for urban occupation.

16. Necessary process to implement

First, it is necessary to formulate a project/programme (p/p) with a good cost-benefit ratio; practical; with tangible results; and of great benefit to the communities.

The awareness of communities and authorities must be raised by means of workshops, lectures and the media.

Funding by national, regional and local governments. Use international auspices only as seed money or in complementary investments.

Firm commitment of the local authorities to impulse the p/p. Use local trained consultants to reduce operating costs and for (p/p) follow up.

Leadership of the executing institution and efficient task force; indispensable to have good communication with the top level of decision-making.

Efficient and transparent management of the funds (this time in charge of UNDP). Be proactive. For example, some theses are developed at universities 1-2 years before an activity is initiated.

17. Strength and limitations

The multihazard approach hazard map - a key tool for safe, sound urban development - uses microzonation methods and techniques based on global existing knowledge and experience, mainly in Japan and California as well as the results of damage surveys of 22 disasters of geological and climatic origin that occurred in the Americas from 1963 to 2007. During the development it reached the state-of-the-art level, early in the 1980s.

Limitation: The SCP-1S consists of: hazard map, land-use plan, disaster mitigation profile projects and implementation by municipalities. The SCP implementation is not being carried out as expected, due to the limited economic and technical capacities of local governments. During the next few years INDECI and UNDP will concentrate on tackling this important problem.

18. Lessons learned through implementation if any

For a long-lasting programme as is SCP-1S it is necessary to have:

• Strong support from the highest political decision-makers to ensure continuous funding. This is possible using windows of opportunities.

• Good governance. In this case, smooth correlation between the institutional management and the disaster-assessment working group.

Team work with prudent leadership, so that every member feels that he "owns" the programme, and that his contribution is very important.

VI. Resources required

19. Facilities and equipments required

In this era of the interconnected computer, there is no need for large offices: a small one is sufficient for the SCP Task Force and its assistants. As the Programme uses conventional engineering methodology, it is possible to use existing private laboratories or those at the national universities, with which most of the INDECI consultants are associated. But the methodology is updated according to international advances. For example, the contribution of Idriss, 1991, and Seed et al. 2001 on the great amplification of seismic waves in soft soil versus rigid soil or rock in the range of small acceleration.

The conclusion agreed well with our own research into the microzonation effects in field surveys of 15 EQs occurred in the Americas from 1963 to 2007; the impact on the vulnerable adobe housing, very sensitive to V to VIII MMI degrees, was analyzed. Modern technology is included also through young consultants such as Dr. Zenon Aguilar who was trained by Prof. H. Iemura at Kyoto University. Dr. Aguilar owns modern equipment and software.

20. Costs, organization, manpower, etc.

First and foremost, a strong, well organized executing institution is needed, with quick access to decision-makers at the top level of central government.
A well informed, highly motivated task force, and knowledgeable and able consultants on geology, soil mechanics, hydrology/hydraulics, urban planning, the environment and GIS will be required. In this case most of them are university professors, who were trained on the job by the SCP Task Force.
The cost per city varies widely depending on size, existing information, accessibility, and the existence of local resources in terms of personnel and facilities, such as a laboratory.
But the cost may be the cheapest of the ongoing SC programmes, because of the very reasonable consulting fee, thanks to the participation of graduated students developing their thesis.
Existing soil data in use as a complement of soil exploration plan. They are available at the Ministry of Education and Ministry of Health since sites were investigated for the design and construction of new schools and hospitals.
The SCP designates some US$ 200,000/per year for consulting fees and supervision, paid by Peru's Central Government. This does not include salaries of the INDECI authorities or of the SCP Task Force and its assistants nor does it include the operational cost of INDECI Central Office or those of INDECI's regional offices when they provide assistance to the SCP Task Force (for example, transportation costs in their respective regions).
UNDP and municipalities provide some contributions is cash or in kind.

VII. Message from the proposer if any

21. Message

Three disasters of natural origin, three opportunities.

When the Ica region or Pisco Peru earthquake occurred, (Mw 8.0 USGS) on August 15, 2007 (**Fig. 1**), the SCP-1S had completed the hazard maps, land-use plans and disaster mitigation profiles of 123 Peruvian cities and towns with 6,3 million inhabitants. On that list were 16 cities and towns located in the macroseismic area, including the provincial capitals of the worst affected zone: Ica, Pisco, Chincha, and Cañete.
Two days after the earthquake, the author started a systematic damage survey focused on the seismic microzonation effects. In the SCP-1S 2001-2002 hazard maps, the Pisco beach area (**Fig. 2**) and Tambo de Mora (**Fig. 3**) were graded as very-high-hazard and high-hazard, because these sectors are threatened by soil liquefaction and tsunami, as in fact occurred on August 15, 2007.

Since the hazard maps of the investigated cities and towns were in good agreement with the actual degree of damage caused by the August 15, 2007 event and its geographic distribution, the national authorities, i.e. Peru's Civil Defense (INDECI) and the Ministry of Housing, Construction, and Sanitation (MVCS) decided to reconstruct and expand the affected cities based on their validated – i.e. reviewed and expanded – hazard maps. The UNDP continues supporting this Peruvian national effort. The regional and local authorities and the affected communities were fully informed on the general situation, and they accepted that decision.

In mid-September 2007, the validation of the hazard maps of the main affected cities was started. To the list were added 10 towns which had been severely affected by the August 2007 earthquake. By June 2008, validated or new hazard maps were available for 26 cities and towns, and these are now being applied in their urban plans for reducing the risk of disaster.

The validation of the hazard map for the city of Pisco started in mid-September 2007. Due to a quick decision of Peru's Civil Defense (INDECI), funds were immediately made available from the INDECI 2007 investment programme. Pisco city's validated hazard map was completed by December 2007 (**Fig. 4**).

In September, 2007, Dr. Kim Howells, Minister of Foreign and Common-wealth Office (FCO) of the United Kingdom visited the affected area. The author gave Dr. Howells a very brief explanation of the SCP-1S, the updated 1998-2007 results, and how its applications reduce the initial construction/reconstruction costs, and especially the maintenance cost, if the constructions are damaged in future events. By using the hazard maps and earthquake-resistant techniques developed in Peru during the last decade, this cost is able to be reduced substantially. Consequently, the Department for International Development of the United Kingdom (DFID, UK) donated US$500,000; thanks to the well-prepared request formulated by the UNDP/Peru.

With part of the funds donated by the DFID-UK, the hazard maps of Ica, Chincha and Cañete were validated, these being the provincial capital cities located in the macroseismic area. The hazard maps of 12 towns, and an additional 10 towns that had not previously been investigated but which were severely affected by the 2007 earthquake, were studied. All those studies started in November 2007 and concluded in May 2008. Most of the consultants had previously engagements with the SCP-1S; they were residents in the affected area, and professors and researchers of the National University of Ica. The resulting hazard maps are of good quality and they were completed on time, thanks to the hard work and dedication of the SCP-1S INDECI/UNDP consultants.

The Minister of Housing, Construction and Sanitation, Mr. Enrique Cornejo Ramirez in the presentation of the Manual on the Development of Sustainable Cities, edited and printed by UNDP/Peru in May 2008 with DFID funds, said that it had been "unanimously decided to reconstruct the cities affected by the Ica region's earthquake of 15 August 2007 applying their validated hazard maps."

The SCP-1S programme started in 1998, when there was the need to reconstruct the cities affected by the El Niño 1997-98, and it was expanded country-wide when the Regional Seismic Scenario 1992-95 was seen to coincide closely with the real effects of the 2001 Arequipa earthquake; the programme is now being consolidated as a result of the Ica region 2007 earthquake.

It may be concluded: Three disasters of natural origin, three opportunities, well used as a result of team work on the part of national, regional, and local Peruvian authorities, UNDP/Peru the affected communities, and consultants.

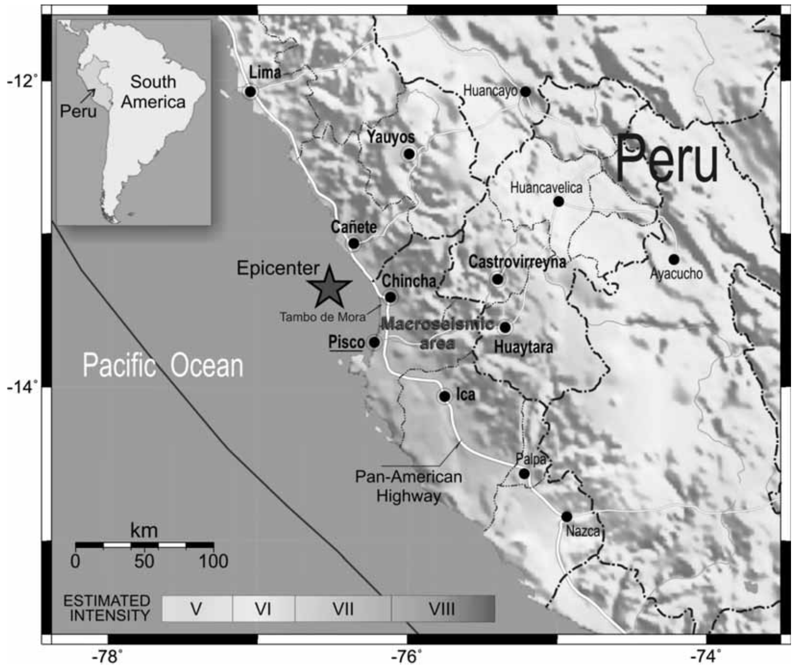


Fig. 1 Macroseismic area of the Peru August 15, 2007 earthquake, where the location of Pisco and Tambo de Mora are underlined. In those localities occurred the worst destruction in the macroseismic area as had been foreseen by the 2001–2002 hazard map. In both places, strips parallel to the coastal line, were graded as very–high-hazard. Those strips are threatened by soil liquefaction and tsunami intrusion.

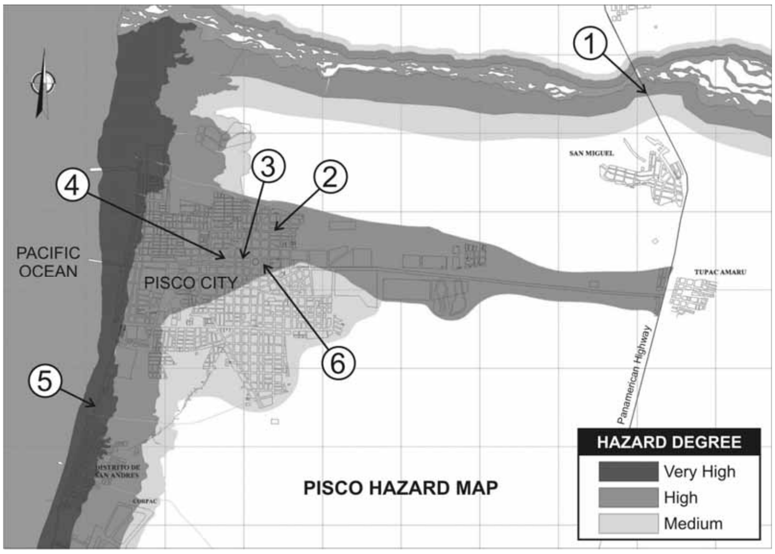
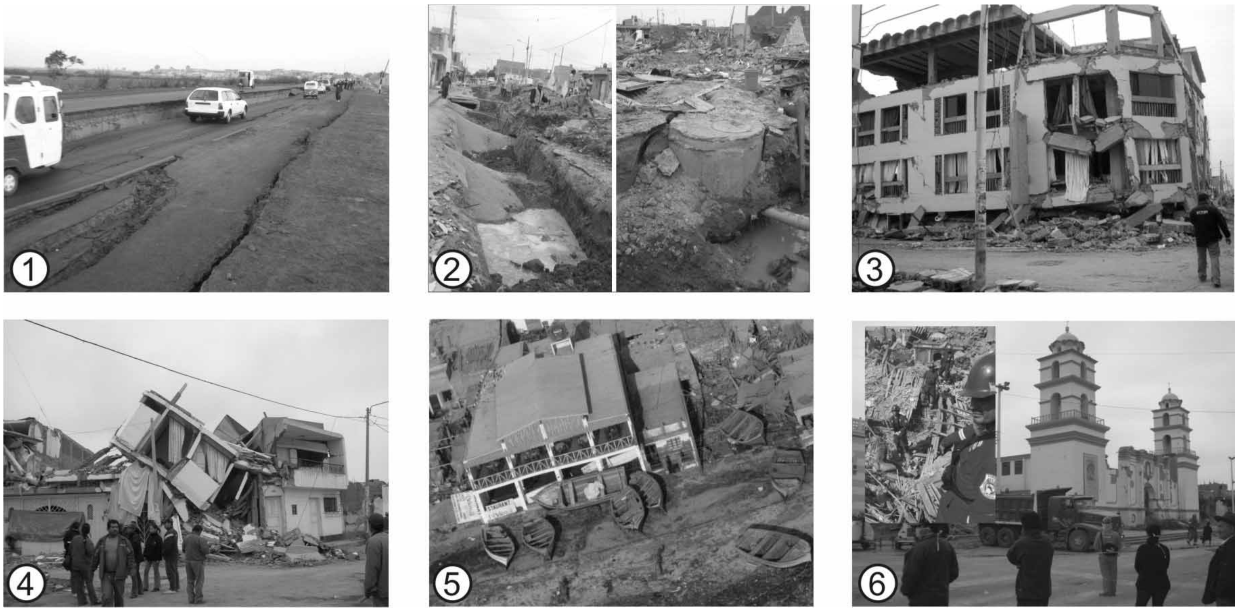


Fig. 2 Pisco Hazard map developed by the SCP-1S INDECI/PNUD in 2001 – 2002. At the location indicated; damage sustained there in some locations is shown below.



1. Damage on the Pan-American Highway.
2. Soil at downtown Pisco.
3. Collapsed Embassy Hotel.
4. R.C. building in downtown Pisco.
5. Tsunami effects in San Andres.
6. San Clemente Church at the Pisco main square.

1. Soil liquefaction in the upper part of Tambo de Mora.
2. Settlement in the jail of Tambo de Mora.
3. Sand volcano.
4. Lateral spread of a wall, "opening a door". Both walls were separated only 2 cm and were aligned.
5. A house that had settled some 0.70 m due to soil liquefaction.
6. Adobe church, with no damage at all. Located only 200 m from where widespread soil liquefaction occurred. The church is located on dry, stiff soil very different from the saturated silty sand existing nearby. This is a clear example of the microzonation effect.

Fig. 3 Effects of the August 15, 2007 Earthquake in Tambo de Mora

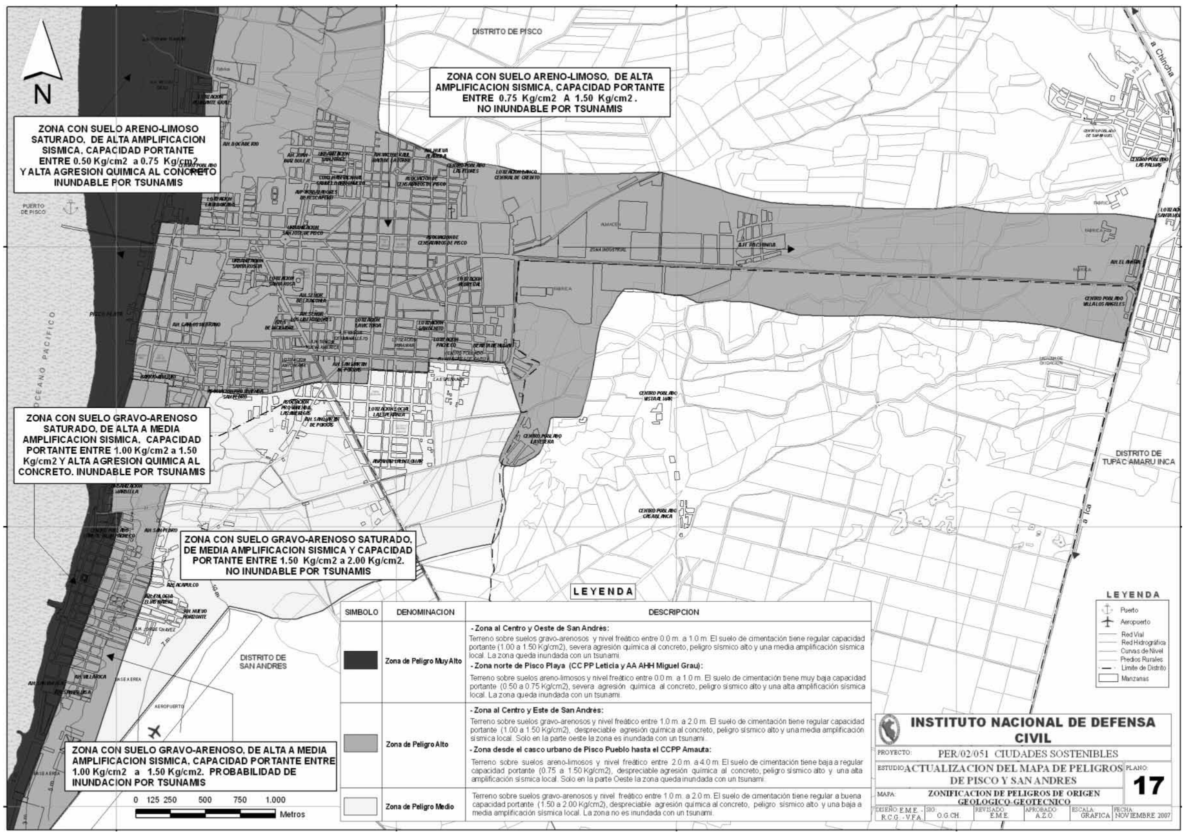


Fig. 4 Validated Pisco hazard map (December 2007)

The hazard map reviewed from September to December 2007, by the SCP-1S INDECI/PNUD Pisco was also studied by the Japan Peru Center for Earthquake Engineering Research and Disaster Mitigation from the Civil Engineering Department of the National University of Engineering (CISMID/FIC/UNI). The SCP-1S (2001-2002) and the validated hazard map agreed well, the very high hazard sectors of the three maps are practically carbon copies of each other.
This is one of the mean reasons why Mr. Enrique Cornejo Ramirez, the Minister of Housing, Construction and Sanitation (MVCS) said: "It was decided by consensus to develop the reconstruction plans of the main affected cities based on their validated hazard maps".

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

According to the UN, during the next 3 decades the world population will increase by two billion people. Most of them are going to live in large and medium cities of developing countries. It is necessary to settle them safely and orderly. The SCP is easy to replicate as it uses conventional expertise existing around the globe; specialists: in geology, soil mechanic, hydrology/hydraulics, urban planning, environment and GIS.

IX. Application examples

No.1

E1-1. Project name if available
Sustainable Cities Programme, 1st Step (SCP-1S)

E1-2. Place
130 cities and towns located countrywide in Peru, with 6.4 million inhabitants

SUSTAINABLE CITIES PROGRAM INDECI/UNDP, 1998-2008. RESULTS

REGIONS CITIES&TOWNS

1 TUMBES ✓	**Tumbes (88.4*), Aguas Verdes (10.3)**, Zarumilla, Papayal.
2 PIURA ✓	**Talara (97.8), Sullana (160.0), Paita (57.4), Sechura (16.7), Chulucanas (38.9), Huancabamba (6.8), Ayabaca (6.0), Castilla (108.7), Catacaos (50.4)**, Piura, Suyo.
3 LAMBAYEQUE ✓	**Chiclayo (535.4), San José (7.6), Pimentel (14.2), Eten (11.9), Picsi (4.8), Puerto Eten (2.5), Túcume (6.7) Monsefú (24.6), Reque (9.7), Lambayeque (40.9), Ferreñafe (32.3), Mórrope (4.7), Santa Rosa (13.0)**
4 LA LIBERTAD	Trujillo.
5 ANCASH	**Chimbote (313.2), Huarmey (17.1), Carhuaz (7.2), Recuay (3.1), Cátac (2.6), Ticapampa (2.5), Huaraz (93.3), Caraz (11.3), Yungay (5.9), Ranrahirca (0.8)**
6 LIMA ✓	**Cañete (40.8), Cerro Azul (6.6), Nuevo Imperial (14.5), San Luís (11.7), Imperial (35.7), Quilmaná (12.5), Lunahuaná (3.8), San Antonio (3.4), Asia (14.1), Mala (22.8)**, Chosica, Santa Eulalia, **Ricardo Palma (3.9), Matucana (4.4), Chancay (38.0)**, Huacho, Supe Puerto, Paramonga, Barranca.
7 ICA ✓	**Ica (283.1), San José de los Molinos (6.0), La Tinguiña (31.6), Palpa (8.2), Parcona (49.7), Nasca (35.5), Subtanjalla (16.2), Pueblo Nuevo (1.5), Tate (2.0), Guadalupe (8.3), Santiago (5.7), Los Aquijes (2.5), San Juan Bautista (0.9), Pisco (64.6), Chincha (151.9), Chincha Alta (49.8), Alto Laran (6.8), Grocio Prado (16.2), Pueblo Nuevo (36.8), Sunampe (17.6).**
8 AREQUIPA ✓	**Arequipa (1,073.0), Camaná (51.4)**, Cocachacra, Caraveli, Punta de Bombón, Dean Valdivia, Aplao, Chuquibamba, Corire, Cosos, La Real, Huancarqui, Lara, Viraco, Pampacolca, Lluta, Machaguay, Huanca, Callalli, Sibayo.
9 MOQUEGUA	Omate, Puquina, Moquegua, Ilo.
10 TACNA ✓	Tacna, **Locumba (1.1), Tarata (4.7), Candarave (2.3)**
11 AYACUCHO ✓	**Ayacucho (107.4)**, Huanta.
12 CUSCO ✓	Cusco, Ollantaytambo, Urubamba, **Calca (10.5)**, Pisac, Sicuani.
13 MADRE DE DIOS	**Puerto Maldonado (35.2)**, Iberia, Iñapari.
14 CAJAMARCA ✓	**Cajamarca (98.2), Baños del Inca (5.3), Jaén (54.7)**
15 SAN MARTÍN ✓	**Moyobamba (37.3)**, Tarapoto, **Juanjuí (18.0), Bellavista (8.2), San Hilarión (3.0), Lamas (11.3), Rioja (19.0), Nueva Cajamarca (15.8), Yuracyacu (3.8)**
16 APURIMAC	Abancay.
17 JUNIN	San Ramón.

**Thousands of inhabitants*

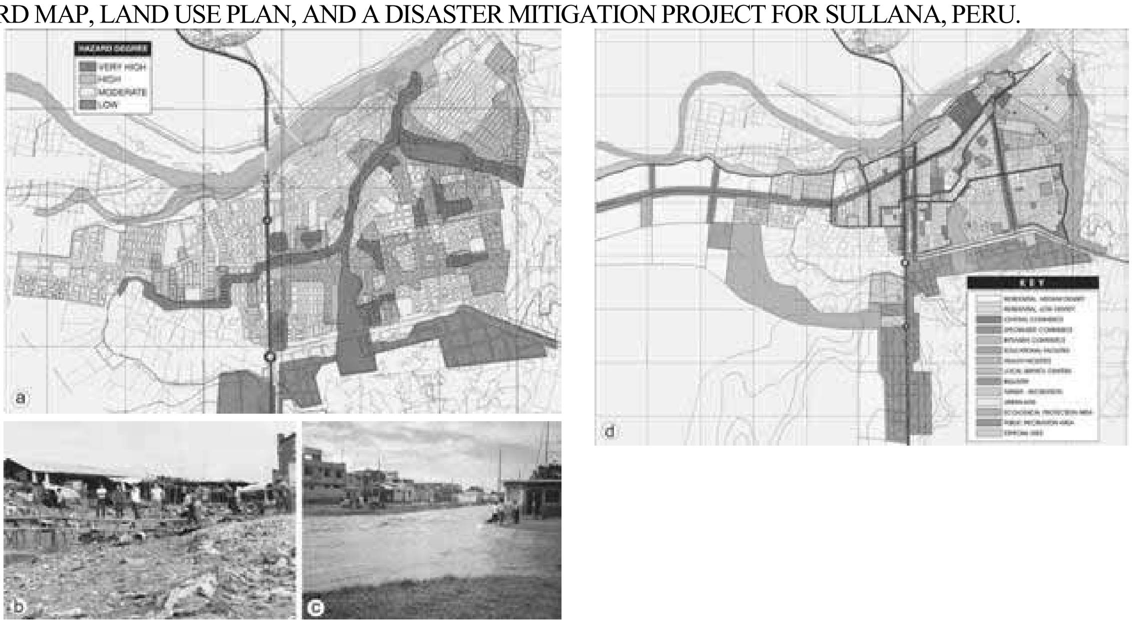
From 11/1998 to 06/2008, 133 cities and towns with 6.4 million inhabitants have been investigated. Agreements have been signed with participating local national universities: . In 10 years some 80 consultants have been trained on the job.

SECTORS CLASSIFIED PER DEGREE OF HAZARD

DEGREE OF HAZARD	CHARACTERISTICS	EXAMPLES	RESTRICTIONS AND RECOMMENDED USAGE
1) HIGHLY HAZARDOUS (Red)	- Forces of nature or their effects are so strong that man-made constructions cannot withstand them. - If the phenomenon occurs, losses reach 100%. - The cost of reducing damage is so high that the cost-benefit ratio rules out its use for urban purposes.	- Sectors threatened by landslides, avalanches, and sudden flows of mud and rocks. - Areas threatened by pyroclastic flows or lava. Beds of gullies originating at the summit of active volcanoes, and their deposition zones that can be affected by mud flows. - Sectors threatened by soil spreads. Areas threatened by floods with great hydrodynamic power, speed, and erosive force. - Sectors adjacent to V- or U-shaped vertices of bays threatened by tsunamis. - Soils with high probability of widespread liquefaction or soils that are collapsible in large proportions.	**Forbidden to use these sectors for urban purposes.** It is recommended to use them for ecological reserves, for open air recreation, or for the cultivation of short-cycle crops.
2) HAZARDOUS (Orange)	- The natural threat is high, but effective damage-reduction measures can be taken at reasonable costs, using appropriate techniques and materials.	- Strips adjacent to very-high-hazard sectors. The threat is considerably reduced, but the hazard remains high. - Sectors where high seismic acceleration is expected due to geotechnical features. - Sectors that slowly become inundated and remain under water for several days. - Partial occurrence of liquefaction and expansive soils.	Urban use permitted with prior detailed studies by experienced specialists, to qualify degree of hazard and fix the limits with the above-mentioned sector. Recommendable for low-density urban use. Adobe construction is not permitted.
3) MEDIUM (Yellow)	- Moderate natural threat.	- Soil of intermediate quality, with moderate seismic accelerations. - Very sporadic flooding with little depth or speed.	Suitable for urban use. Normal geotechnical studies required.
4) LOW (Green)	- Soils where there will be low amplification of seismic waves. - Very remote possibility of intense natural phenomena or gradual soil failure.	- Flat or gently sloping land, rock or compact, dry soil, with high load capacity. - High-lying non-floodable land, at a distance from cliffs or unstable hills. Not threatened by volcanic activity or tsunamis.	Ideal for high-density urban use and the location of indispensable buildings such as hospitals, schools, police stations, fire stations, etc.

To provide some guidance in the development of hazard maps, a matrix with the degree of hazard, their characteristics, some typical examples of natural threats and restrictions and recommendations on the use of different sectors are included.

HAZARD MAP, LAND USE PLAN, AND A DISASTER MITIGATION PROJECT FOR SULLANA, PERU.



a. Hazard Map for Sullana, Peru. The continuous red blue strip is the canal constructed in 1984-85, following a route traced by nature in 1983, when a 100-300 m strip was destroyed by dammed water overflowing because the platform of the Pan American Highway had broken. (Dam break).
b. Damage in La Quebrada during El Niño 1982 – 1983.
c. The canal along La Quebrada freeway flooded by El Niño 1997-98. No significant damage was reported in Sullana.
d. Land-use plan for Sullana, Peru, 2000. Note that a lot of agricultural land next to the city has been protected with a green belt. The area to be developed is the desert zone to the left, to the south west.
(From Kuroiwa, Julio 2004. Disaster Reduction Living in Harmony with Nature. Chapter 2. Sustainable Cities. Agenda for the 21st Century. p43)

E1-3. Year
1998 to date

E1-4. Investor

Mostly Peru's Central Government funds Contributions from local governments and UNDP, DFID from the U.K.

E1-5. People involved
SCP Task Force: Prof. Julio Kuroiwa, leader, Mr. Alfredo Perez (CE), Mr. Alfredo Zerga (urban planner). Mr. Ciro Mosqueira, National Director of the SCP and deputy chief of INDECI. Dozens of consultants.

E1-6. Monetary costs incurred
For consulting fee and supervision, an average US$ 200,000/per year, including use of laboratories considered in the consulting fee. That amount does not include full time permanent staff of SCP, Task Force; nor does it include INDECI authorities in their headquarters and regional offices, nor does it include supporting employees.

E1-7. Total workload required
Full time work of the SCP Task Force and its assistants, a dozen of 6-8 months part time of each consultant.

E1-8. Evidence of positive result
Hazard maps, land-use plans and disaster-mitigation profiles have been developed for 80 cities, and hazard maps for 130 cities, including the former 80. All those results have been unanimously approved by their communities, mayors and council members, and enforced by municipal ordinances.

No.2

E2-1. Project name if available
Relocation of Tipon town.

E2-2. Place
Tipon is located some 10 km south east (SE) from of Cusco city, Peru, in the Peru south-eastern region

E2-3. Year
Flooded in 1992 and in 1994

E2-4. Investor
Peru Civil Defense (INDECI) funded. The families involved in the relocation

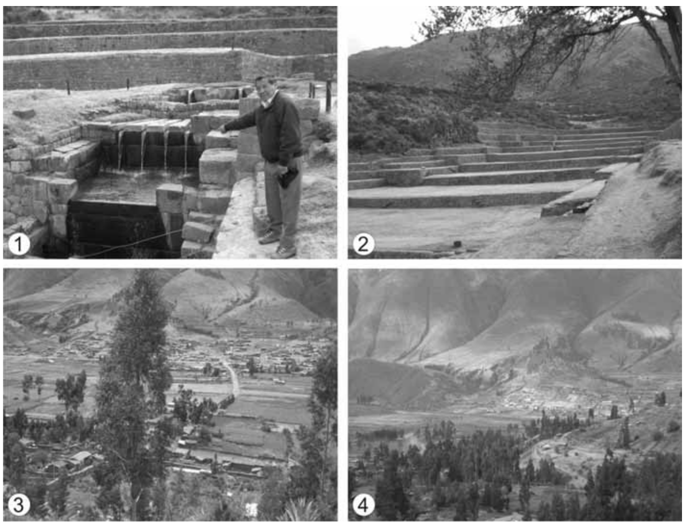
E2-5. People involved
The relocation of Tipon, severely inundated in 1992 and again in 1994, was recommended and executed by Ruperto Benavente, Professor of Geology at the National University of Cusco, who is the local consultant of SCP-1S INDECI/UNDP, trained on the job by the SCP-1S Task Force. The process started in the 1990s and is almost completed in 2008. About 400 people's now living in the new location. About 200 continue living in its original location, but out of the inundation threated sectors

E2-6. Monetary costs incurred
The consultancy fee of Prof. Benavente was less than US$ 3,000 and paid by Peru Civil Defense. The new location was provided by the Peruvian State and the relocated families built their homes at this new location by themselves.

E2-7. Total workload required
The most important resource was the convincing argument delivered by Prof. Benavente to the local communities and authorities regarding their future safety.

E2-8. Evidence of positive result
Most of the former residents of Tipon are now living in their new town.

TIPON



1. Prof. Ruperto Benavente (Geologist) of the National University of Cusco, showing Tipon. According to the American Society of Civil Engineers (ASCE), Tipon is a water engineering masterpiece of the Inca Empire which covers a 500–acre, self–contained walled settlement. Kenneth R. Wright P.E, of Denver, CO, said that Tipon was planned integrating water, soil, agriculture and topography, creating a virtual water garden that impresses all who visit this place.

2. General view of Tipon, located in the rural community of Choquepata, province of Quispicanchis, Cusco region, at 13º 34´ 09´´S and 71º 47´ 20´´W, some 10 km south east of the city of Cusco, Peru, at 3,560 m.a.s.l, on average. The community of Choquepata, which was relocated, is some 2 km, downstream from Tipon.

3. To the left, the lower part of the community of Choquepata, which was affected by mud flows in 1992 and 1994. Far on the slope is New Tipon. At present (2008), some 400 people are resettled in New Tipon, and 200 remain at Choquepata, both on flood-free areas. Prof. R. Benavente developed the hazard map, and did the coordination with the Peruvian Civil Defense Regional Office of Cusco, local authorities and the Choquepata community members. He convinced all of them of the need to relocate part of Choquepata (Photo courtesy of Prof. R. Benavente, taken on September 29, 2008)

4. Closer view of New Tipon. Photo taken by the author in August 2007.

No.3

E3-1. Project name if available
New Antamina Town named El Pinar, where management, high-ranking staff, employees and labors of the Antamina Mining Company live at present.

E3-2. Place
El Pinar is located in the upper part of Huaraz, the capital city of the Ancash Region. Huaraz was razed during the Peru 1970 earthquake, near 10,000 people were killed under their adobe houses, built on soft, water-saturated soil. Previously, in 1941, an avalanche had killed some 5,000 people there.
The location of El Pinar was initially selected by the Antamina executives and its main consultant, Mr. Miguel Romero, an urban planner and Peru's former Deputy Minister of Housing and Construction.

E3-3. Year
2000

E3-4. Investor
Antamina Mining Company. It is an important Peruvian polymetallic mining company. Mitsubishi (10 % share in the organization) provided powerful pumping equipment to transport semi-liquid ore from the high Andean mountain region (over 4,000 m.a.s.l.) to a sea port.

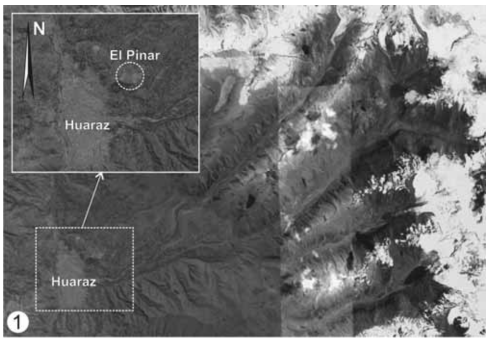
E3-5. People involved
Antamina Mining Operation Manager, Mr. Miguel Romero, an urban planner and his team. They were selected following a public bidding. The author was in charge of coordinating the microzonation studies and the El Pinar hazard map.

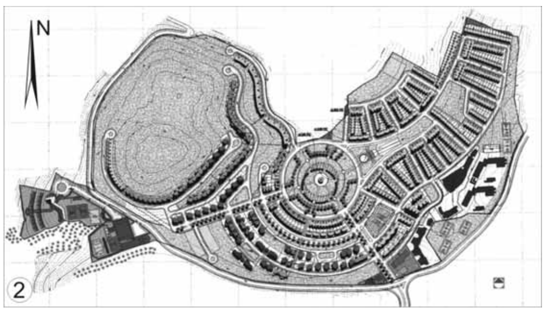
E3-6. Monetary costs incurred
The site investigation, urban development plan including the design of lifelines services as water, sewage energy and communication systems and housing typical design, cost some US$ 250,000

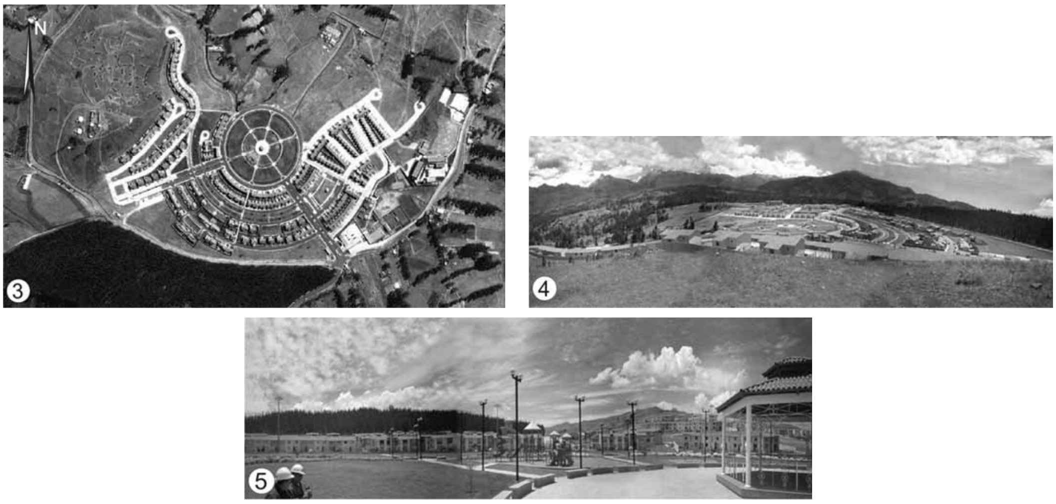
E3-7. Total workload required
The project was developed in 10 months in the year 2000 by a team of urban planners, architects, civil, structural and sanitation engineers. Some 40 men/month + assistants.

E3-8. Evidence of positive result
In the El Pinar Town live now some 5,000 residents. It was constructed from 2001 to 2004 by a private construction company.

EL PINAR







1. Location of El Pinar in the Huaraz area, Peru.
2. General Plan of El Pinar by Miguel Romero, architect and urban developer.
3. Satellite view, 2005. Notice that the north-eastern part is not developed yet, and the round plaza is located in the center of El Pinar. The drainage canals: one located in the lower part of the Plaza is the original drainage that has been functioning for centuries. The hazard map was developed by a team headed by the author.
4. General view of El Pinar. Note that the houses are located on gentle slopes inclined toward the plaza. The general drainage is toward the left of the picture.
5. Partial view of the built-up area of El Pinar.

X. Other related parallel initiatives if any

• The UNISDR/UNESCO SCP focuses on reducing earthquake damage. Damage from climatic disasters is gradually being included.
• The aim of the UNHABITAT/UNEP SCP is that the cities and towns will be made economically, socially and environmentally sustainable. This is one of the leading technical cooperation programmes in the field of urban environmental planning and management, and it is in agreement with Agenda 21 and UNHABITAT Agenda.
The SCP of the United Nations University, UNU, Shibuya, Tokyo, Japan, includes climatic hazards, and it is to be applied in SE Asia.

XI. Remarks for version upgrade

The INDECI/UNDP SCP, making good use of SCP-1S 1999-2008 results, is integrating public and private sectors, international aid agencies and NGOs to strengthen and enlarge this Programme in the 2007-2011 Action Plan, as already approved by the top authorities of Peru's Civil Defense. It will continue receiving UNDP support.

Attached files:
> 6_IOT3_P.pdf (PDF - 376 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 15)

I. Heading

1. Title

Village Tank Cascade Systems of Sri Lanka

ID:	DRH 15
Hazard:	Flash flood, Drought, Land degradation
Category:	Transferable indigenous knowledge (TIK)
Proposer:	C.M. Madduma Bandara
Country:	SRI LANKA;
Date posted:	05 February 2008
Date published:	14 January 2009

The present status of a village tank located within a cascade

The present status of a village tank located within a cascade.

Contact
Prof. C.M.Madduma Bandara
Emeritus Professor, University of Peradanaya; Visiting Professor, Kyoto University, (2007/8) Japan
Home: 45-C, Angampitiya Road, Meda Bowala, Kandy. Sri Lanka.
Tele: 0094-81-2388397; Mobile Phone 0094-777-289998
Email: madduband@yahoo.com

2. Major significance / Summary

'Cascade Systems' - an ancient, small- scale but widespread irrigation technology is observed in the Dry Zone of Sri Lanka. Some date back to over two millennia, but remain still operational, providing a unique case of resilience and long-term sustainability. However, due to deforestation of catchments, changes in management systems, increasing external economic controls and the breakdown of old social order, their present functioning remains far below optimum levels. This may be rectified through certain improvements in land use planning, innovative management approaches and promotion of market- oriented agriculture.

3. Keywords

Cascade Systems; Form and Substance; Relevance; Potential for Improvement; Rural Development

II. Categories

4. Focus of this information

Transferable indigenous knowledge (TIK)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, National governments and other intermediate government bodies (state, prefecture, district, etc.), NGO/NPO project managers and staff
5-2. Other users: Policy makers, Motivated researchers

6. Hazards focused

Flash flood, Drought, Land degradation
The main disasters addressed by cascade systems are Droughts and Flash Floods. They also address the issues of land degradations as indicated by their function as silt traps. Other related disasters are health hazards resulting from the present use of agro-chemicals; Interactions with wild-life (e.g. Human-elephant conflict).

7. Elements at risk

Human lives, Human networks in local communities, Business and livelihoods, Infrastructure, Rural areas, River banks and fluvial basin, Mountain slopes, Agricultural lands, Cultural heritages

III. Contact Information

8. Proposer(s) information (Writer of this template)

Prof. C.M.Madduma Bandara
Emeritus Professor, University of Peradanaya; Visiting Professor, Kyoto University, (2007/8) Japan
Home: 45-C, Angampitiya Road, Meda Bowala, Kandy. Sri Lanka.
Tele: 0094-81-2388397; Mobile Phone 0094-777-289998
Email: madduband@yahoo.com

9. Place where the technology/knowledge originated

SRI LANKA;
Dry Zone of Sri Lanka, North Central Province

10. Names and institutions of technology/knowledge developers

Re-discovery of Cascade systems (Madduma Bandara (1985) University of Peradeniya; Research Studies Sakthivadivel et.al. (1997) and (Panabokke 2000) International Irrigation Management Institute, Colombo

11. Title of relevant projects if any

Watershed Management, Ecology and Rural Development

12. References and publications

Madduma Bandara, C.M. (1982) Effect of Drought on the Livelihood of Peasant Families In the Dry Zone of Sri Lanka: A Study of the Mahapotana Korale in the North Central Province. Climatological Notes: No.30, University of Tsukuba, Japan.

Madduma Bandara C.M. (1985) Catchment Ecosystems and Village Tank Cascades in the Dry Zone of Sri Lanka: A Time-Tested System of Land and Water Management; in Strategies for River Basin Management (Eds. Lundqvist,J. et.al.) Linkoping, Sweden.

Madduma Bandara, C.M. (1995). Tank cascade systems in Sri Lanka: Some thoughts on their development implications. In Haq, K A,et.al (Eds.), International Irrigation Management Institute, Colombo.

Panabokke, C.R (2000). The small tank cascade systems of the Rajarata: Their setting, distribution patterns, and hydrography. Colombo, Sri Lanka: Mahaweli Authority of Sri Lanka.

Sakthivadivel, R. et.al. (1997) Rehabilitation planning for small tanks in cascades: A methodology based on rapid assessment. Colombo, Sri Lanka: IIMI research report 13.

13. Note on ownership if any

Administratively, Minor Irrigation Systems come under the jurisdiction of the Department of Agrarian Services. However, they are owned and operated by the local community under the provisions of the Agrarian Development Act.

Cascade systems were originated within the community and practiced over many generations. Presently managed by Farmer Organizations and Provincial Councils

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

1) Recurrent Droughts and long dry spells (and their tendency to accelerate due to global climate change).

2) Floods during high rainfall and dam breaches

3) Physical setting with an array of watersheds of different sizes, shapes and their natural resources endowments

4) Ecological change, deforestation, soil erosion. Increasing human elephant conflicts

5) Social cohesion and kinship in rural society

6) Poverty, backwardness and food shortages during droughts

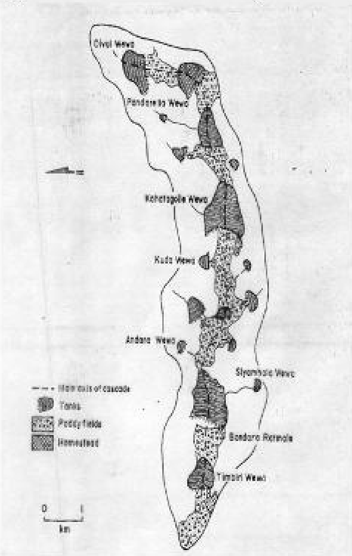
7) Out-migration and flight of talent and productive resources

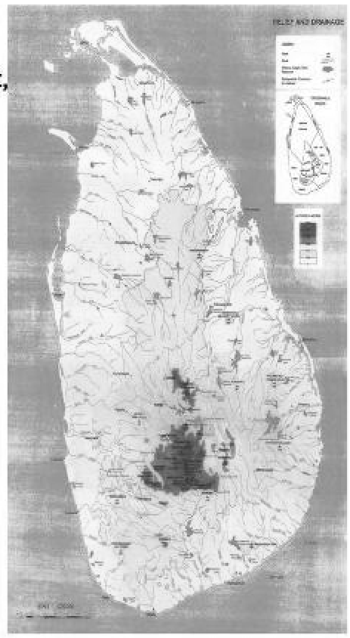
V. Description

15. Feature and attribute

1) More efficient management of scarce water resources in a drought prone area
2) Physical rehabilitation of tank cascade systems
3) Restoration of the community spirit and appropriate rural institutions
4) Land use zoning and nature conservation
5 Economic upliftment without environmental damage through appropriate cropping, animal husbandry and aqua-culture.

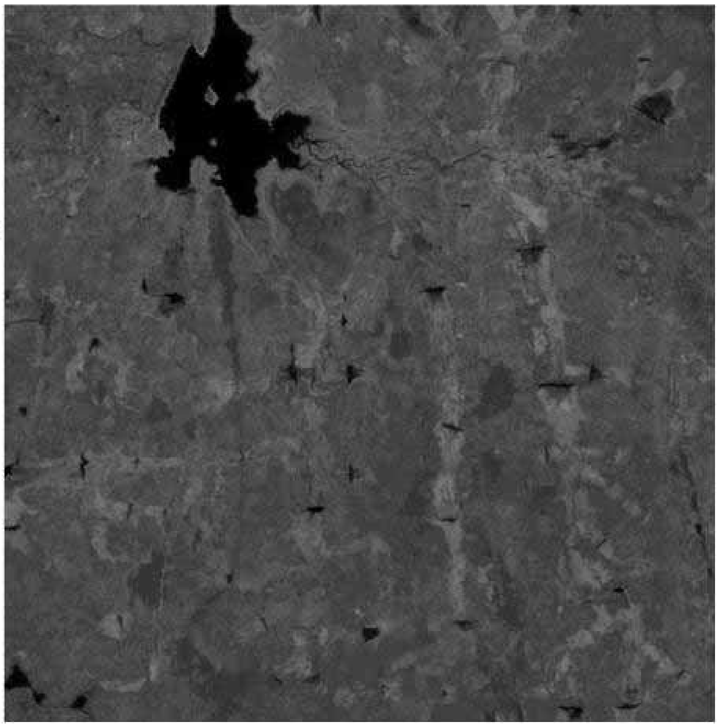
Cascades of village tanks nestled inside mini- watersheds in the North Central Dry Zone of Sri Lanka, presenting a traditional technology that, developed over long periods of history, to face the challenges of recurrent drought and flood hazards.





A satellite image of Cascading Village tank systems feeding a large reservoir in the Dry Zone of Sri Lanka

(Dark spots representing water bodies)



The present status of a village tank located within a cascade

16. Necessary process to implement

1) Submission of a comprehensive proposal
2) Official clearance and approaches
3) Location of adequate funding sources
4) Implementation strategy at field level
5) Identification of resource persons and field personnel
6) Interim evaluations and mid-term corrections
7) Ensuring sustainability of the project

17. Strength and limitations

Strengths

1. Clear Identification of a traditional technology
2.Unique nature and sustainability of an ancient system
3. Although small in scale the practice is more widespread in the dry zone of Sri Lanka, and possibly even outside Sri Lanka (e.g. India, Thailand, China, and Japan)
4. Increasing recognition of the value and potential of cascade-based development among regional planners and civil engineers

Constraints

1. Lack of funding for research and development
2. Location of the cascade technology in remote under-privileged areas of the country
3. Inadequate political and administrative will to embark on a major programme of this nature

18. Lessons learned through implementation if any

Some initiatives have been made by international organizations such as ‘Plan International’ and North Central Provincial Council to promote cascade-based rural development. These efforts, though commendable, lacks vision, direction and leadership. Activities at field level are often not coherent due to lack of an understanding of the systems principle and the actual cascade mechanisms. Evaluations of the progress in most implementation programmes is often biased and not so professional. The resources input to implement the necessary strategies had been marginal and minimal. The need for training a group of committed cadre of personnel with a clear understanding and vision is seriously felt.

VI. Resources required

19. Facilities and equipments required

1) Need for some initial support for development of a comprehensive proposal is vitally necessary. Both seed money and expert technical support is needed for this purpose 2) Facilities for field surveys (official space, travel, salaries and subsistence for experts and field personnel) 3) One full-time team leader and at least three experts with attractive remuneration. 4) At least One 4-weel vehicle, 3 motor cycles and 2 bicycles 5) Communication facilities, computers, office and field materials and facilities for promotion of education and awareness

20. Costs, organization, manpower, etc.

Funds; Around US$ 250,000 Organization: Office space, one project leader and three experts Man power; about 8-10 assistants Project period; 5-6 years Area of Operation: North Central Dry Zone of Sri Lanka with the base at Anuradhapura Town

Cost given is to cover the development needs of about 3 model cascade systems of different sizes ranging from 3-10 Square Kilometers. Proposed cascade development could be undertaken in collaboration with the local office of PLAN Sri Lanka, which is presently handling some experimental cascades in the area.

VII. Message from the proposer if any

21. Message

Village cascade systems reflect the wisdom of managing droughts, flash floods and land degradation in a tropical environment that suffers chronically from seasonal water shortages. The cascade technology has withstood the test of time and lasted for over two millennia. Restoration and development of cascade systems is still useful in rural renewal and local resource management. The development of a few model cascade systems may create a multiplier effects on managing water resources in similar environments. Therefore there is a need to compare similar systems developed in a few other countries such as India, Thailand and Japan in collaboration with appropriate agencies. This may also help in addressing the impending world food crisis by way of ensuring sustainable food production leading to mitigation of rural poverty.

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

Currently there is much interest in the issues of ecology and sustainability. Proposed project would prove to be an ideal testing ground for such concepts and the development of model human settlements for the future.

IX. Application examples

No.1

E1-1. Project name if available
Village Tank Cascade Systems for Drought Mitigation and Rural Development. Cascade development forms part of the current Provincial Development Plan. Its implementation is undertaken on an experimental scale by PLAN Sri Lanka - an NGO with international networks.

E1-2. Place
North Central and North Western Provinces of Sri Lanka

E1-3. Year
2009-2014

E1-4. Investor
Presently Plan International, Possibly FAO, UNDP, ADB, JBIC

E1-5. People involved
To be Provided with the Comprehensive Technical Proposal

E1-6. Monetary costs incurred
To be Provided with the Comprehensive Technical Proposal

E1-7. Total workload required

To be Provided with the Technical Proposal

E1-8. Evidence of positive result
To be ascertained at Interim Evaluations. A tangible result would be the creation of a few model cascade systems that could be emulated in other areas. An intangible result would be rural renewal and improvement of community spirit.

X. Other related parallel initiatives if any

Among the other parallel or related initiatives may include the following:
1. Traditional Knowledge World Bank, located at Renaissance villa in Florence, Italy and its activities; Website : http://www.tkwb.org/
2. UNCCD. (2005). Revitalizing Traditional Knowledge. A Compilation of Documents and Reports from 1997 – 2003. UNCCD, Bonn, Germany; Website: http://www.unccd.int
3. UN Decade for Indigenous People; Website : http://www.un.org/rights/indigenous/mediaadv.html
4. World Bank Indigenous Knowledge (IK) Programme; Website: http://go.worldbank.org/CFZJDCEDM0
Some activities related to the above International initiatives are also undertaken in Sri Lanka. However, they do not cover the subject of cascading systems.

XI. Remarks for version upgrade

Attached files:
> 100715_Scientific_Validation_of_Cascade_Management_P.pdf (PDF - 580 Kb)
> 8_TIK6_P.pdf (PDF - 501 Kb)
> An_Illustrative_of_Photograph_of_a_Village_Tank_in_a_Cascade_System.doc (DOC - 285 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 16)

I. Heading

1. Title

Stilt House Building Technology for Flood Disaster Reduction in Flood-prone Areas

ID:	DRH 16
Hazard:	Storm surge, Flood, Flash flood
Category:	Transferable indigenous knowledge (TIK)
Proposer:	Weihua FANG
Country:	CHINA;
Date posted:	06 February 2008
Date published:	01 February 2009

Newly built concrete house in water-logging areas in Dongting Lake Area of Hunan Province.

Contact
Dr. Weihua Fang (Associate Professor of the Academy of Disaster Reduction and Emergency Management, Beijing Normal University) and Fei HE
Academy of Disaster Reduction and Emergency Management, Beijing Normal University
No.19, Xinjiekouwai Street, Bejing 100875, China.
E-mails: fang@ires.cn
Tel: +86-10-58802283
Fax: +86-10-58802158

2. Major significance / Summary

Flood is a major threat to lives and properties in the riparian and coastal regions. The stilt Flood is a major threat to lives and properties in the riparian and coastal regions. The stilt house building technology, an indigenous knowledge in West Hunan Province, China, has been verified by its history of more than 1,000 years. It has also been developed into new forms and applied in modern concrete buildings.

3. Keywords

Stilt house, building technology, flood risk reduction

II. Categories

4. Focus of this information

Transferable indigenous knowledge (TIK)

5. Anticipated Users

5-1. Practitioners: Administrative officers, National governments and other intermediate government bodies (state, prefecture, district, etc.), NGO/NPO project managers and staff, Experts, Architects and engineers, Rural planners
5-2. Other users: Local residents

6. Hazards focused

Storm surge, Flood, Flash flood

7. Elements at risk

Human lives, Buildings, Rural areas, Coastal areas

III. Contact Information

8. Proposer(s) information (Writer of this template)

Dr. Weihua Fang (Associate Professor of the Academy of Disaster Reduction and Emergency Management, Beijing Normal University) and Fei HE
Academy of Disaster Reduction and Emergency Management, Beijing Normal University
No.19, Xinjiekouwai Street, Bejing 100875, China.
E-mails: fang@ires.cn
Tel: +86-10-58802283
Fax: +86-10-58802158

9. Place where the technology/knowledge originated

CHINA;

10. Names and institutions of technology/knowledge developers

11. Title of relevant projects if any

12. References and publications

13. Note on ownership if any

Free use.

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

People live in low-lying flood-prone areas for many reasons: history, tradition, livelihood, social status etc. To fight with flood, the major threat to their lives and properties, residents in such areas were forced to develop the unique stilt building technology so as to raise their houses to a higher and safer level while leaving spaces for flood flowing through.

V. Description

15. Feature and attribute

The mechanism of stilt house building technology is simple: raise the house to a higher level and leave spaces for flood flowing through.
Design and build using the following approaches:

- ✓ keep them from blowing away
- ✓ keep the rain out
- ✓ elevate the structures
- ✓ build with materials that can get wet
- ✓ build with materials that can get wet design assemblies to easily dry when they get wet

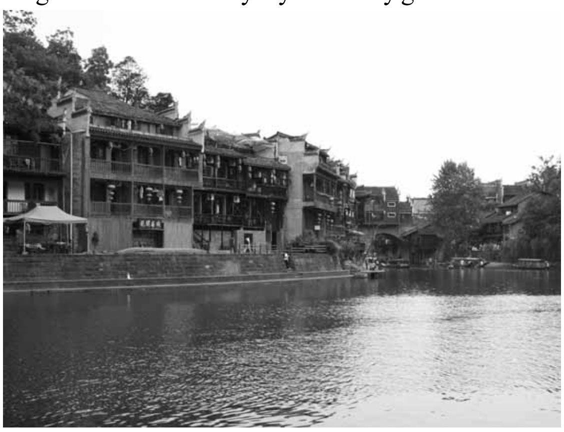


Fig. 1 Wooden stilt house along the riverside with hundreds of years of history in Fenghuang County of Hunan Province of China

Fig. 2 Reconstruction of normal buildings built in around 20 years ago, to stilt concrete house in Xiangjiang River basin of Hunan Province of China

Fig. 3 Newly built concrete house in water-logging areas in Dongting Lake Area of Hunan Province

Fig. 4 New home in Florida Panhandle of the U.S.A

16. Necessary process to implement

First, knowledge of the highest historical water level should be acquired, through indigenous knowledge or scientific analyses, thus to determine the height of the stilts to be built;

Second, characteristic relating to floods should also be taken into consideration, such as flow direction, lasting time etc; Third, proper building technologies should be chosen according to availability of building materials and characteristics of local terrain;

Finally, the stilts must be strong enough to withstand both the weight of the house and strike of flood waves.

17. Strength and limitations

The use of stilt house building technology can effectively reduce flood or water-logging risk. A possible limitation is that this kind of technology may not be suitable for regions where erosion is severe or ground is unstable. Moreover, the stilts must be strong enough.

18. Lessons learned through implementation if any

For houses built along the river, cylinder stilts will produce much less resistance against water flow and thus are more stable. While for houses built in areas where water flow is slower, square stilts have the advantage of easy constructing.

VI. Resources required

19. Facilities and equipments required

Common building equipments.

20. Costs, organization, manpower, etc.

Costs of stilt houses vary according to the material used and number of floors to be built. Cost of a brick-concrete stilt building, usually two to three floors, is between 5,000 and 40,000 RMB (about 600 to 5,000 US Dollars); The time of building such a house is generally one to two months, with manpower of about twenty to thirty.

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
Stilt Wooden Houses in West Hunan Province, China

E1-2. Place
Fenghuang County, Zhangjiajie, Hunan Province, China

E1-3. Year
About 1,000 years ago

E1-4. Investor

E1-5. People involved
Local residents

E1-6. Monetary costs incurred
The cost of a two store wooden house is about 20,000 RMB (in average) Building materials: 10,000 Fitment materials: 3,000 Wage for workers: 7,000

E1-7. Total workload required

About ten manpowers need to work for one month to complete a two to three floor stilt wooden house.

E1-8. Evidence of positive result
Tangible

No.2

E2-1. Project name if available
New stilt house in the Dongting Lake region

E2-2. Place
Wangcheng County, Hunan Province, China

E2-3. Year
1998

E2-4. Investor

E2-5. People involved
Local residents

E2-6. Monetary costs incurred
The cost of a two store building is about 30,000 RMB (in average). Building materials: 15,000 Fitment materials: 5,000 Wage for workers: 10,000

E2-7. Total workload required
About ten to fifteen manpowers need to work for one or two months to complete a two to three floor stilt brick-concrete house.

E2-8. Evidence of positive result
Tangible

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:
> 8_TIK4_P.pdf (PDF - 198 Kb)

DRH-Asia Contents (DRH 17)

I. Heading

1. Title

Indigenous Knowledge on Flood Risk Management in Bangladesh

ID:	DRH 17
Hazard:	Flood
Category:	Transferable indigenous knowledge (TIK)
Proposer:	Muhammad Saidur Rahman
Country:	BANGLADESH;
Date posted:	06 February 2008
Date published:	13 October 2008

Toilet and houses built on platform raised above flood level.

Contact
Muhammad Saidur Rahman
Director, Bangladesh Disaster Preparedness Center (BDPC)
House 15A, Road 8, Gulshan, Dhaka, Bangladesh.
Telephone: + 88 (02) 9862169, +88 (02) 9880573, +88 (02) 8819718
Mobile: +88 (02) 1711524722
Fax: +88 (02) 8819718
E-mail: saidur1943@gmail.com and saidur@bdpc.org.bd

2. Major significance / Summary

Due to geographical location Bangladesh is one of the most flood-prone countries in the world. Every year it is affected by flood of varying magnitude. Since the term “disaster management” is understood as post-disaster relief and rehabilitation operations by policy makers and the key actors, hardly any importance is given on pre-disaster preparedness. Early warning against flood is not disseminated in a way which is understandable by the people at risk.

Since people in different areas use their indigenous knowledge to cope with flood disasters, there is a need to collect and collate good practices from different areas and promote them widely to the entire flood-prone areas through effective communication media.

3. Keywords

Indigenous knowledge, flood risk, vulnerabilities

II. Categories

4. Focus of this information

Transferable indigenous knowledge (TIK)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), NGO/NPO project managers and staff, Teachers and educators, Rural planners, Environmental/Ecological specialists
5-2. Other users: Policy makers, Motivated researchers, Local residents

6. Hazards focused

Flood

7. Elements at risk
Human lives, Human networks in local communities, Business and livelihoods, Rural areas, River banks and fluvial basin, Agricultural lands

III. Contact Information

8. Proposer(s) information (Writer of this template)
Muhammad Saidur Rahman
Director, Bangladesh Disaster Preparedness Center (BDPC)
House 15A, Road 8, Gulshan, Dhaka, Bangladesh.
Telephone: + 88 (02) 9862169, +88 (02) 9880573, +88 (02) 8819718
Mobile: +88 (02) 1711524722
Fax: +88 (02) 8819718
E-mail: saidur1943@gmail.com and saidur@bdpc.org.bd

9. Place where the technology/knowledge originated
BANGLADESH;

10. Names and institutions of technology/knowledge developers
Bangladesh Disaster Preparedness Center-BDPC

11. Title of relevant projects if any

12. References and publications
BDPC: Flipcharts, Baner Shathe Bosobas (living with flood), BDPC project reports.

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice
Bangladesh is characterized by flat terrain of alluvial soil, criss-crossed with an intricate system of over 230 rivers and rivulets. It is the largest delta of the three major river systems of the world i.e. The Ganges, The Bramahputras and The Meghna. 92.5 % of the catchment areas of these river systems lie in the upstream, beyond the international boundary of Bangladesh. As such, the very geographical location makes the country very prone to flood disasters. Due to poor economic condition, the impacts of floods are high and heavy on the physical infrastructure and the life and livelihood of the people. A brief statistics of three major flood disasters during the last two decades is presented below:

Event	Impacts
1988 floods	Inundated 61 % of the country, estimated damage US$ 1.2 billion, affected more than 45 million people
1998 floods	Inundated nearly 100,000 sq-km, estimated damage US$ 2.8 billion, damaged 500,000 homes, rendered 30 million people homeless, heavy loss to infrastructure, 1,100 deaths
2004	Inundation 38 %, damage US$ 6.6 billion deaths 700, affected people nearly 3.8 million

Disaster management is quite often understood by the key actors as post-disaster relief and rehabilitations operation. As such, inadequate level of importance is given on risk management and disaster preparedness at family and community level. This can be reflected by the fact that flood early warning issued by very well equipped public agency is not easily understood by the community at risk. Nor are they related to local context. Hence there is a need to promote indigenous knowledge of survival and coping with floods to all the people living in flood-prone areas.

V. Description

15. Feature and attribute

Poor people living in flood prone areas for hundred of years, practice indigenous knowledge for a number of activities including the following ones for preparedness, coping and response in flood disasters.

1. Preparedness before the flood

Before the flood season starts in June, the people conduct various activities which include raising the plinths of houses, cattle shed, installing toilet on raised ground (these are done considering the highest level of previous flood). Repair and strengthen houses by putting strong bamboo or other wooden pillars and make the thatched wall of the houses stronger. Plant trees around their houses to protect those from soil erosion. Store emergency survival dry food, fodder, seeds, fire woods and keep portable earthen cooking stove for use during emergencies.

Figs. 1&2 Toilet and houses built on platform raised above flood level

2. Coping with flood disasters

There are a lot of coping mechanisms practiced in flood-prone areas. People make raised bamboo or wooden platforms inside their rooms to live and keep useful materials above the level of flood water which enters their houses. During the flood season, all the roads are inundated. It becomes difficult to move from the houses for daily essential activities. It is quite common during this time that people use raft, made of banana-plants, for their movement and communication.

“Water, water everywhere, but not a drop to drink”, this is the common scene during the flood. Almost all the tube wells go under flood water. To keep the hand pump of the tube well above the raising level of water, in some areas people add additional pipe.

Fig. 3 Raft made of banana plants

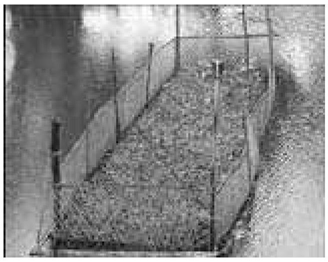


Fig. 4 Traditional cultivation in flood prone area

3. After the flood

At this stage, flood affected people repair their houses, clear the debris from the house, plant quick growing vegetables and start income generating activities.

16. Necessary process to implement

Raising plinth of houses and cattle shed

For raising the plinth of houses, toilets and cattle sheds, people generally use earth from the nearby open space. They raise the platform by piling up earth considering the highest flood level. For compressing the land they use rammer. Grass and other small plants are planted on the slopes of raised houses.

Fig. 5 Raising the plinth houses

Installing toilets on raised ground

Most of the toilets in flood prone areas are built on digging the earth and setting up the rings made of concrete in it. During the flood season toilets go under water, cause problems for people especially the women and creates water pollution. As such, people install toilets on raised ground. At first they raise the ground with earth and then install the toilets on it.

Tree plantation for protecting houses from soil erosion

There are a number of trees which can protect houses from soil erosion. These include Dhol Kolmi, Kasia, Bamboo, Banana, Hogla, Chailla (local Bengali names) etc. The people in flood-prone areas plant these surrounding their houses. These quick growing trees are found in every flood prone area.

Food preservation

Flood creates scarcity of food. During the flood in Bangladesh, it is the people of the community who survive in emergency period managing food by themselves. Generally, emergency food supplied by the humanitarian organizations or government organizations reach those areas after a few days of the flood. Even the quantity of food is not enough for the victims. So, the people of these areas preserve dry foods for using in flood emergency. The foods which are preserved before the flood are Muri (puffed rice), Chira (pressed rice), Sugarcane Molasses, Naru (made of coconut and molasses), dried jackfruit seeds. These food are stored in various means such as preserving in shika (a kind of bag made of jute strings which are hanged from ceiling), packing dry food in air tight polythene.

Preservation of portable earthen cooking stove and fuel

Generally, the people in flood-prone areas cook their food by earthen cooking stove using fuel like jute stick, dried up cow dung. Since maximum families rear cattle, so, cow dung is easily available. They preserve portable earthen cooking stove and fuel for using during the flood disasters.

Fig. 6 Earthen cooking stove

Raising suction head of tube well

The suction head of tube well is raised above the level of rising flood water by using additional pipe.

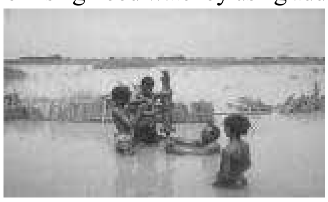


Fig. 7 Raising the suction head of tube well

Cultivating on floating platform

During the flood, people use floating platform for the purpose of growing crops (mainly vegetables). Generally these platforms are made of bamboo. At first the bamboos are put on the water keeping equal gap among the bamboos. Then these are tied with rope. The bamboos are covered with mats which are also made of bamboo. Clay is piled up on the mat to prepare a land for plantation.

Making Raft

Banana plants are grown widely in flood prone areas. Generally, people grow these around their houses for fruits. During the flood season, banana plants are used as raft. A few banana plants, at least two are used for making raft. The plants are affixed with each other by strong sticks then it is tied up by rope. It is used during flood as a way of communication.

Repair the houses

After the flood, people start to repair their houses by themselves. They use thatch or bamboo to repair their houses.

Plant fast growing vegetables

Fast growing vegetables are planted after the flood like cucumber, spinaches, ladies finger, brinjal etc.

17. Strength and limitations

Strength There are a number of strengths of the projects. They include the following:

- The indigenous knowledge is practiced for hundreds of years
- It is rooted in the traditional culture of rural society
- They are easy to replicate in areas where some of the good practices are not used

The project will have sustainable impact on the life and livelihood of people for generations

Limitations

- The public and private institutions place dis-proportionate emphasis on post-flood relief and rehabilitation operations giving very limited focus on appreciation and supporting community practice and culture
- Lack of appreciation from key actors in the field of disaster management, including donors and NGOs, for empowerment of the poor and the disadvantaged living in areas vulnerable to the threats of flood disaster.

18. Lessons learned through implementation if any

A project on promotion and disseminate of indigenous knowledge titled as "Promotion of Family and Community Level Flood Preparedness Through Public Awareness Program" was implemented in the Chowhali Upazila (sub-district) Under Sirajgonj district of Bangladesh. The lessons learned through implementation of the project are as follows:

a. early warning systems were integrated at community level

b. people were aware on preparedness activities

c. people's coping capacity against flood was enhanced

d. established network between community, NGOs, GOs and other service providing agencies.

VI. Resources required

19. Facilities and equipments required

Local facilities included: School, Union Parishad, Upazila Parishad, UNO (Upzila Nirbahi Officer) conference room etc. were used for providing training and arranging meetings.

Equipments required: computer, training materials, materials for collection of secondary information etc.

20. Costs, organization, manpower, etc.

Approximately US$ 300,000 would be required to design, develop and pilot the project for a population of approximately 300,000 in two highly flood prone sub districts of Bangladesh.

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has fair applicability demonstrated by implementation in one or more field sites.

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
Promotion of Family and Community Level Flood Preparedness Through Public Awareness Programme

E1-2. Place
The project was implemented in the Chowhali Upazila (sub-district) under the district of Sirajgonj of Bangladesh. Total land area of the area is about 210 sq. km.

E1-3. Year
2001

E1-4. Investor
DIPECHO (European Union) through an Italian NGO called APS

E1-5. People involved
The involvement of people to implement the projects were as follows:
Project Staff: Project Director, Project Coordinator, Research Consultant, Research Officers, Research Assistants, Program Officers, Admin-cum-Accounts Officer, IEC Materials Development Officer, Training Officers, Computer Operator, Messenger, Local NGO Workers and Security guards.

Volunteers: Change Agents (volunteers as teachers, social respected persons, students, imams of the mosques etc.)

Disaster Management Committee: UDMC (Union Disaster Management Committee) members, UzDMC (Upazila Disaster Management Committee) members.

Government Officers: UNO (Upazila Nirbahi Officer), Agriculture Officer, Livestock Officers and other department's officers.

E1-6. Monetary costs incurred
US$100,000

E1-7. Total workload required
Timeframe: One year
Human Resources: 28 Project Staffs, UzDMC and UDMC committee members and Change Agents (volunteers).

E1-8. Evidence of positive result
Positive Results: enhancement of coping capacity, loss reduces, raising awareness, identification of the indigenous survival techniques, awareness on preparedness, promotion of effective links and partnerships between community and NGOs, CBOs, and/or Government agencies, Key actors' encouragement and inspiration to integrate indigenous risk reduction practices into the planning and implementation of their disaster management programs

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 18)

I. Heading

1. Title

Bamboo T-shelter for Post Disaster Reconstruction

ID:	DRH 18
Hazard:	Earthquake, Tsunami, Volcanic eruption, Landslide, Mudflow, Dust storm, Cyclone/Typhoon, Storm surge, Flood, Flash flood, Drought
Category:	Implementation Oriented Technology (IOT)
Proposer:	Atsushi Iizuka
Country:	INDONESIA;
Date posted:	06 February 2008
Date published:	09 June 2009

Bamboo shelter built at a village.

Contact
Atsushi Iizuka
Professor of Civil Engineering, Kobe University
T.Shigemura: Professor of Architecture, Kobe University
T.Asai, Assistant Professor of Architecture, Kobe University
tsutomu@kobe-u.ac.jp, asait@kobe-u.ac.jp
TEL:(+81)78-803-6065, Dept. of Architecture, 1-1 Rokkodai, Nada, 657-8501, Kobe, Japan

2. Major significance / Summary

Bamboo T-shelter, aiming at housing reconstruction after the Java earthquake, 2006 was designed having features including.
1) Semi permanent housing: easily extending rooms
2) Easy construction and inexpensive cost
3) Sufficient strength: well devised joint part

3. Keywords

Reconstruction, Housing, Bamboo material, Temporary shelter

II. Categories

4. Focus of this information

Implementation Oriented Technology (IOT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Others (Local residents who lost heir houses, Sufferers)
5-2. Other users: Local residents

6. Hazards focused

Earthquake, Tsunami, Volcanic eruption, Landslide, Mudflow, Dust storm, Cyclone/Typhoon, Storm surge, Flood, Flash flood, Drought

7. Elements at risk

Human lives, Buildings

III. Contact Information

8. Proposer(s) information (Writer of this template)

Atsushi Iizuka
Professor of Civil Engineering, Kobe University
T.Shigemura: Professor of Architecture, Kobe University
T.Asai, Assistant Professor of Architecture, Kobe University
tsutomu@kobe-u.ac.jp, asait@kobe-u.ac.jp
TEL:(+81)78-803-6065, Dept. of Architecture, 1-1 Rokkodai, Nada, 657-8501, Kobe, Japan

9. Place where the technology/knowledge originated

INDONESIA;
Daerah Istimewa Yogyakarta

10. Names and institutions of technology/knowledge developers

Tsutomu Shigemura and Tamotsu Asai, Kobe University

11. Title of relevant projects if any

21 century COE project “Design Strategy towards Safety and Symbiosis of Urban Space”, Kobe University

12. References and publications

Not yet

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

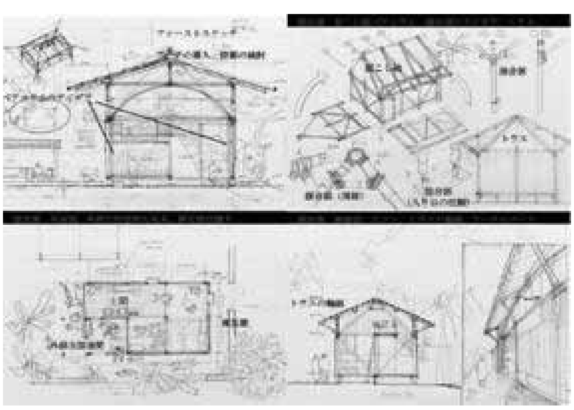
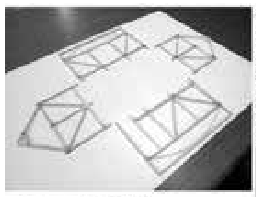
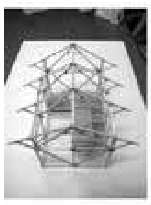
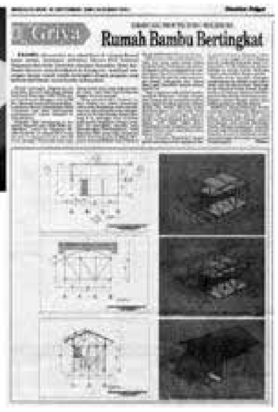
Java earthquake, 27th, May, 2006, took about 6,000 lives of local people in Yogyakarta area. And many people lost their housings. A major reason of death of people was due to the collapse of brick-built houses. In this earthquake, the necessity of providing temporary housing for the people who lost their houses arose as an urgent treatment under a critical financial situation. Some NGO and NPO financially or directly supported to supply the temporary houses and permanent houses to the people who lost their houses. However, such a support caused a sort of unfairness between the disaster-stricken areas.

Then, Professor T. Shigemura and Dr. T. Asai, the COE research group of Kobe University, designed and proposed the bamboo T-shelter which could be self-built by the local people.

V. Description

15. Feature and attribute

Prof. Shigemura and Dr.Asai (Kobe U. COE) designed Bamboo T-shelter 1) Semi permanent housing: easily extending rooms 2) Easy construction and inexpensive cost 3) Sufficient strength: well devised joint part

16. Necessary process to implement

The bamboo T-shelter does not require the special skill to build it. And it is expected to cost less than 2,000 thousand Indonesian Rupiah.

17. Strength and limitations

Sufficient strength for a permanent house can be expected. However, connecting the bamboo columns by ropes requires proper care for ensuring the sufficient strength of the house when it is built. Also, there are some local people who have unpleasant feeling for the bamboo houses depending on localities.

18. Lessons learned through implementation if any

Not found yet.

Bamboo shelter built at a village

VI. Resources required

19. Facilities and equipments required

Described in 'Feature and attribute'

20. Costs, organization, manpower, etc.

Described in 'Necessary process to implement'

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
No information

E1-2. Place
Yogyakarta in Indonesia

E1-3. Year
2006

E1-4. Investor
Local government

E1-5. People involved
No information

E1-6. Monetary costs incurred
Approximately 1,900 thousand Indonesian Rupiah per a bamboo T-shelter.

E1-7. Total workload required
It is expected that a man can build an unit of the bamboo t-shelter in a couple of days.

E1-8. Evidence of positive result
This bamboo T-shelter was officially employed by the Yogyakarta local government and reported in a local newspaper, see 'Feature and attribute'.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 19)

I. Heading

1. Title

Effective Cyclone Early Warning Dissemination at Community Level

ID:	DRH 19
Hazard:	Cyclone/Typhoon, Storm surge
Category:	Process Technology (PT)
Proposer:	Muhammad Saidur Rahman
Country:	BANGLADESH;
Date posted:	07 February 2008
Date published:	29 September 2010

Contact
Muhammad Saidur Rahman
Director, Bangladesh Disaster Preparedness Center (BDPC)
House 15A, Road 8, Gulshan, Dhaka, Bangladesh.
Telephone: + 88 (02) 9862169, +88 (02) 9880573, +88 (02) 8819718
Mobile: +88 (02) 1711524722
Fax: +88 (02) 8819718
E-mail: saidur1943@gmail.com and saidur@bdpc.org.bd

2. Major significance / Summary

Cyclone is the natural hazard which causes huge loss of lives and properties in Bangladesh. Since cyclones can not be prevented, the most cost-effective way to minimize the loss is to put in place an effective and sustainable early warning dissemination system at family and community level.

3. Keywords

Cyclone, early warning, volunteerism, community

II. Categories

4. Focus of this information

Process Technology (PT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, National governments and other intermediate government bodies (state, prefecture, district, etc.), Teachers and educators
5-2. Other users: Policy makers, Local residents

6. Hazards focused

Cyclone/Typhoon, Storm surge

7. Elements at risk

Human lives, Business and livelihoods, Infrastructure, Rural areas, Coastal areas, Agricultural lands

III. Contact Information

8. Proposer(s) information (Writer of this template)

Muhammad Saidur Rahman
Director, Bangladesh Disaster Preparedness Center (BDPC)
House 15A, Road 8, Gulshan, Dhaka, Bangladesh.
Telephone: + 88 (02) 9862169, +88 (02) 9880573, +88 (02) 8819718
Mobile: +88 (02) 1711524722
Fax: +88 (02) 8819718
E-mail: saidur1943@gmail.com and saidur@bdpc.org.bd

9. Place where the technology/knowledge originated

BANGLADESH;

10. Names and institutions of technology/knowledge developers

Mr. Claes Hagstroem
International Federation of Red Cross and Red Crescent Societies
and Bangladesh Red Crescent Society

11. Title of relevant projects if any

This concept and practice of early warning dissemination through community volunteer is being tested in flood prone areas of Bangladesh.

12. References and publications

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

Bangladesh is one of the most disaster-prone countries in the world, the main cause of which could be attributed to it's geographical location. The impact of disaster is quite high because of inadequate physical infrastructures and poor socio-economic condition of the people of this country.

Floods and cyclones are the major disasters, of which the later cause severe destruction to lives and properties. The cyclone of 12 November 1970, the worst in the recorded history in the world, killed over 500,000 people in just one night. The reason for this colossal loss of human lives was the failure on the part of the public authorities to disseminate early warning to the people at risk.

Immediately after the devastating cyclone, the International Federation of Red Cross and Red Crescent Societies, responding to a resolution taken in the United Nations General Assembly, took the initiative to set up a program for dissemination of early warning at family and community level against approaching cyclone. Today, this is the widely acclaimed Cyclone Preparedness Program (CPP) of Bangladesh.

V. Description

15. Feature and attribute

Cyclone Preparedness Program (CPP) is the organization of volunteers in the truest sense of term. The volunteers are recruited under a set of criteria which includes the minimum age of 18, ability to read and write the national language (Bengali) etc. They are dedicated and committed. In fact, they come to CPP with the sprit of service to the people living in the areas vulnerable to cyclone. They don’t receive any remuneration for the services they provide. Today CPP has the strength of over 49,000 volunteers, spread over 3,280 Units/villages in the entire coastal belt and offshore islands of Bangladesh.

The primary aim of the CPP is to minimize the loss of lives and properties in the cyclonic disasters by strengthening the capacity of the people of the coastal belt to reduce the risk and cope with disaster. The volunteers have the following specific responsibilities, and are trained in the relevant disciplines: *

- Dissemination of early warning
- Evacuation to safe havens and shelter management
- *Conduction of rescue operation
- Provision of first aid to the injured
- Assistance for post-cyclone relief and rehabilitation operations

The primary and the basic responsibility of the volunteers is to disseminate the early warning to over ten million people living in the coastal belt and offshore islands. The Storm Warning Center of the Bangladesh Meteorological Department informs the Headquarters (HQ) of CPP, located in capital city of Dhaka, as soon as a depression is formed in the Bay of Bengal. The later (CPP HQ) immediately transmits the message to their zonal and sub-district offices through single-side-band radio. In turn, the message is passed on to the unit team leaders in the villages via the Union Team Leaders through VHF radio and/or volunteer messengers.

There is a time gap of at least four days between the formation of a depression in the Bay of Bengal, its turning into severe cyclone and crossing over the coast. Since the time of the first information of formation of depression is received at the village level, the volunteers keep on watching the movement of the depression through the weather bulletins broadcast by national radio and disseminate the information to the people at threat through various means. These include hoisting of warning flags in pre-selected public places (e.g. educational institutions, mosques, market places, big boats, etc), announcement by megaphones and other public address systems, blowing of sirens, interpersonal communication through door to door visits, etc.

Fig. 1 Volunteer Training

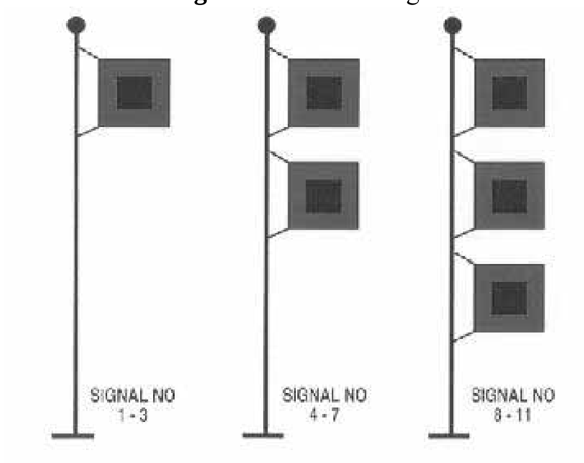
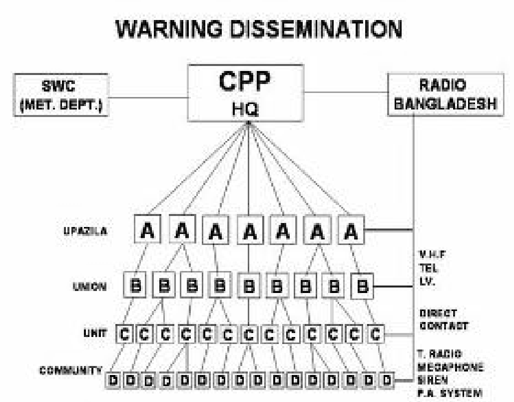


Fig. 2 Signal Flag

Fig. 3 Warning Dissemination

A flowchart showing the process of dissemination of early warning from the Headquarters of CPP down to family and community level is presented below:



When the great danger signals are announced by the Meteorological Department, people are encouraged to evacuate to shelters. The vulnerable groups (e.g. the disabled children, elderly, pregnant) are assisted by the volunteers of CPP in their process of evacuation. They conduct rescue operations during the height of cyclones. Cyclone being a sudden-onset and high impact disaster, causes a lot of physical injuries. As such, immediately after the cyclone has struck, professionally trained volunteers of CPP provide first aid to the persons in need. Finally, CPP volunteers provide cooperation, support and assistance to the Government, National Red Crescent Society and the private sectors engaged in emergency relief and rehabilitation operations. The voluntary nature of the organization and the sprit of the volunteers contribute greatly not only to the quality of services they provide but also the sustainability of the organization. The volunteers performed very well in the last super cyclone "Sidr". They are so committed that 26 of them lost their lives while trying to save others during the cyclone of 1991, which killed 138,000 people.

In early 70's, after the devastating cyclone of 1970 and the brutal war of liberation in 1971, the IFRCS started a number of projects. Only CPP is still surviving for the last 38 years because of the voluntary nature of the organization and commitment of the volunteers.

16. Necessary process to implement

There is a very well-defined and elaborate arrangement for implementation of CPP. In each Unit (composed of one or more than one villages) there is a team of 15 volunteers, including five women, and headed by a Unit Team Leader, democratically elected by the volunteers. On an average ten units would form an Union, the lowest level of local government institutions. The Union Volunteer Committee is formed with all the ten unit leaders and is headed by an elected Union Team Leader. In turn, the Upazila (sub-district) Volunteer Team, composed of all the Union Team Leaders, will have a democratically elected Upazila Team Leader.

At the national level, CPP is managed by two committees (Policy Committee and Implementation Board), composed of representatives from both the Government and the National Red Crescent Society. The "Policy Committee", responsible for giving policy directions and mobilization of resources, is headed by the Minister-in-charge of the Ministry of Food and Disaster Management. The management of CPP is overseen and monitored by the "Implementation Board", which is headed by the Secretary (highest ranking civil servant) of the Ministry of Food and Disaster Management.

CPP is an organization of volunteers with Red Cross in nature (using it's emblem and imbibed with it's spirit) with one hundred percent of its recurring cost coming from the Government of Bangladesh. IFRCS and other funding agencies provide resources for transports, warning and telecommunication equipments, training of volunteers etc., as when needed.

17. Strength and limitations

Strengths: The following are the strengths of CPP

1. Volunteers organization
2. Spirit, commitment and dedication of the volunteers
3. Rooted in the community
4. Use of the emblem of Red Cross (symbol of impartiality and neutrality) and the service-orientation of the organization
5. Assured and sustained funding support from the Government
6. Check and balance through the policy and management committees, constituted with the representatives form the Government and the Red Crescent Society.

Weaknesses:

1. The officers in civil administration are transferred quite frequently from one Ministry/Department to another. As such, the Director of Administration of the Programs nominated from the Ministry of Disaster Management and the representatives from different Ministries who sit in the Policy Committee and the Implementation Board of the Program CPP can not have the sustained commitment for long time which is required for such a vital program.

2. The performance of CPP is appreciated by all concerns, particularly during and after cyclonic disasters. Since the program was started by Red Cross and the volunteers use its emblem, quite often the National Red Crescent Society claims ownership of the Program, which is not always appreciated by the other stakeholder.
3. The Policy Committee and the Implementation Board, responsible for framing policy and management of the Program respectively, are composed of representatives from the Government and the Red Crescent Society. Both the stakeholders have the tendency of controlling the management of the Program, which sometimes create confusion among the staff members and slows down the implementations of planned activities.
4. Since the Government of Bangladesh pays all the costs related to running the Program, the accounts are maintained and audited under Government rules and systems. This leaves no space for flexibility which is required to run a Program like CPP.

18. Lessons learned through implementation if any

Lessons learned: The proposer of the project, being the first director of CPP in 1972, identifies the following challenges for replication of the project in other countries:

1. The process of planning and development of CPP during the years of its formation and growth, and also the ups and downs that CPP had during the last thirty five years, must be documented properly to learn both the enabling and the hindering lessons.
2. The need of a Champion, with 100 % commitment and dedication, and charismatic leadership, who would generate and sustain the commitment of service to tens at thousands of local poor people to act as volunteers for years. Another challenge is to maintain a team of officials who would develop professionalism among the community volunteers.
3. The third challenge is to keep the volunteers engaged and involved in social and development activities or programs in their localities throughout the year so that they are able to respond professionally and efficiently in time of need.
4. Systems should be developed in such a way that due recognition are given to the volunteers by all the concerns e.g. the community, private and public sectors.

VI. Resources required

19. Facilities and equipments required

Office set ups, communication equipments e.g. single side band, VHF and transistor radios, warnings equipments, e.g. flags, megaphones, sirens etc. transports etc.

20. Costs, organization, manpower, etc.

At present, there is a strength of 146 full-time staff members. The recurring cost is over half a million US dollars per year.

VII. Message from the proposer if any

21. Message

Effective early warning, relevant to the local contexts and disseminated through volunteers trusted and respected by the communities at risk, contribute greatly in reducing the loss of lives and properties caused by any disaster. For sustainability of such warning dissemination program, there is no other alternatives but to empower the community and develop their sense of ownership.

Cyclone Preparedness Program is a time-tested program. Initiating, participating or even supporting such program is a great opportunity to serve the distressed humanity, a MUST for people of all faiths and religions.

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has fair applicability demonstrated by implementation in one or more field sites.

23. Notes on the applicability if any

The cyclone of 1970, which killed around half a million people, is the worst in the recorded history of the world. This devastating disaster was followed by the war of liberation in 1971 in which over three million people were killed. So, the National Red Cross Society had huge operations to alleviate the sufferings of the people affected by the natural and man-made disasters respectively. As such, the Red Cross had the resources and technical support from other national societies in the world, particularly the Japanese Red Cross and the Swedish Red Cross, to initiate the Cyclone Preparedness Program.

IX. Application examples

No.1

E1-1. Project name if available
Cyclone Preparedness Program

E1-2. Place
Bangladesh

E1-3. Year
Since 1972

E1-4. Investor

E1-5. People involved
The Community Volunteers, National Red Crescent Society and the Government

E1-6. Monetary costs incurred

E1-7. Total workload required

E1-8. Evidence of positive result
The organization has survived, grown and has successfully performed it's duties in several cyclones during the last 38 years. Effective dissemination of early warning at family and community levels contributed significantly in reducing the death toll in recent cyclones.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:

> 5.JPG (JPG - 11 Kb)
> E.JPG (JPG - 68 Kb)
> 2.JPG (JPG - 38 Kb)
> 3.JPG (JPG - 31 Kb)
> 4.JPG (JPG - 39 Kb)
> k.JPG (JPG - 22 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 22)

I. Heading

1. Title

Process for Community Acceptance of Earthquake Technology --- UNCRD Experiences Applying NSET Approach of Shaking-table Demonstration ---

ID:	DRH 22
Hazard:	Earthquake
Category:	Implementation Oriented Technology (IOT) , Process Technology (PT)
Proposer:	Shoichi Ando
Country:	NEPAL; JAPAN; AFGHANISTAN; BANGLADESH; INDIA; INDONESIA; IRAN, ISLAMIC REPUBLIC OF; PAKISTAN; TAJIKISTAN;
Date posted:	07 February 2008
Date published:	09 June 2009

Masonry Training before Shake-table Demonstration

Contact
Shoichi Ando Dr. (UNCRD) andos@hyogo.uncrd.or.jp
Phong Van G. Tran Dr. (UNCRD) tranp@hyogo.uncrd.or.jp
Hayato Nakamura (UNCRD) nakamura@hyogo.uncrd.or.jp
Amod M. Dixit Mr. (NSET-Nepal) adixit@nset.org.np

Disaster Management Planning Hyogo Office,
United Nations Centre for Regional Development (UNCRD), UN DESA

1-5-2 Wakihama-kaigan-dori, Chuo-ku, Kobe city, Hyogo, Japan
e-mail: rep@hyogo.uncrd.or.jp
Tel: +81-78-262-5560,
Fax: +81-78-262-5568

2. Major significance / Summary

Community Based Disaster Management (CBDM) activities utilizing shake-table demonstration resulted in effective to disseminate earthquake resistant technology as well as to raise public awareness through the experiences of Disaster Management Planning Hyogo Office of the United Nations Centre for Regional Development (UNCRD).

3. Keywords

CBDM (community based disaster management), public awareness, shake-table demonstration, NSET approach

II. Categories

4. Focus of this information

Implementation Oriented Technology (IOT), Process Technology (PT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, Municipalities, NGO/NPO project managers and staff, International organizations (UN organizations and programmes, WB, ADRC, EC, etc.) , Experts, Teachers and educators, Architects and engineers, Information technology specialists, Others, Academic institutes, Specialists group, Community members

5-2. Other users: Policy makers, Motivated researchers, Local residents

6. Hazards focused
Earthquake

7. Elements at risk
Human lives, Business and livelihoods, Buildings, Urban area, Rural areas, Cultural heritages

---

III. Contact Information

8. Proposer(s) information (Writer of this template)
Shoichi Ando Dr. (UNCRD) andos@hyogo.uncrd.or.jp
Phong Van G. Tran Dr. (UNCRD) tranp@hyogo.uncrd.or.jp
Hayato Nakamura (UNCRD) nakamura@hyogo.uncrd.or.jp
Amod M. Dixit Mr. (NSET-Nepal) adixit@nset.org.np

Disaster Management Planning Hyogo Office,
United Nations Centre for Regional Development (UNCRD), UN DESA

1-5-2 Wakihama-kaigan-dori, Chuo-ku, Kobe city, Hyogo, Japan
e-mail: rep@hyogo.uncrd.or.jp
Tel: +81-78-262-5560,
Fax: +81-78-262-5568

9. Place where the technology/knowledge originated
NEPAL; JAPAN; AFGHANISTAN; BANGLADESH; INDIA; INDONESIA; IRAN, ISLAMIC REPUBLIC OF; PAKISTAN; TAJIKISTAN;

10. Names and institutions of technology/knowledge developers
National Society for Earthquake Engineering - Nepal (NSET)
Amod M. Dixit Mr.(NSET-Nepal) adixit@nset.org.np
United Nations Centre for Regional Development (UNCRD) / UN DESA
Shoichi Ando Dr. (UNCRD) andos@hyogo.uncrd.or.jp

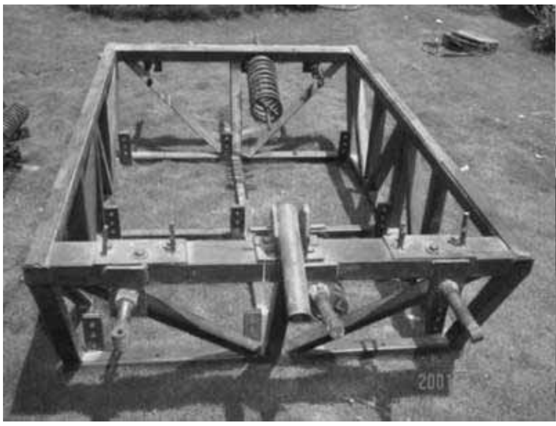
11. Title of relevant projects if any
Sustainability in Community Based Disaster Management (CBDM) (-2004)
Urbanisation and CBDM (2005)
Gender in CBDM (from 2006-)

12. References and publications
See website: http://www.hyogo.uncrd.or.jp/publication/proceedings.html and
http://www.hyogo.uncrd.or.jp/cbdm/htfviii.htm

13. Note on ownership if any
UNCRD, NSET

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice
High human casualties in earthquakes in Bam, Iran and Gujarat, India are attributed to the collapse of traditional adobe and masonry houses built informally by homeowners themselves with input from local masons. The buildings did not have the engineering input to be safe from earthquakes. There is large stock of such residential buildings in seismically active part of the world and people, particularly in developing countries, continue practice to build and live in such houses because of the socio-economic and technical reasons.




V. Description

15. Feature and attribute

The improvements over the traditional construction for earthquake resistance should be simple to adopt so that local craftsmen can easily get the know-how and implement it without difficulty in construction. Awareness to the homeowners is critical for safer construction of non-engineered buildings as owner themselves do decide the construction.

UNCRD is committed to providing expertise, opportunities, and ways for communities to be empowered to increase their resiliency against disasters. Simultaneously, it aims to impart the CBDM and low-tech safer construction practice at the government level so that both communities and government can sustain efforts at the grass-roots level through institutionalization of these activities.


16. Necessary process to implement

Masons are the technical service providers for non-engineered construction. Urban dwellers may take service from technicians to prepare building layout drawings for municipal approval, if permit process exists. Hence technicians and masons are key persons in implementing the safer construction practice. As capacity building of the community for safer technology, training to these groups is must. Projects have been formulated in such way that hands-on trainings, which are much more effective than classroom session for masons, can be provided in a demonstration work. Shake table tests have also been used as confidence building measure for masons on what they would have been learning. It requires knowledge on earthquake engineering to explain the damages of buildings to the public, it needs also easily understandable explanation to disseminate the necessary information to the governmental officers and general public.

(Sponsored by JICA)

17. Strength and limitations

Positive aspects

1) All participants easily aware the danger of collapse of vulnerable houses.
2) It is also easily understandable how retrofit works effectively.
3) Masons training can be implemented during the preparation process.

Negative aspects

1) It will take almost two weeks to prepare the demonstration model.
2) It may be rather expensive to prepare a shake-table.

18. Lessons learned through implementation if any

All participants recognized the importance of seismic retrofit and reinforcement of their own houses aster the shake-table demonstration, not only in the urban area but also in the rural area.

2003 Tajikistan

2002 Afghanistan

VI. Resources required

19. Facilities and equipments required

Simple test demonstration on pair of building models, one in traditional form and another with proposed seismic improvement, prepared at 1/10th scale and shook on the top of improvised shake-table is found as a very convincing tool for common people to opt seismic resistance system. As this methodology was developed by NSET (National Society for Earthquake Technology – Nepal), UNCRD calls this method as "NSET Approach" recently. At some incremental shaking to the table, traditional building will collapse and one with seismic measures will withstand with minimum or no damage.

20. Costs, organization, manpower, etc.

Resource persons from NSET Manpower: one project manager, one engineer, and one experienced mason in addition training participants such as local masons and engineers Fund: approximately 15,000-20,000 US$ for full demonstration and training

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
PNY project
(Patanka New Life Plan)

E1-2. Place
Patanka village, Gujarat, India

E1-3. Year
2003

E1-4. Investor
CODE (NGO Kobe), SEEDS,
and other organizations

E1-5. People involved
Manu Gupta (SEEDS),
Earthquake Disaster Mitigation Research Center (EDM),
National Center for People's-Action in Disaster Preparedness (NCPDP), NSET,
UNCRD

E1-6. Monetary costs incurred
oint project implementation by SEEDS, EDM, NCPDP, NSET, and UNCRD (UNCRD covered mission cost of researchers)

E1-7. Total workload required
See Patanka New Life Plan; The report summarizing the purpose, the methods and the activities of the PNY (Patanka New Life Plan) project (Published by UNCRD)

E1-8. Evidence of positive result

No.2

E2-1. Project name if available
Afghanistan Shake-table Demonstration

E2-2. Place
Kabul, Afghanistan

E2-3. Year
2003

E2-4. Investor
Afghanistan government, UNCRD

E2-5. People involved
Minister, Ministry of Urban Development and Housing, Afghanistan
Prof. Anand S. Arya, India and professors of Kabul Univ.
NSET,
UNCRD

E2-6. Monetary costs incurred
Public organizations (Implementation by NSET) (UNCRD covered mission cost of researchers)

E2-7. Total workload required
See GUIDELINES For Earthquake Resistant Design, Construction, and Retrofitting of Buildings in AFGHANISTAN; Ministry of Urban Development and Housing / Government of Afghanistan UNCRD Hyogo (Published by UNCRD)

E2-8. Evidence of positive result

No.3

E3-1. Project name if available
Bam Shake-table Demonstration

E3-2. Place
Bam, Kerman province, Iran

E3-3. Year
2004

E3-4. Investor
Kerman government, Hyogo prefecture

E3-5. People involved
Iranian Ministries
NSET, CODE
UNCRD

E3-6. Monetary costs incurred

E3-7. Total workload required

E3-8. Evidence of positive result

X. Other related parallel initiatives if any

Project name if available

XI. Remarks for version upgrade

Attached files:
> ShakeTablePamphlet_0.pdf (PDF - 388 Kb)
> Presentation1.ppt (PPT - 2243 Kb)
> 1.jpg (JPG - 37 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

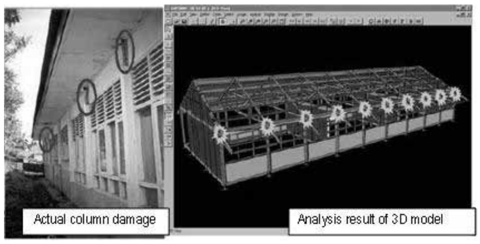
DRH-Asia Contents (DRH 23)

I. Heading

1. Title

Engineering of Non-Engineered Masonry Houses for Better Earthquake Resistance in Indonesia

ID:	DRH 23
Hazard:	Earthquake
Category:	Implementation Oriented Technology (IOT) , Process Technology (PT)
Proposer:	Krishna S. Pribadi
Country:	INDONESIA;
Date posted:	07 February 2008
Date published:	09 June 2009



Correlation of Analysis Result with Actual Damage.

Contact

(1) Ir Teddy Boen
Senior Advisor World Seismic Safety Initiative (WSSI) and Director PT Teddy Boen Konsultan
PT Teddy Boen Konsultan
Prisma Kedoya Plaza C 7-8, Jalan Raya Perjuangan, Kebon Jeruk, Jakarta Barat 11530
Phone: +62-21-5310478 Fax: +62-21-5310591
Email: tedboen@cbn.net.id

(2) Dr. Krishna S. Pribadi, Senior Researcher in Center for Disaster Mitigation, Insitut Teknologi Bandung - INDONESIA
Center for Disaster Mitigation, Integration and Application R & D Building ITB, 8th Floor, Jl. Ganesa No. 10, Bandung-Indonesia 40132
E-mails : ksppribadi@bdg.centrin.net.id; ksuryanto@si.itb.ac.id
Phone Office : (+62) (22) 70808949, 2504987 ext. 1819
(+62) (22) 2502272
Fax. : (+62) (22) 2510714; 2508125
Handphone : (+62) 811217666
Office website : http://kppmb.itb.ac.id

2. Major significance / Summary

Brick masonry is the most utilized building material in the non-engineered buildings in Indonesia which includes the people's ordinary housings and many public buildings such as schools and health facilities. The process is useful in improving their safety from earthquake hazards, through a series of process which includes analysis and devising techniques to strengthen the masonry buildings and a way to ensure that the method is properly implemented in the field by the concerned parties.

3. Keywords

Rural, urban, non-engineered buildings, earthquake, damage analysis

---

II. Categories

4. Focus of this information

Implementation Oriented Technology (IOT), Process Technology (PT)

5. Anticipated Users

5-1. Practitioners: Municipalities, NGO/NPO project managers and staff, International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Commercial entrepreneurs, Experts, Architects and engineers and others
Builders, masons and technicians
5-2. Other users: Motivated researchers, Local residents

6. Hazards focused

Earthquake

7. Elements at risk

Human lives, Buildings

III. Contact Information

8. Proposer(s) information (Writer of this template)

(1) Ir Teddy Boen
Senior Advisor World Seismic Safety Initiative (WSSI) and Director PT Teddy Boen Konsultan
PT Teddy Boen Konsultan
Prisma Kedoya Plaza C 7-8, Jalan Raya Perjuangan, Kebon Jeruk, Jakarta Barat 11530
Phone: +62-21-5310478 Fax: +62-21-5310591
Email: tedboen@cbn.net.id

(2) Dr. Krishna S. Pribadi, Senior Researcher in Center for Disaster Mitigation, Insitut Teknologi Bandung - INDONESIA
Center for Disaster Mitigation, Integration and Application R & D Building ITB, 8th Floor, Jl. Ganesa No. 10, Bandung-Indonesia 40132
E-mails : ksppribadi@bdg.centrin.net.id; ksuryanto@si.itb.ac.id
Phone Office : (+62) (22) 70808949, 2504987 ext. 1819
(+62) (22) 2502272
Fax.: (+62) (22) 2510714; 2508125
Handphone: (+62) 811217666
Office website: http://kppmb.itb.ac.id

9. Place where the technology/knowledge originated

INDONESIA;
(Bengkulu, Aceh, Yogyakarta)

10. Names and institutions of technology/knowledge developers

(1) WSSI
(2) CDM-ITB

11. Title of relevant projects if any

Retrofitting of School Buildings Post-earthquake Reconstruction of Bengkulu, 2002

12. References and publications

13. Note on ownership if any

Teddy Boen, CDM-ITB

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

In year 2000, the Bengkulu Earthquake devastated many houses and school buildings. Approximately 200 people died, many others were injured due to collapsed buildings. Most of the buildings and houses were of the type masonry construction. They are either reinforced or non-reinforced, using either baked clay brick or sand-cement brick. The buildings are usually non-engineered, built by masons with traditional knowledge of construction technique, transferred from father-to-son and from common practice. Despite the availability of some simple guidelines, the method of building practice varies from place to place, mostly in improper ways of constructing the building elements, resulting in poor, vulnerable building and houses.

The development of the process is driven by the general spread of these characteristic vulnerable non-engineered buildings in Indonesia, and the intention to improve the building practice in order to reduce their vulnerability to earthquake.

V. Description

15. Feature and attribute

The process is aimed at improving the seismic safety of the non-engineered houses and buildings, by improving the construction process and by imparting some technologies to ensure the integrity of the building elements during earthquake. It is expected that by transferring the improved knowledge without neglecting the indigenous knowledge, the community could protect themselves and even could help others in reducing the disaster risk by implementing proper building construction.

16. Necessary process to implement

The process needs a survey and identification of typical damages suffered by many non-engineered masonry structures during earthquakes. Understanding of masonry building behavior shown by characteristic damages found in post-earthquake stricken areas is important to devise methods in reducing its vulnerability.

A structural analysis to correlate field observation and structural simulations using 3D models of the non-engineered masonry structures would help to better understand how damages occurred at various building elements during an earthquake (See **Fig. 1**).

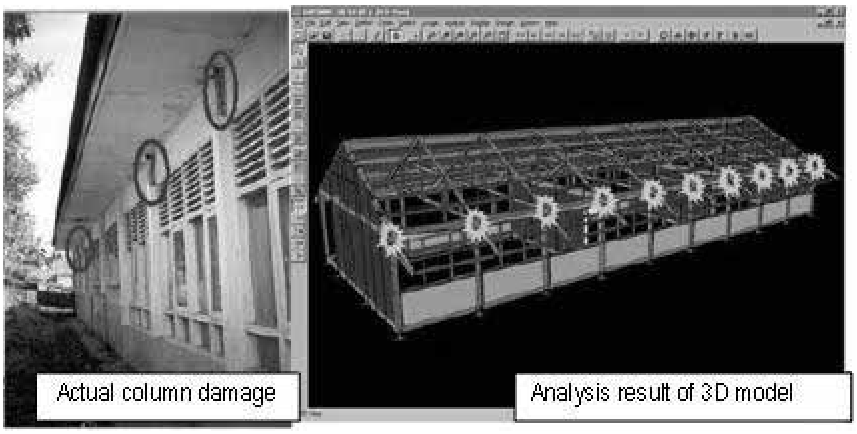


Fig. 1 Correlation of Analysis Result with Actual Damage

Field observation on how the field technicians and masons work during the construction process would lead to the understanding of the causes of the failures of the elements in performing properly during earthquake. The lack of proper connection details and proper crucial elements designing as well as lack of workmanship and material quality and other factors add to the cause of the weaknesses of the structures.

With the understanding of the above factors, a set of guidelines for masonry non-engineered building is developed, which include also the provision of adequate confinement for the masonry walls and proper connection between elements. The dissemination process of the technology should include developing user friendly field guidelines for local technicians and masons and proper training to implement the guidelines, which include some demonstrations of weak and proper non-engineered structures, proper connection details including details of reinforcement bar splices, and proper way of preparing the construction materials and executing the brick laying as well as pouring concrete.

Proper supervision during the learning process is very important to develop good understanding and proper working attitude and behavior from the part of the field technicians and masons (See **Fig. 2**). The experience obtained by them during the process can then be replicated to others and also they can perform similar education process to other technicians and masons as well as to home or building owners.

Fig. 2 Execution of new construction and retrofitting

17. Strength and limitations

The strength of this method lies in the fact that it does not introduce new technology to the people, but it encourages the use of already existing local technology with some incremental improvements which enhance the current practices to improve its performance in resisting earthquakes.

It is however limited to the practical uses of confined masonry technique which has been long practiced by masons and technicians in Indonesia, which is part of the local culture, using truly available local resources (materials, human resource and technology). The application of this method in other country should be based on thorough assessment of the local customs in constructing their houses and in the availability of local materials.

18. Lessons learned through implementation if any

There were some resistances from the side of local masons in practicing the recommendations on construction detail improvements, as it needed some skills to be able to implement properly the techniques. However through proper training and supervision, this difficulty could be overcome.

VI. Resources required

19. Facilities and equipments required

The survey needs a keen eye on the various types of construction damages, supported by the use of ordinary digital camera. The analysis requires the use of structural analysis such as SAP 2000 and ETABS, and CAD drawing software. For the purpose of demonstrating bad and good behavior of non-engineered buildings, simple house building model is constructed with the purposes of showing the necessary proper connections between building elements (foundation, beams, columns, walls, roof trusses). For the shaking table, an ordinary table can be used, shaking is simulated by several strong impacts to the side of the table. Mock-ups are necessary for the purpose of showing the proper fabrication of the building elements and their connections.

20. Costs, organization, manpower, etc.

Funding is not crucial, but good organization and adequate human resources for conducting the survey, analysis, design works, training and supervision of the masons are necessary. Efficient and transparent management of funds and whole activities are as well strongly needed in the process of project implementation. Strong, well organized executing institutions with excellent human resources are needed in this project, and this is part of the capacity building process within the program.

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
School repair and retrofitting projects in Bengkulu post-earthquake reconstruction project, 2001

E1-2. Place
Bengkulu Province (Bengkulu City and surrounding districts).

E1-3. Year
2001- 2002

E1-4. Investor
Bengkulu City Government, Indosiar TV Station

E1-5. People involved

Ir Teddy Boen

E1-6. Monetary costs incurred
Approximately US$ 40,000 for a 6 months works in analysis, design, training and supervision of about 20 school buildings (each works worth about US$ 30,000), which includes travel expenses and other operational costs (training, material preparation, counseling/supervising and advising, workshops)

E1-7. Total workload required
Full time work with total duration of 6 months

E1-8. Evidence of positive result
Since the construction of the schools, no damage has been reported during the subsequent earthquakes in the region.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:
> 7_PT8_P.pdf (PDF - 537 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 24)

I. Heading

1. Title

Social Skills Required to the Researchers Ensuring for Acceptability to Disaster Area

ID:	DRH 24
Hazard:	Earthquake, Tsunami, Volcanic eruption, Landslide, Mudflow, Dust storm, Cold wave, Heat wave, Zud, Cyclone/Typhoon, Storm surge, Flood, Flash flood, Glacial Lake Outburst Flood (GLOF), Snow avalanches, Epidemic, Drought, Desertification, Land degradation, Multi-hazard
Category:	Process Technology (PT)
Proposer:	Tomohide ATSUMI
Country:	JAPAN;
Date posted:	07 February 2008
Date published:	27 October 2008

Contact
Tomohide Atsumi
Associate Professor, Center for the Study of Communication-Design, Osaka University, Japan
1-1 Senri Expo Park, Suita, Osaka 565-0826, Japan
atsumi@hus.osaka-u.ac.jp
TEL: 81-6-6879-8066 FAX:81-6-6879-8064

2. Major significance / Summary

Describes what to know and how to get into the disaster-stricken area after the disaster based on long-term participatory observations in Chuuetsu region of Japan, where a series of major earthquakes hit in 2004, focusing on activities by researchers, graduate, and undergraduate students.

3. Keywords

Process technology, participatory observation, researchers, students

---

II. Categories

4. Focus of this information

Process Technology (PT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), NGO/NPO project managers and staff, Experts, Teachers and educators, Architects and engineers, Sociologists and political economists, Information technology specialists, Urban planners, Rural planners, Environmental/Ecological specialists
5-2. Other users: Motivated researchers, Local residents

6. Hazards focused

Earthquake, Tsunami, Volcanic eruption, Landslide, Mudflow, Dust storm, Cold wave, Heat wave, Zud, Cyclone/Typhoon, Storm surge, Flood , Flash flood, Glacial Lake Outburst Flood (GLOF), Snow avalanches, Epidemic, Drought, Desertification, Land degradation, Multi-hazard

7. Elements at risk
Human lives, Human networks in local communities, Business and livelihoods, Information and communication system, Urban areas, Rural areas, Coastal areas, River banks and fluvial basin, Mountain slopes, Agricultural lands, Cultural heritages

III. Contact Information

8. Proposer(s) information (Writer of this template)
Tomohide Atsumi
Associate Professor, Center for the Study of Communication-Design, Osaka University, Japan
1-1 Senri Expo Park, Suita, Osaka 565-0826, Japan
atsumi@hus.osaka-u.ac.jp
TEL: 81-6-6879-8066 FAX:81-6-6879-8064

9. Place where the technology/knowledge originated
JAPAN;
Kobe and Niigata

10. Names and institutions of technology/knowledge developers
Osaka University

11. Title of relevant projects if any
Case Station and Field Campus (Dr. Norio Okada, Kyoto University, Japan)

12. References and publications
Related to a book chapter in Japanese
Atsumi, T. (in press) Wrap-up your research: To be a bi-lingual. J.Koizumi & K. Shimizu eds. Invitation to Practical Research. Tokyo: Yuhikaku.

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice
Since the 1995 Kobe Earthquake, I have been involved in disaster relief, recovery, and revitalization processes both as a researcher and as a volunteer member of a non-profit organization for disaster. It has been obvious that some researchers and/students are successful in research and practices in the disaster-stricken area, while others are not. It is usually not due to their research background, but due to their social skills to get into the area and meet people. As a social/human scientist with group dynamics as a major background, I examined and summarized the skills as a process technology for disaster research and practice. Theoretical and methodological investigations have been re-conducted for its traditional method, i.e., action research, and social skills described here are examined.

V. Description

15. Feature and attribute
If researchers and/or students start to investigate disaster field, it is essential for them to be sensitive to survivors of the disaster and the community. Needless to say, survivors do NOT live for the research. They are NOT the object of research, but possible partners. Therefore, although researchers would like to conduct their own research, they should re-think the following questions before actually starting the research: What does this research for? How do they contribute to the survivors in front of the researchers? Such reflective consciousness may lead researchers to achieve the aim with survivors. Here are a list of what to know and how to get into the disaster-stricken area after the disaster.

16. Necessary process to implement
You are supposed to examine the items listed up in this technology before, during, and after your research and practice. There are a couple of lists: One is categorized by phases of disaster-cycle, while the other is divided into three categories, i.e., for researchers, graduate, and undergraduate students, respectively. The first lists include, for instance, "Survivors First", "Do participate and practice rescue and relief. Don’t be an Observer", and "Do not stick to doing research; it’s just a result" during early relief phase, whereas the second lists covers, for

example, "Try to work together with local leaders day-to-day", "Study the local history", and "Talk easily about your theory" for researchers (See the attached documents for detail). Remember that the operation of these skills depends on the specific context of the particular disaster, and on the personality of the researcher. In other words, it changes from case to case, and "Ten men, ten colors". It is suggested that, once readers study these skills from this database with some examples, they just go out to the field. In the field, try to be creative and to improvise the skills they study here. If they are still at the learning stage, they need to be trained in the field. In other words, it is best for them to follow an experienced researcher and ask her/him to take them to her/his field. This on-the-job-training (OJT), or in-the-field-training (IFT) should be effective and education program including IFT should be established.

Fig. 1

Fig. 2

17. Strength and limitations

This technology is based on actual experiences of a series of long-term fieldwork by one who is both a researcher and an NPO staff member. So that, it is relatively easy to implement. However, it still lacks how to teach this technology in a classroom in advance for the actual disaster.

18. Lessons learned through implementation if any

Please refer to an example (e.g., Cases of Shiodani). Some people are already sensitive to this technology, while others are not. As indicated above, there has been no good/perfect way of teaching this technology yet. Hence, the next step is to develop an effective program to make people sensitive to this technology.

VI. Resources required

19. Facilities and equipments required

Educational program for this technology.

20. Costs, organization, manpower, etc.

Usual cost for managing a class.

VII. Message from the proposer if any

21. Message

This technology is one of many possible procedures to go into a field. Whether users make use of this technology or not depends on the particular context they are involved in. To understand this technology fully, users are recommended to be guided to a field by an experienced instructor and to learn how to understand and utilize this process technology in the field. Surely, anyone wishing to use it should be strongly advised to contact the author.

It is essential for the researchers to make contact with survivors in the disaster field because nothing can be done there without any good relationship between survivors and researchers. Of course, natural science attempts to produce universal knowledge; whereas human science focuses on particularity (e.g., historical, cultural differences) of the knowledge. In other words, the former is categorized as "nomothetic science", while the latter "narrative science" (Atsumi, 2007). Therefore, this technology may be used more frequently for the latter than for the former. However, since both natural and human sciences of disaster attempt to make the current situation better for survivors, even natural scientists are supposed to use this technology to pursue their scientific research. It is simply because sciences of disaster, both natural and human, should contribute to survivors first.

Although this PT is described as a technology, it also contains the spirit of researchers toward survivors. Hence, readers are expected to learn this PT with its spirit here, but do NOT simply "apply" it to a particular field. Once you put this PT with its spirit, just go out to the field and think from time to time including its historical, cultural, and political contexts.

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

This technology does not take into account a possibility of activities with people in different languages. So, linguistic aspects of this technology (e.g., how to involve an interpreter effectively) are for future investigation.

IX. Application examples

No.1

E1-1. Project name if available
Foot-bath by university students at shelters

E1-2. Place

E1-3. Year
2007

E1-4. Investor

Tomohide Atsumi with NPO members in Kobe

E1-5. People involved
University students, mostly undergraduate, from Kobe University, Kobe Gakuin University, Osaka University, and Nagaoka University of Technology, with Hisaichi-NGO Kyodo Center, Nippon Volunteer Network Active in Disaster, and Chuuetsu Fukko Network.

E1-6. Monetary costs incurred
Transportation, Meal, Accommodation, and Stipend (total budget is still growing, but about ten thousand US dollars)

E1-7. Total workload required
A group of students have visited the area several times under the coordination of a leader for about two months. Before starting this project, students of Osaka University learned how to offer the foot-bath from a specialist in 2004 in order to provide this service to the survivors of the 2004 Chuetsu earthquake. They offered the foot-bath service for more than 2 years there. Students of other universities learned this technique from Osaka University students at the temporary housing in Nagaoka. They learned not only how to take care of the feet of survivors, but also how to talk to them, how to listen to them, how to smile to them, and how to keep contact with them in the field. It is easy to describe its physical side of technique (i.e., what water temperature are comfortable, how to use a basin), but social skills were learned through the in-the-field-training (IFT).

E1-8. Evidence of positive result
Reports from the students and the leader have been read positively through internet and media responded in positive ways.

No.2

E2-1. Project name if available
Side-by-side with local relief operators

E2-2. Place
Kariwa Village, Niigata, Japan

E2-3. Year
2007

E2-4. Investor
Tomohide Atsumi and NPO members in Kobe and Nagoya

E2-5. People involved
Staff members of Nippon Volunteer Network Active in Disaster including Tomohide Atsumi as a researcher, The NGO Collaboration Center for HANSHIN QUAKE Rehabilitation, and Rescue Stock Yard.

E2-6. Monetary costs incurred
Transportation, Meal, Accommodation, and Stipend (total budget is still growing, but about ten thousand US dollars)

E2-7. Total workload required
The Chuetsu-Oki earthquake hit Kariwa Village as well as Kashiwazaki-city. Not only volunteers from outside, but also staff members of the local Social Welfare Council were supposed to help survivors in the village. The staff members were residents of the village and they themselves were affected by the disaster. They had to support not only their own family members, but also other residents in the village. They were extremely busy for their own family, but they had to spend their time to other survivors. They also felt some pressure from the outsiders who came to the village to share their experiences from past disasters. The staff members of NPOs from Kobe and Nagoya described above attempted to stay close to the local staff of the Social Welfare Council and keep listening to their voices. It was a good way to researchers to be accepted to disaster area.

E2-8. Evidence of positive result
Staff members of the NPO above have still been working with survivors in the village. When there is an event, they are asked to join. Such friendly relationship should contribute to the long-term revitalization of the village.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) - **DRH-Asia Contents (DRH 25)**

I. Heading

1. Title

Earthquake Risk Reduction and Education

ID:	DRH 25
Hazard:	Earthquake
Category:	Process Technology (PT), Transferable indigenous knowledge (TIK)
Proposer:	Farokh Parsizadeh
Country:	IRAN, ISLAMIC REPUBLIC OF;
Date posted:	07 February 2008
Date published:	01 December 2008

"Earthquake and Safety" Drills

Contact
Mr. Farokh Parsizadeh (Research Associate)
Mr. Mohsen-Ghafory Ashtiany (Distinguished Professor)
International Institute of Earthquake Engineering and Seismology (IIEES)
26 Arghavan St., N. Dibajie, Farmanieh
Tehran, I.R.Iran
Tel: 0098 21 22294932; Email: parsi@iiees.ac.ir

2. Major significance / Summary

- Universal
- Children represent the future
- Schools have post
- Disaster roles as shelters and relief centers
- Important role in development
- Act as a catalyst to bind the community
- Provides confidence in the community
- Promotes safety culture
- Ensure leadership among future generations

3. Keywords

Disasters, Education, Risk, Earthquakes

II. Categories

4. Focus of this information

Process Technology (PT), Transferable indigenous knowledge (TIK)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.), NGO/NPO project managers and staff, International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Financing and insurance business personnel, Experts, Teachers and educators, Others

5-2. Other users: Policy makers, Motivated researchers, Local residents

6. Hazards focused
Earthquake

7. Elements at risk
Human lives, Human networks in local communities

III. Contact Information

8. Proposer(s) information (Writer of this template)
Mr. Farokh Parsizadeh (Research Associate)
Mr. Mohsen-Ghafory Ashtiany (Distinguished Professor)
International Institute of Earthquake Engineering and Seismology (IIEES)
26 Arghavan St., N. Dibajie, Farmanieh
Tehran, I.R.Iran
Tel: 0098 21 22294932; Email: parsi@iiees.ac.ir

9. Place where the technology/knowledge originated
IRAN, ISLAMIC REPUBLIC OF;

10. Names and institutions of technology/knowledge developers
International Institute of Earthquake Engineering and Seismology (IIEES)

Vida Heshmati, IIEES, Heshmati@iiees.ac.ir
Ali Ehsaan Seif, IIEES, seif@iiees.ac.ir
Yasamin O. Izadkhah, IIEES, izad@iiees.ac.ir

11. Title of relevant projects if any

12. References and publications
Planning Guides for Preparedness Before, During, and After an Earthquake, Proceedings of the Second International Conference on Seismology and Earthquake Engineering (SEE-2), May 1995.Y.O. Izadkhah and, F. Parsizadeh

Guideline on Earthquake and Safety for Kindergarten Teachers (English-2007) F.Parsizadeh, Y.O.Izadkhah, V.Heshmati.

What we should know about Earthquakes (Pesian-2005) F.Parsizadeh, P.Fatemi.

Earthquake and Safety (Persian-2004) F.Parsizadeh, A.E.Seif,V.Heshmati.

Earthquake and Safety Councils in Schools (Persian-2004) F.Parsizadeh, A.E.Seif.

Earthquake and Safety Guideline for Kindergarten Instructors (Persian-2004) F.Parsizadeh, V.Heshmati.

Guideline on National Earthquake & Safety Drill for Schools Administrators (Persian since 2001). F.Parsizadeh, A.E.Seif.

13. Note on ownership if any
IIEES

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice
Iran, being in one of the most active tectonic regions of the world, faces high seismic hazard. The country has experienced many devastating earthquakes with a magnitude of 7.0 or more throughout its history. After the Manjil-Rudbar Earthquake of June 1990 and during IDNDR, there has been considerable effort in Iran, nationally and internationally to develop effective public awareness and education for different levels of the society. The comprehensive earthquake risk reduction programme in Iran was launched in 1991. Along with the improvement of new methods for design and construction of structures, earthquake education has developed and grown as another effective activity.

In this regard, educating the children, as the future of any community at risk, can be regarded as an effective strategy to communicate safety messages to the entire community. In other words, educating the children serves to disseminate vital information to most of the population via the knowledge, skills and enthusiastic motivation of children. The children convey messages throughout society, starting with their parents. Consequently, schools play a major role in the development of disaster-aware citizens. It is proposed that children can act as a key factor in the promotion of safety culture, leading to disaster prevention and risk reduction.

V. Description

15. Feature and attribute

The main objective is to initiate a series of activities to protect people from the impacts of future earthquakes.

Also:

- Development and implementation of a comprehensive program addressing all groups of the society. - Increasing public awareness and preparedness using all types of media. - Educating children and youngsters about earthquake preparedness at all school levels by including materials in textbooks, films, conducting drills, exhibitions, drawing and writing competitions, posters, etc. - Conducting annual national drill in schools on November 8th. - Organizing annual art, painting and training exhibitions.

-Strengthening the key role of women in hazard mitigation programs and promotion of seismic safety culture.

16. Necessary process to implement

In order to update the teacher's information, there is on-the-job training, for teachers as well as administrative staff. Materials including scientific definitions of earth and the related science, earthquake preparedness, and the national drills have been taught. These classes are in two participatory and non-participatory sections. In participatory section, the face to face method is used by the instructors. In non-participatory sessions, the teachers use books. They will then be tested in a specific date through an exam. It is worth to mention that the sources for these materials is produced by the IIEES and is distributed through Ministry of Education.

In order to increase the public awareness and teaching on national drills, the TV short announcements is conducted by IIEES and is broadcasted through national Radio and TV 10 days before the drills.

17. Strength and limitations

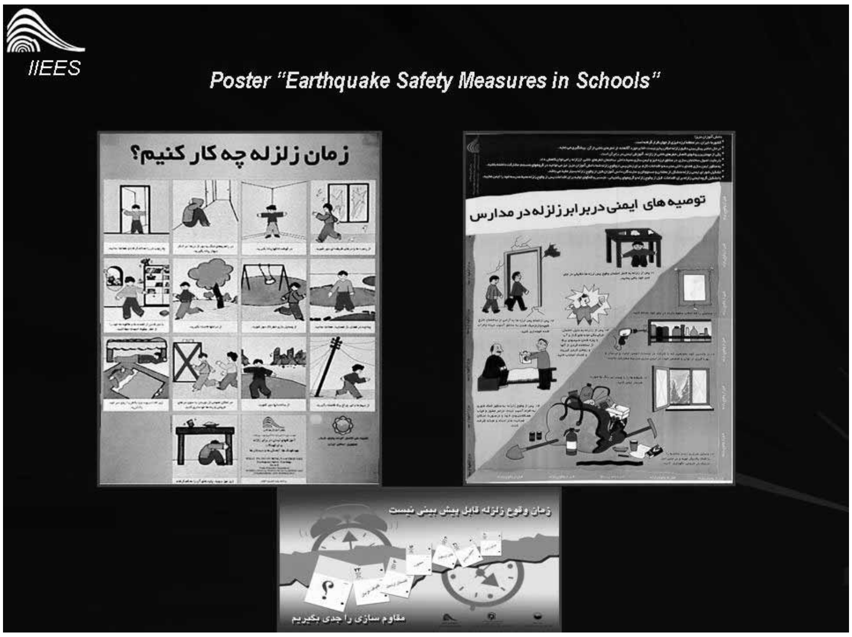
18. Lessons learned through implementation if any

VI. Resources required

19. Facilities and equipments required

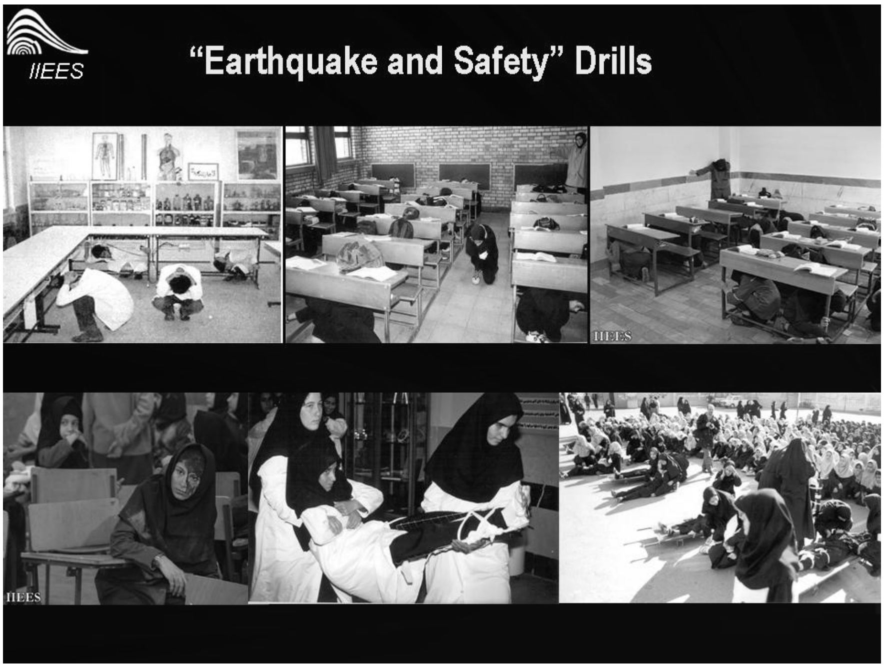
1- Conducting guidelines: The guideline is for schools' administrators giving instructions on how to perform the national drill. The contents of this guidelines consists of: - The necessity of performing the drills - Drills objectives - Role of parents - Drill performance - Time of the drill - Necessary measures before and during drills This guideline is published in 150,000 copies and is sent to all schools.

2- Posters: One of the ways to increase the public awareness is through posters. The poster should be designed in a way that it can transfer some visual information to the children as well as increase their awareness. The poster is published in 300,000 copies each year and every school receives two copies.



3- Street billboards: This is another media to help in increasing the public awareness and stimulating the society curiosity and interest about national drill, the seismic strengthening and the seismicity of the country.

4- Conducting films and short announcements: One of the methods in teaching students is through educational films. The educational film related to national drill is conducted and produced by IIEES. Additionally, for public awareness and distributing more information on drills, short announcements are produced by IIEES and broadcasted from national Radio and TV channels. National Drill Permanent Council The strategy of drill performance is designed through the National Drill Permanent Council. This council consists of the representatives of Ministry of Education (with the full authority), Ministry of Science, Research and Technology, Ministry of Interior, The Red Crescent Society of Iran, and National TV and Radio. This council submits the projects to the planning committee after identifying the general policy for implementing them. It is worth mentioning that the permanent secretariat of this council is located in IIEES. Planning Committee This committee has to implement the approved issues of the National Drill Permanent Council after review. The members of this committee consists of: A representative from IIEES, 4 representatives from Ministry of Education, one representative from Tehran Ministry of Education, one representative from National TV and Radio, one representative from The Red Crescent Society of Iran, one representative from Ministry of Interior, and one representative from the Student Organization. Provincial Committee In order to approve the decisions in the whole country, a provincial committee is held in each province. This committee consists of the representative of the province (The head of unexpected events committees), the representative of National TV and Radio, the representative of the Red Crescent Society of Iran, and the representative of Ministry of Education. Their responsibilities are to accomplish an effective drill in their province.



Members of National Earthquake Drill Council

Ministry of Education

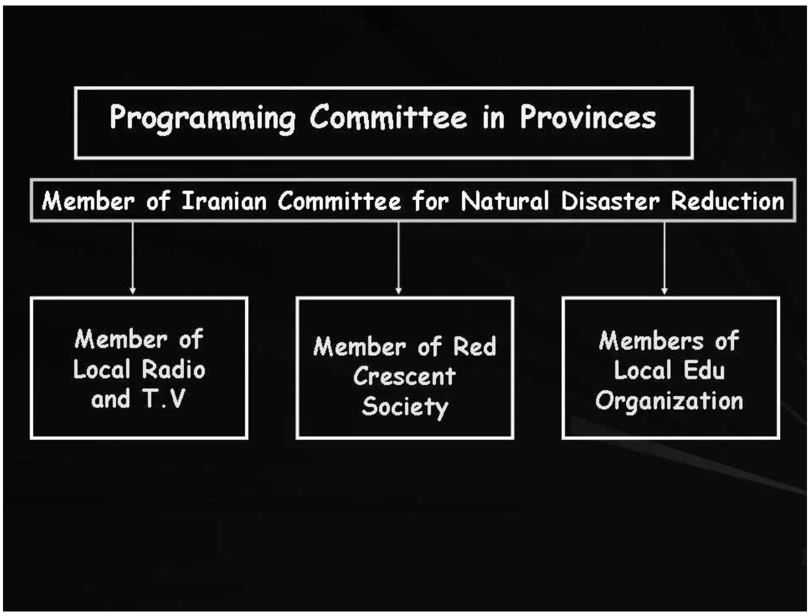
Ministry of science, Research and Technology

Ministry of Interior

Iranian Red Crescent Society

Iran Radio -T.V Broadcasting

International Institute of Earthquake Engineering and Seismology, Secretary of Council



20. Costs, organization, manpower, etc.

100,000 US Dollars

VII. Message from the proposer if any

21. Message

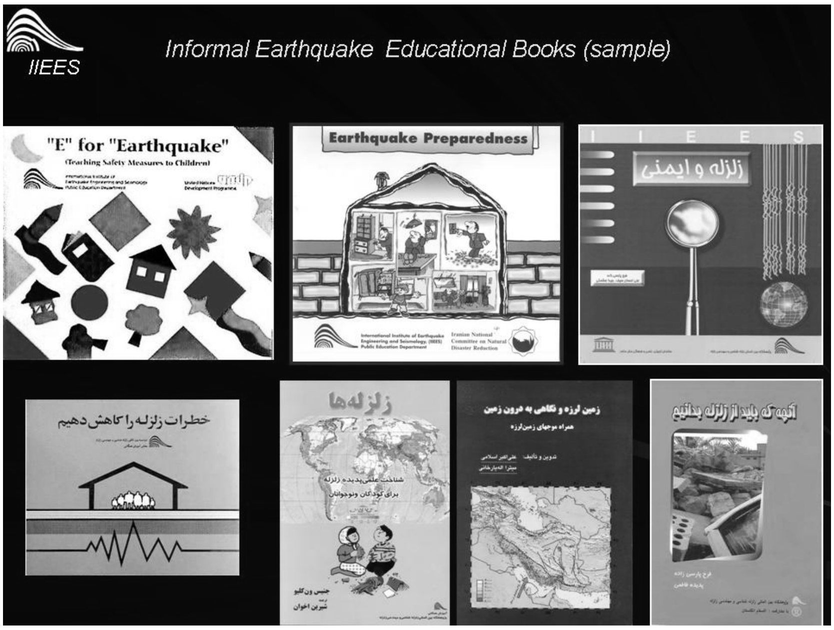
1-The implemented public education programs in Iran have proven to be effective in raising the awareness of young generation toward earthquake safety and the valuable experiences can be applied in other countries as well.

2-Following is the response of the author to the DRH Facilitators' comments in the discussion screen. It is duplicated here with some illustrations added.

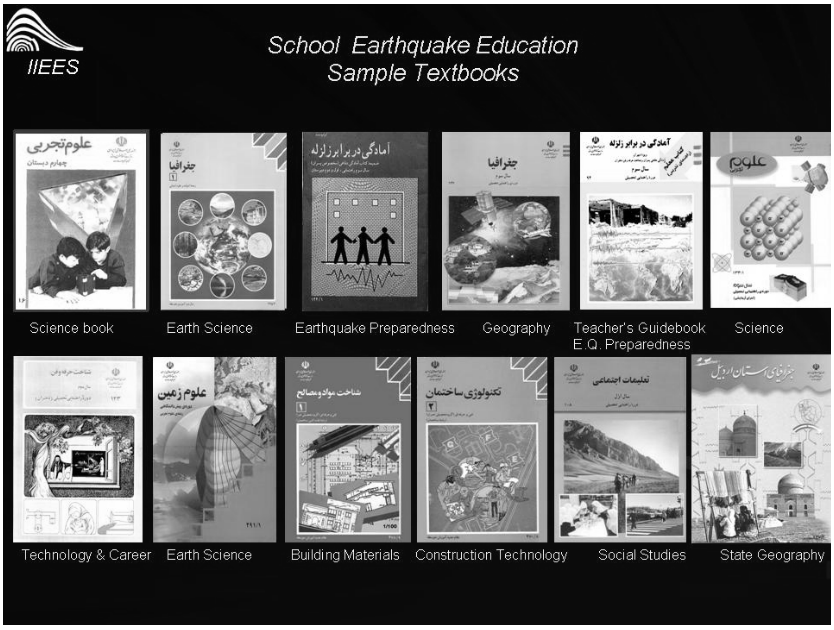
1) Exam is a method to encourage teachers to update their knowledge about earthquakes and how to deal with it which would lead to a better understanding of risk and measures for reducing it. The questions for exams come from books which are published by IIEES.

2) Earthquake risk education in general leads to an enhanced perception of risk, better understanding of protective measures and less fear of a hazard. What is difficult to assess is how all this understanding is used during a disaster event. The question is posed: "Does this understanding really influence the children's behaviour and consequently the behaviour of their family? The children's knowledge and understanding of earthquakes does not guarantee that the knowledge will be appropriately applied when it is needed. Therefore the use of participatory methods as well as non-participatory was to test the example of the "knowledge-to-behaviour" relationship and their interrelation. In practice, behaviour is not always necessarily as expected and taught. Therefore, to achieve behavioural change, there is a need to incorporate appropriate knowledge into the culture of the target group for the current and future generations. In earthquake safety, both concepts of 'how to do' and 'what to do' needed. This is why there is a need for both participatory and non-participatory approaches.

3) All educational materials are prepared by IIEES by group of specialist consist of earth science, Structural engineering, social sciences and educationalist.



4) The textbooks material in various levels of the schools can be classified into the three categories as follows: *a. Scientific subjects on earth and earthquake:* Science books of 4th, 5th, 8th and 12th grade and Geography books of 8th and 10th grade cover scientific materials on the earth structure, continental movements, earthquake phenomenon, faults, seismicity, and seismic hazard. Considering that the geography books are regionally prepared, provides earthquake information related to the related province. *b. Earthquake preparedness, response and recovery:* "Earthquake Preparedness" book for 8th and 9th grades and "Technology and Careers" book for the 8th grade covers materials on the most appropriate activities to be preformed before, during and after a damaging earthquake; as well as guideline for school preparedness and the first aids. *c. Technical and engineering aspects of safe building:* How to build a safe and earthquake resistant building is being though in the construction major of the technical high schools. The curriculum and text book of this major has been modified in order to train construction technician aware and knowledgeable on building standards and criteria of a seismically safe building. *d. Social and cultural aspects of earthquake:* "Social Science" books of 3rd and 7th grades and "Persian Literature" book of the 8th grade look at earthquake from social and literature point of views with the aim of creating self confidence and proper social behavior at the time of earthquake.



VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
Conducting Earthquake Safety Council (Phase 1)

E1-2. Place
10 Secondary and High School in Tehran

E1-3. Year
2007-2008

E1-4. Investor

E1-5. People involved
10 staff

E1-6. Monetary costs incurred
35,000 US Dollars

E1-7. Total workload required
1,240 hours

E1-8. Evidence of positive result

No.2

E2-1. Project name if available
Earthquake Safety Council (Phase 2)

E2-2. Place
20 Secondary and High School in Tehran

E2-3. Year
2008-2009

E2-4. Investor

E2-5. People involved
10 staff

E2-6. Monetary costs incurred
40,000 US Dollars

E2-7. Total workload required
1,240 hours

E2-8. Evidence of positive result

No.3

E3-1. Project name if available
Earthquake Safety Network (Phase 3)

E3-2. Place
30 Secondary and High School in Tehran

E3-3. Year
2009-2010

E3-4. Investor

E3-5. People involved
10 staff

E3-6. Monetary costs incurred
30 million Toman (30,000 US Dollars)

E3-7. Total workload required
1,240 hours

E3-8. Evidence of positive result

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:
> DRH.pdf (PDF - 801 Kb)
> Slide4-1.jpg (JPG - 109 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 26)

I. Heading

1. Title

Disaster Management Support System by Utilizing Satellites under the Framework of "Sentinel Asia"

ID:	DRH 26
Hazard:	Earthquake, Tsunami, Volcanic eruption, Landslide, Mudflow, Cyclone/Typhoon, Storm surge, Flood, Flash flood, Glacial Lake Outburst Flood (GLOF), Snow avalanches, Wildfire, Drought
Category:	Implementation Oriented Technology (IOT)
Proposer:	Takayuki Nakamura
Country:	JAPAN;
Date posted:	12 February 2008
Date published:	22 September 2008

Satellite Images before and after Disaster.

Contact
(1)Japan Aerospace Exploration Agency (JAXA), Disaster Management Support Systems Office (DMSSO)
2-2-1 Ohtemachi, Chiyoda-ku, Tokyo, 100-0004 Japan
TEL: -81-3-3516-9100, FAX: -81-3-3516-9160
E-mail: sentinel.asia@jaxa.jp

(2) Satellite Applications and Promotion Center (SAPC), Asian Branch of the Disaster Management Support Systems Office
B.B. Building 15th Flr. Room No.1502, 54 Asoke Road, Sukhumvit 21, Bangkok, 10110 Thailand
TEL: -66-2259-4192 (ext. 12), FAX: -66-2260-7027
E-mail: sentinel.asia@jaxa.jp

2. Major significance / Summary

"Sentinel Asia" initially is an internet-based, node-allotted, information distribution backbone, eventually distributing relevant satellite and in-situ spatial information on multiple hazards in the Asia-Pacific region. The system will draw on satellite derived products and imagery from all available earth observing geostationary satellites, or low-earth orbiting satellites, including meteorological satellites that provide routine data to the region. The main derivates of Sentinel Asia are overlaid satellite images on digital maps provided by Digital Asia Web-GIS functions, where satellite images are value-added images with extraction of stricken area, original satellite images for FTP and on-site digital camera images.
(Web Site: http://dmss.tksc.jaxa.jp/sentinel/)

3. Keywords

Space technology, Satellite image, Disaster management support system

II. Categories

4. Focus of this information

Implementation Oriented Technology (IOT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.), NGO/NPO project managers and staff, International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Experts,
Information technology specialists, Urban planners, Rural planners, Environmental/Ecological specialists
5-2. Other users: Policy makers, Motivated researchers

6. Hazards focused

Earthquake, Tsunami, Volcanic eruption, Landslide, Mudflow, Cyclone/Typhoon, Storm surge, Flood, Flash flood,
Glacial Lake Outburst Flood (GLOF), Snow avalanches, Wildfire, Drought

7. Elements at risk

Human lives, Infrastructure, Buildings, Urban areas, Rural areas, Coastal areas, River banks and fluvial basin,
Mountain slopes, Agricultural lands, Cultural heritages

III. Contact Information

8. Proposer(s) information (Writer of this template)

(1)Japan Aerospace Exploration Agency (JAXA), Disaster Management Support Systems Office (DMSSO)
2-2-1 Ohtemachi, Chiyoda-ku, Tokyo, 100-0004 Japan
TEL: -81-3-3516-9100, FAX: -81-3-3516-9160
E-mail: sentinel.asia@jaxa.jp

(2) Satellite Applications and Promotion Center (SAPC), Asian Branch of the Disaster Management Support Systems Office
B.B. Building 15th Flr. Room No.1502, 54 Asoke Road, Sukhumvit 21, Bangkok, 10110 Thailand
TEL: -66-2259-4192 (ext. 12), FAX: -66-2260-7027
E-mail: sentinel.asia@jaxa.jp

9. Place where the technology/knowledge originated

JAPAN;

10. Names and institutions of technology/knowledge developers

Japan Aerospace Exploration Agency (JAXA)
Satellite Applications and Promotion Center (SAPC)

11. Title of relevant projects if any

None

12. References and publications

None

13. Note on ownership if any

None

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

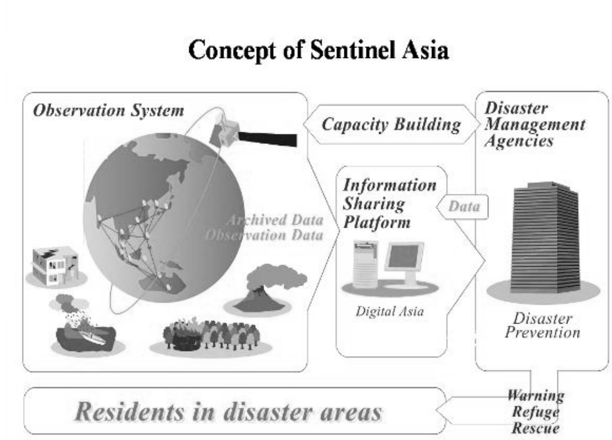
According to UN statistics, the Asia and Oceania region has the largest proportion of natural disasters in the world. Even before the recent Indian Ocean Tsunami and earthquakes in India and Pakistan, compounded by its high levels of population (close to 3 billion), the region covers more than 50 % of the global fatalities associated with such disasters. While droughts are still considered world-wide the number one cause of fatalities associated with disasters, other calamities such as flooding, earthquakes, wildfires, high winds and landslides are high on the list of sources of deaths, destruction and economic losses in the region.

V. Description

15. Feature and attribute

Many of the causes and impacts of natural hazards, including droughts, are observable in real-time from space by earth observing systems. When efficiently combined with modern information-distribution methods, such data can be sent rapidly to affected communities and local emergency agencies as early warning before the disaster occurs, or as post-disaster maps to assist in recovery operations. A new project called "Sentinel Asia" was proposed in 2004 by the Asia-Pacific Space Agency Forum (APRSAF) to showcase the value and impact of earth observation technologies, combined with near real-time internet dissemination methods and Web-GIS mapping tools.

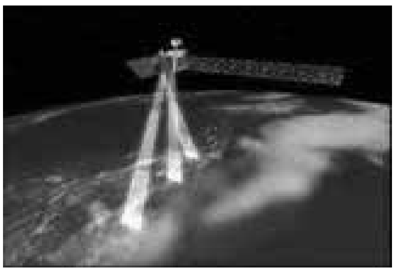
"Sentinel Asia" is a "voluntary and best-efforts-basis initiative" led by the APRSAF to share disaster information in the Asia-Pacific region on the Digital Asia (Web-GIS) platform and to make the best use of earth observation satellites data for disaster management in the Asia-Pacific region.



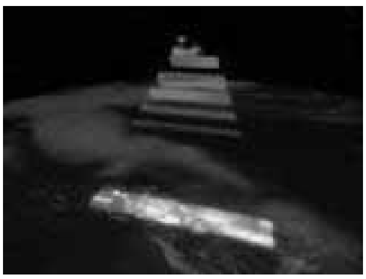
"Sentinel Asia" consists of three steps of the Disaster Management Support System. The first step was carried out in 2006 to 2007 by utilizing the earth observation satellite data. It aims at improving safety in society by ICT and Space technology. It improves speed and accuracy for disaster preparedness and early warning, leading to a minimization of victims, and social and economic losses.

Currently participating satellites are ALOS, IRS, MTSAT-1R, Terra & Aqua and others. The ALOS (Advanced Land Observing Satellite), which was launched by JAXA on January 2006, is an earth observation satellite designed to obtain the precise topographic data. The ALOS has three remote sensing instruments, or the Panchromatic Remote sensing Instrument for Stereo Mapping (PRISM), the Phased Array type L-band Synthetic Aperture Rader (PALSER), and the Advanced Visible and Near Infrared Radiometer type 2 (AVNIR-2).

ALOS

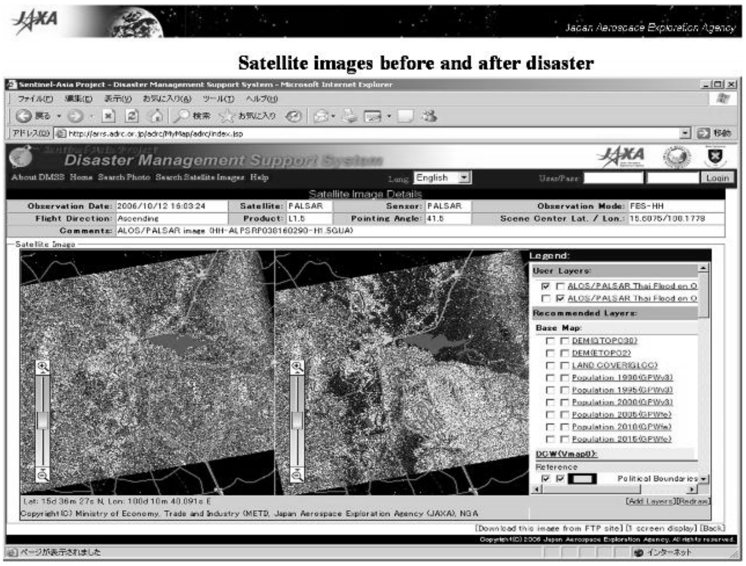


PRISM



PALSAR

AVNIR-2



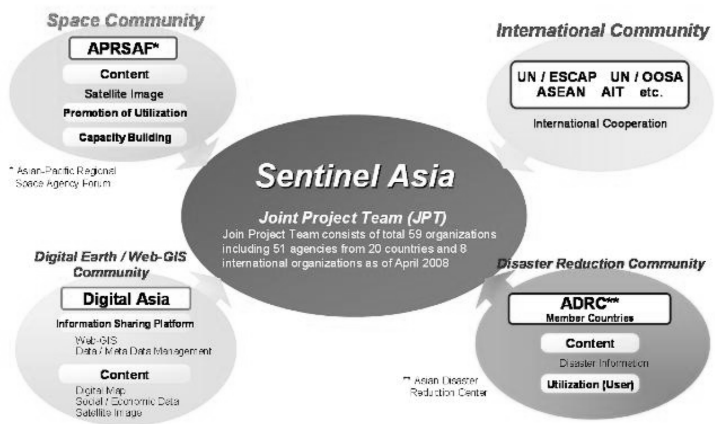
16. Necessary process to implement

To promote Sentinel Asia, the Joint Project Team (JPT) was organized. JPT is open to all the APRSAF member countries, disaster prevention organizations and regional and international organizations who wish to participate in disaster information sharing activities. Currently JPT consists of a total of 59 organizations including 51 agencies from 20 different countries and 8 international organizations, as well as the Asian Disaster Reduction Centre.

The main activities of "Sentinel Asia" are manifold, such as emergency observation in case of major disasters, observation requests from the members of the JPT, wildfire and flood monitoring, as well as capacity-building for the utilization of satellite images for disaster management. The system is also to be used by member countries of "Sentinel Asia" in the Asia-Pacific region to 'trigger' dedicated satellite-data acquisitions through their participating and cooperating space agencies during major disasters in their countries.

Sentinel Asia is promoted under cooperation among the following four communities: Space Community (APRSAF); International Community (UN/ESCAP, UN/OOSA, ASEAN, and AIT etc.); Disaster Reduction Community (ADRC and its member countries); and Digital Asia Community (Keio University etc.).

Framework of Sentinel Asia



The goal of the project is that a fundamental distributing service is created, which produces disaster related data products and images in the Asia-Pacific region in near real-time. These services encompass a variety of different deliverables. Space organizations provide true-color, best resolution JPEGS of satellite images. Satellite data also produces wildfire hotspot and precipitation data. Other basic data given by Digital Asia is a millionth digital map by the NGA (National Geospatial-Intelligence Agency) and LANDSAT images, which cover the entire area of Asia. Furthermore on-site digital camera images are supplied and fine regional digital maps, which are contributed by national geography organizations alongside others.

Furthermore, additional detailed disaster information will be made available by the Asian Disaster Reduction Center (ADRC).

17. Strength and limitations

Strength The project focuses on retrieving and sharing disaster information. A lot of state-of-the-art space technologies such as communication satellites and advanced information technologies are utilized in order to implement this project. In addition, the framework APRSAF (Asia- Pacific Regional Space Agency Forum) and the network of ADRC (Asian Disaster Reduction Center) are useful for the sake of making this project function appropriately.

Limitation On the other hand, it is a still challenge to find adequate ways how effectively and precisely satellite images are distributed to end-users, for example, national or local decision-makers to deal with the damage caused by natural disasters in Asia-Pacific region.

18. Lessons learned through implementation if any

It is still a challenge to find adequate ways how to effectively distribute satellite images to end-users, such as national or local decision-makers to enable them to deal with the damage caused by natural disasters.

Moreover, in order to send satellite images to the regions affected by natural disasters properly and prompt, the capacity for downloading is critical. According to the survey conducted by Keio University of Japan, the downloading speed differs in Asian countries. Many Asian countries joining JPT (Joint Project Team) of APRSAF utilize low-speed circuits which are less than 512KB in case of downloading from Japanese servers. The only exceptions are Australia and Korea. The average speed is approximately 190KB. The Web site system of “Sentinel Asia” should be developed to be efficiently utilized even in these narrow band areas.

Aiming at a more robust and user-friendly Web-GIS system and reflecting wider ranges of user requests of data and information services, the “Sentinel Asia Step2 (2008-2012)” was agreed at the APRSAF-14, which was held in Bangalore, India in November 2007. The main objectives of “Sentinel Asia Step2” are as follows.

1. Participation of Various Satellites
- Earth observation satellites: ALOS (JAXA), MTSAT-1R (JMA), IRS (ISRO), KOMPSAT (KARI), THEOS (GISTDA), etc.
- Communications satellites: WINDS (JAXA) etc.

2. Improvement of Accessibility to Information
- From data sharing (Step1) to data sharing and transmission
- Facilitate access to disaster-related information through various means including satellite communication using WINDS

3. Value-added Data
- To provide analyzed images and easily comprehensible interpretations from images
- To organize framework of analysis group

4. Expansion of Disaster Scope
- To extend STEP1’s focus on Wildfires and Floods
- To include monitoring during signs before disasters happen and environmental change
- Strengthening contribution to management of wildfire which bears substantial influence on global warming

5. User Expansion
- To expand users to local disaster authority in cooperation with UNESCAP

VI. Resources required

19. Facilities and equipments required

The common information-sharing platform, 'Digital Asia (DA)'internet-based Web-GIS, is recommended, for use in this project by countries that do not already operate Web-GIS systems. DA is one of Academic Frontier Projects of MEXT (Ministry of Education, Culture, Sports, Science and Technology of Japanese Gov.) It is promoted by Keio University which supports easy distribution of various kinds of geospatial and other linked data like natural and social data via the Internet, in order to make rapid strategic planning and risk management decisions across Asia.

A large database already exists as core data held in Keio University, which is then externally distributed to all Digital Asia servers or compatible systems in each participating organization across Asia. All relevant data for this project on Digital Asia servers will be freely open to the general public on the Internet as public assets. “Sentinel Asia” is one of the many applications of the overall Digital Asia program for disaster management objectives.

20. Costs, organization, manpower, etc.

A schematic of the operation of the Digital Asia system is that geo-coded information can be easily uploaded to OGC-based Digital Asia servers. For implementation of Digital Asia servers, the Sentinel Asia Technical Implementation Team will provide the necessary technical support to organizations that request it. Digital Asia server (Hardware) will also be provided by Digital Asia, if requested.

The members of Joint Project Team (JPT) can request an emergency observation at disasters. Besides, in case any readers hope to obtain the data, they are recommended to contact with the Disaster Management Support Systems Office (DMSSO) in Tokyo or the Asian Branch of the DMSSO in Bangkok.

VII. Message from the proposer if any

21. Message

In case readers hope to acquire more technical information such as the utilization of satellite images, methodologies of using remote sensing technique, or more specified information such as emergency observation, wildfire monitoring, flood monitoring, capacity building, etc., they are recommended to visit the website of the Sentinel Asia.

(Web Site: http://dmss.tksc.jaxa.jp/sentinel/)

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has fair applicability demonstrated by implementation in one or more field sites.

23. Notes on the applicability if any

Asia-Pacific region is prone to natural hazards. However, not only in Asia-Pacific region but also in other regions in the world, many people suffer from natural disasters every year. There are also strong needs in other continents for the utilization of satellite images to lessen the damage caused by natural hazards. In view of this, “Sentinel Asia” can be replicated in other areas as a good application of space technology.

IX. Application examples

X. Other related parallel initiatives if any

None

XI. Remarks for version upgrade

Attached files:

> 3.jpg (JPG - 23 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 28)

I. Heading

1. Title

Community Based Disaster Risk Reduction (CBDRR)

ID:	DRH 28
Hazard:	Multi-hazard
Category:	Process Technology (PT)
Proposer:	Krishna S. Pribadi
Country:	PHILIPPINES; INDIA; NEPAL; CAMBODIA; INDONESIA;
Date posted:	17 March 2008
Date published:	09 June 2009

Community members working together in reducing village flood risk as part of action plan implementation.

Contact
Dr. Krishna S. Pribadi
Center for Disaster Mitigation, Integration and Application R & D Building ITB, 8th Floor, Jl. Ganesa No. 10, Bandung-Indonesia 40132
E-mails: ksppribadi@bdg.centrin.net.id; ksuryanto@si.itb.ac.id
Phone Office: (+62) (22) 70808949, 2504987 ext. 1819 (+62) (22) 2502272
Fax.: (+62) (22) 2510714; 2508125
Handphone: (+62) 811217666
Office website: http://kppmb.itb.ac.i

Dr Teti Argo
Researcher at Center for Disaster Mitigation, Institut Teknologi Bandung (CDM-ITB).

Dr Wayan Sengara
Head, Center for Disaster Mitigation, Institut Teknologi Bandung (CDM-ITB).

2. Major significance / Summary

Reducing social vulnerabilities resulting in reducing disaster impact on human lives and property by improving the community's disaster resilience through enhancing their awareness, and in organizing disaster planning and preparedness at the local community level. The community will have the ability to identify risk, plan, prioritize and implement actions to reduce risk from natural hazard at the community level.

3. Keywords

Community, hazard, vulnerability, natural disaster, resilience,

II. Categories

4. Focus of this information

Process Technology (PT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.), NGO/NPO project managers and staff, International organizations (UN

organizations and programmes, WB, ADRC, EC, etc.), Experts , Teachers and educators, Sociologists and political economists, Rural planners, Environmental/Ecological specialists
5-2. Other users: Policy makers, Motivated researchers, Local residents

6. Hazards focused
Multi-hazard

7. Elements at risk
Human lives, Human networks in local communities, Urban areas, Rural areas, Coastal areas, River banks and fluvial basin, Mountain slopes

III. Contact Information

8. Proposer(s) information (Writer of this template)
Dr. Krishna S. Pribadi
Center for Disaster Mitigation, Integration and Application R & D Building ITB, 8th Floor, Jl. Ganesa No. 10, Bandung-Indonesia 40132
E-mails: kppribadi@bdg.centrin.net.id; ksuryanto@si.itb.ac.id
Phone Office: (+62) (22) 70808949, 2504987 ext. 1819 (+62) (22) 2502272
Fax.: (+62) (22) 2510714; 2508125
Handphone: (+62) 811217666
Office website: http://kppmb.itb.ac.i

Dr Teti Argo
Researcher at Center for Disaster Mitigation, Institut Teknologi Bandung (CDM-ITB).

Dr Wayan Sengara
Head, Center for Disaster Mitigation, Institut Teknologi Bandung (CDM-ITB).

9. Place where the technology/knowledge originated
PHILIPPINES; INDIA; NEPAL; CAMBODIA; INDONESIA;

10. Names and institutions of technology/knowledge developers
(1) CDM ITB

11. Title of relevant projects if any
Community Based Flood Mitigation in Urban Areas: Case Study of Bandung and Jakarta Cities
Developing Community Based Disaster Risk Reduction in Aceh Province and West Sumatra Province

12. References and publications

13. Note on ownership if any
Center for Disaster Mitigation (CDM ITB)

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice
Disaster events and/or societal circumstances, which became the driving force either for developing the technology or enhancing the practice Indonesia is an archipelago located at the conjunction of four tectonic plates (Eurasia, Pacific, Philippines and Indo-Australian). The topography varies from mountainous to long coastal zones. The country is exposed to considerable threats from natural hazards such as earthquake, landslides, volcanoes, floods and tsunamis. Communities are mostly at risk because of the lack of awareness and capacity to cope with the disasters. On the other hand, government capacity to protect the population from natural disasters is limited. As the communities can not depend solely on government actions to protect their life, there is a need to improve their awareness and capacity in order to make them safer from disaster. The Jakarta big flood event in 2002 and the catastrophic tsunami event of 26th December 2004 which strike the coastal areas in Aceh Province and Nias Island had been the driving force for enhancing the practice. The Tsunami had devastated large parts of the coastal areas, destroyed settlements and social and economic infrastructure (schools, health centers, public buildings, lifelines), caused 200,000 human lives loses and loss of livelihoods. Strengthening the local community capacity for preparing them to face various hazards and reducing its impact is considered as one of the strategic moves to reduce the disaster risk.

V. Description

15. Feature and attribute

The aim of CBDRR is to reduce vulnerabilities and increase capacities of households and communities to withstand damaging effects of disasters. CBDRR contributes to people's participation and empowerment in achieving sustainable development and sharing its benefits. One of many benefits of CBDRR addressed in the United Nations International Decade for Disaster Reduction (UN-IDNDR) is that: Community participation will positively address the local socio-economic concerns. It will empower them with knowledge and skills; develop the leadership capability of the community members, which will further strengthen their capacity to contribute to development initiatives. The process is more about capacity building and community empowerment process for improving the community capacity in reducing their vulnerability against natural hazard.

16. Necessary process to implement

The whole process is shown in **Fig. 1**. During the process, it is important to develop and enhance the collaborative mechanism between the local authorities, the local communities and other stakeholders, and to build up the vulnerability reduction measures while capitalizing on the already existing indigenous capacity and wisdoms. This is a process based initiative and learning process which is as (if not more) important as the project outcomes for both project and targeted communities.

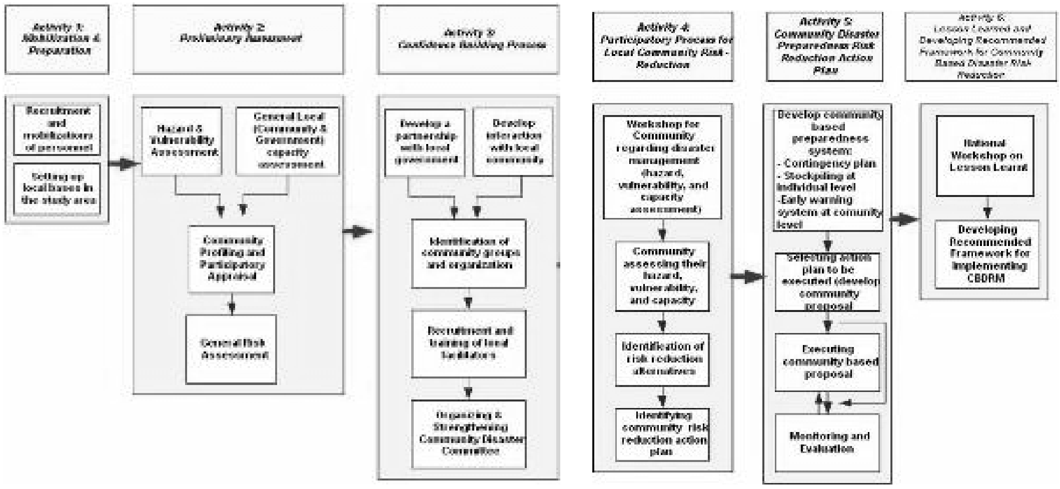


Fig. 1 CBDRR Implementation Framework

First, the necessary step for implementation is communicating the intention of implementing CBDRR program to the local government and community in each concerned area of work. The discussions with the local community as well as local government officials could take place in different places such as in public venue (government office, school, mosque etc), community leader's house, coffee shops, open field and other places in the community, in order to cater to the needs and availability of different groups within the community to be involved. (**Fig. 2**)

Fig. 2 Discussion of CBDRR Program with the community and Local Government officials

One of initial and essential activity towards developing community-based risk reduction would be to conduct hazards and vulnerability assessment of the area. Information on local capacities (community and government) has to be collected to be combined with hazard and vulnerability to provide a picture of level of risk of the area and community toward potential/future disaster. Experts' input is necessary to the process of the general risk assessment. Participatory risk assessment is developed as part of the process. Participatory method is used when dealing with the community in order to develop collaboration among community members in selecting, designing and implementing community action plan (**Fig. 3**).

Facilitating the organizing of the local community is a crucial process. It is expected that at the end of this facilitation, a local committee on disaster reduction is formed. This committee will take the role in leading the local community in the process of developing a community action plan in disaster reduction. In the implementation, the community is the one who will claim ownerships over the process that is worked out in the area and take initiative lead to innovation among community members. As the process should also enhance the networking capacity of the community, we need also to involve the local government in the process to become the partner of the community in reducing disaster risk in the area. Conducting workshops where local government and community representatives sit together to discuss their role in disaster reduction is also used in this process as a means to foster collaboration between them (**Fig. 4**). Implementation of community actions is often in the form of a collective community work (**Fig. 5**).

Fig. 3 Dissemination of disaster knowledge and participatory process in community hazard and vulnerability assessment

Fig. 4 Workshops on CBDRR for local community Disaster Committee, Local authority, NGOs

Fig. 5 Community members working together in reducing village flood risk as part of action plan implementation

17. Strength and limitations

The CBDRR process empower the community to develop their own disaster coping mechanism, enhanced with outside technical input and strengthened with the development of their networks to ensure the sustainability of the process. The community becomes less dependent to government action and resources. However, the community will not be able to sustain their actions if they cannot mobilize their own resources and cannot also solicit support from potential funding agencies. However, it is important to ensure that the community can realize their own strength and weakness, and that the process does not create a more dependent community toward outside support.

18. Lessons learned through implementation if any

Good communication and strong coordination is the key to the success of this venture. Experience shows that it will be much easier to work with community in pre-disaster situation, provided that risk awareness can be developed during the process. Working in a post-disaster situation will be more difficult, especially if the relief stage is still a major enterprise and the social tissue is seriously affected by the disaster. Situation will be more difficult when there are many organizations working in relief stage distributing aid gifts, which create an atmosphere of dependence within the community. Building community preparedness in this situation will require a lot of efforts.

VI. Resources required

19. Facilities and equipments required

To support the activities in the fields, local facilitators are needed. They need to be supported by some basic tools such as maps, measuring tools, discussion facilitating tools such as meta-plan, simple awareness materials etc. In some stages, expert input will also be needed for enhancing the process. Local transportation means is needed by facilitator for accessing different places in the process. Some communication equipment will also be useful in the facilitation process. The local community committee will need a place which will function as a disaster information center as well as disaster committee's office. It may also cover the necessity for enhancing the preparedness system such as contingency planning, stockpiling (food, float, boat, etc) and early warning system at community level.

20. Costs, organization, manpower, etc.

Budget is required for operational cost such as facilitators' cost and efforts for expert input, transportation and communication costs, office facilities and expenses for organizing meeting events and dissemination materials. Experts in multi hazard phenomena as well as in community based approach are needed to support the process. Training specialist support is needed for organizing various trainings, which are needed for forming the facilitators as well as to provide trainings to local government officials and community leaders. Both of them can come from individuals, universities and NGOs. Trainings on emergency preparedness and response such as earthquake and tsunami drills at village level, first aid, emergency sheltering etc. can be conducted by involving other organizations such as Red Cross, Fire Brigade, SAR Unit, Health Department, local government Disaster Management Unit. The process can be implemented by various organizations with adequate capacity to implement CBDRR. Action oriented research institutions can develop and implement methodology for effective and sustainable CBDRR programs. Much respected religious-based organizations can play an important role in the implementation of the process. With the respect they already obtained from the community, the strong network of informal religious leaders deployed within it and the regular communication with their members through regular religious practices, they are well positioned to implement successful CBDRR programs. Technical support to these organizations can be obtained from technical organizations such as the research and development/academic institutions already armed with best practices and tools. This collaboration can enhance the development of CBDRR knowledge through constant exchange of knowledge and experience, between field works and research and development activities.

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
Developing Community Based Disaster Risk Reduction in Aceh Province and West Sumatra Province

E1-2. Place
5 villages in 3 Districts (West Aceh, Aceh Jaya and Nagan Raya) in Aceh Province and 1 City in West Sumatra (Pariaman) Indonesia

E1-3. Year
2006 to 2007

E1-4. Investor

UNDP

E1-5. People involved
The people from the local community.
Researchers from CDM ITB : Dr. Krishna S. Pribadi (Project manager and Disaster Management Expert); Dr. Teti Argo (Community Based Disaster Management Expert); Mr. Soleh Hadisutisna (Community Based expert); Dr. I Wayan Sengara (Geotechnical/Earthquake Hazard Expert); Dr. Hamzah Latief (Tsunami Hazard Expert); Dr. Soebagiyo Soekarnen (Flood Hazard Expert);; Dr. Dyah Kusumastuti (Non-engineered Structure Expert); Ir. Engkon Kertapati (Geology Hazard Expert);

E1-6. Monetary costs incurred
The project's cost is approximately USD 400,000, funded by UNDP, for all activities in 3 districts in Aceh Province and 1 City in West Sumatra province, such as general risk assessment, training for local facilitator, workshop on disaster management, training on how to build a simple earthquake resistant building, implementation of Community Action Plans, National workshop on Lesson Learnt, Developing Recommended Framework for implementing CBDRR and some other training and drills related to disaster.

E1-7. Total workload required
The project duration is 16 months, involving all the above experts on a non-continuous involvement basis. Full time Project Manager, Project Coordinators, Project Management staffs and full time facilitators are required for the whole process.

E1-8. Evidence of positive result
In five villages where CBDRR programs were implemented, local committees for disaster reduction have been established and they had developed community action plans, some of them have been implemented. The City of Pariaman has allocated its own budget to replicate the program in two other villages, involving the first pilot-project community as resource persons.

No.2

E2-1. Project name if available

E2-2. Place

E2-3. Year

E2-4. Investor

E2-5. People involved

E2-6. Monetary costs incurred

E2-7. Total workload required
Full time work with total duration of 26 months

E2-8. Evidence of positive result

X. Other related parallel initiatives if any

Technical support in capacity building of Nahdlatul Ulama and Muhammadiyah disaster risk management program, a program implemented by CDM-ITB to provide technical support for two large religious-based organizations, funded by AusAid (Australian government development fund), in developing the capacity for conducting community based disaster risk reduction at the pesantren (Moslem boarding school) communities and Islamic school children and Moslem youth organizations, implemented in Sumatera (Padang and Rejang Lebong districts), West Java (Garut district), Jakarta, Central Java (Magelang and Bantul districts), and East Java (Jember district)

XI. Remarks for version upgrade

A version upgrade of the CBDRR implementation framework will be available at the end of the UNDP CBDRR Pilot-Project (September 2007).

Attached files:
> CBDRR framework.jpg (JPG - 166 Kb)
> 7_PT2_P.pdf (PDF - 394 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 29)

I. Heading

1. Title

Indigenous Knowledge for Water Management and Drought Mitigation in India

ID:	DRH 29
Hazard:	Heat wave, Drought, Desertification
Category:	Process Technology (PT), Transferable indigenous knowledge (TIK)
Proposer:	Prof. Vinod K. Sharma
Country:	INDIA;
Date posted:	17 March 2008
Date published:	15 June 2009

Rajasthan, India.

Contact
Dr. Vinod K. Sharma
Professor of Disaster Management and Environment,
Indian Institute of Public Administration, India
profvinod@gmail.com
IIPA, I.P. Estate, New Delhi -110002, India

2. Major significance / Summary

Water harvesting and equitable distribution of water are two major approaches that have proved successful in the mitigation of droughts in traditional societies in the region. The water harvesting technologies are low cost, use local materials and labour, are time tested and are based on simple and easy to understand people's science. The concept of equitable distribution of water is a process technology with its roots in local resource governance, under which local people's councils govern how scarce resources will be distributed within the society.

3. Keywords

Equitable distribution, resource management, participation, low-cost, local skills

II. Categories

4. Focus of this information

Process Technology (PT), Transferable indigenous knowledge (TIK)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, NGO/NPO project managers and staff, Experts, Teachers and educators, Architects and engineers, Rural planners, Environmental/Ecological specialists
5-2. Other users: Policy makers, Motivated researchers

6. Hazards focused

Heat wave, Drought, Desertification

7. Elements at risk

Human lives, Rural areas, Agricultural lands

III. Contact Information

8. Proposer(s) information (Writer of this template)

Dr. Vinod K. Sharma
Professor of Disaster Management and Environment,
Indian Institute of Public Administration, India
profvinod@gmail.com
IIPA, I.P. Estate, New Delhi -110002, India

9. Place where the technology/knowledge originated

INDIA;

10. Names and institutions of technology/knowledge developers

Local Communities / Developed Traditionally

11. Title of relevant projects if any

Global Open Learning for Risk Education/ Certificate Course on Disaster Management for Field Practitioners.

12. References and publications

13. Note on ownership if any

No ownership. People's knowledge.

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

The Thar Desert region, mostly lying in the East Indian state of Rajasthan, is an arid region and has always had scanty rainfall. It has therefore been a traditional practice since ancient times to harvest rainwater and use it as judiciously as possible. Now, with modern dams providing water to the region through canals and piped water systems, the use of such traditional technologies is going down. However, whenever there is a severe drought, the modern systems fail and the people are hard pressed for water for survival.

In such a modern drought situation, the process technology of equitable distribution of water was evolved in recent years. This process is based on determining per capita use of water and then fulfilling this need.

V. Description

15. Feature and attribute

There are two primary features:

1. Harvesting of rainwater so that no water that drops in a watershed area is allowed to leave the area through surface run-off. Harvested water is either captured on the surface in tanks for purification and direct use, or else it is allowed to percolate in the ground for recharging the sub-surface water source.
2. Formation of community council to determine the basis for sharing the available amount of common water resource. This council ensures that distribution is based on individual needs and not on the basis of wealth or land holding.

16. Necessary process to implement

There process includes the following stages:

1. Agreement on availability of land for the rainwater harvesting installations
2. Construction of water harvesting installations through use of local materials, low cost technologies, and voluntary labour
3. Water purification systems, and storage system for direct use purpose, and infiltration system for ground water recharge
4. Formation of a local council for determining the principles and systems of water distribution.

17. Strength and limitations

Strength: The process as well at the technology has been successful for generations due to their simplicity. They are simple to understand and replicate, are low cost, have no harmful side effects, and are totally people centric.

Limitation: Being people centric, these processes are time and labour intensive, and cannot compete with modern technology in terms of throughput. Therefore they are losing out.

18. Lessons learned through implementation if any

The main lesson learnt has been that people have stopped looking at these solutions since they are so attracted with modern technology. Even after the modern technology has very bad impact on the local environment, people forget to turn back and look at their traditional systems. SEEDS implemented a project in the dry region of Gujarat State in India, where water harvesting systems were revived, and people received them very well. The need has now come to sell people's technology back to the people, since they have forgotten about what they have!

VI. Resources required

19. Facilities and equipments required

The requirements for the intervention are very low, and include:

1. Locally appropriate, culturally acceptable and technically reliable (time-tested or technically verified) technology for water harvesting, purification, storage and recharge.
2. Commitment within community to make available the land, materials and labour for the intervention
3. Commitment and respect of the local council for deciding water governance principles that will be respected and followed by everyone in the community

20. Costs, organization, manpower, etc.

Requirement of resources varies, based on scale and type of water use (direct use or ground water recharge). On a broad level, it is as follows:

1. Land parcel – either sourced from a common pool (belonging to the village council), or else donated by owner of the identified land, or else purchased from the owner through a common money pool
2. Materials for the construction – mostly sourced from the local area (items like timber, stones, mud), and some materials purchased from common money pool of the community based organization or village council
3. Labour for construction and maintenance – voluntarily contributed by community members

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

This is indigenous knowledge, but besides being verified historically, it has been tested in a number of cases across the Indian sub-continent, and found to be very successful. Organizations such as Tarun Bharat Sangh, SEVA, SEEDS, Dasholi Gram Swaraj Mandal and many others are examples.

IX. Application examples

No.1

E1-1. Project name if available
Rain Water Harvesting Check Dams
Check dam in Alwar District creates a water source for villagers to survive on during dry months. Photo: www.boloji.com/environment

E1-2. Place
Rajasthan, India

Check dam in Alwar District creates a water source for villagers to survive on during dry months.
Photo: www.boloji.com/environment

E1-3. Year
1985-2000

E1-4. Investor
Tarun Bharat Sangh (Local NGO)

E1-5. People involved
Rajendra Singh

E1-6. Monetary costs incurred
In 1994, TBS undertook a project in village Neembi, which comprised construction of two check dams, repair of an old dam, and construction of a structure perpendicular to the old dam. The total cost of the project was Rs. 500,000. There are many other activities with varying costs.

E1-7. Total workload required
A typical check dam construction may take a month of contributed labour. This may be voluntary or in times of difficulty, based on cash or food for work programmes.

E1-8. Evidence of positive result
There is documented evidence of increased water supply during summer months, and of improved agricultural output from the same parcels of land.

No.2

E2-1. Project name if available
Traditional Structures for Rain Water Harvesting

E2-2. Place
Rajasthan, India

Traditional step well, Delwara. Picture: SEEDS

E2-3. Year
Ancient

E2-4. Investor
Local kings, communities

E2-5. People involved
Entirely driven by local communities

E2-6. Monetary costs incurred
Sometimes voluntary contributions Mostly contributed by the rulers in the form of cash or food for work programmes under drought relief schemes.

E2-7. Total workload required
These could be long term architectural projects employing local villagers as labour during years of drought when crops failed.

E2-8. Evidence of positive result
Many of such structures can still be found dotted across the desert region of India, and are functional even today. There is documented as well as ground evidence of the availability of water during dry months because of these structures.

No.3

E3-1. Project name if available
Pani Panchayat (local water governance council)

E3-2. Place
Village Mahur, Madhya Pradesh, India

One of the irrigation tanks at Mahur, constructed by the Pani Panchayat. Photo: TERI

Jal Biradari (water community) meeting in progress in Naukhada (Rajasthan).
Photo: rainwaterharvesting.org.

E3-3. Year
1972 -

E3-4. Investor
Gram Gaurav Pratishthan (local NGO)

E3-5. People involved
Vilasrao Salunkhe

E3-6. Monetary costs incurred
In 1982, a project in Mahur village was undertaken that involved the building of three lift irrigation schemes. The total project cost was Rs. 300,000. The total cost of the project was borne by the GGP, the government and the villagers themselves, the ratio being 40 % - 20 % respectively. Forty percent was a state government subsidy under a lift irrigation scheme (which does not exist anymore). Forty

percent was given by the GGP as an interest-free loan, to be repaid over five years. The remaining 20 percent was contributed by the villagers in cash. There are many other activities with varying costs.

E3-7. Total workload required
The process has two components – one is the construction of lift irrigation structures that can take a few months, but the second and more important component is the process of forming people's committees that take decisions for equitable distribution of water. Water is distributed to families based on the number of people, and not on the size of land holding or wealth.

E3-8. Evidence of positive result
There is documented evidence of a manifold increase in yield from the agricultural activities. There is also evidence of a shift from dry land farming to cash crops including horticulture, which yielded much higher income for the people.

X. Other related parallel initiatives if any

A number of organizations are promoting similar approaches of water conservation and governance across the drought prone areas of India. Some of these are:
1. Tarun Bharat Sangh (www.tarunbharatsangh.org)
2. SEVA (www.sewa.org)
3. SEEDS (www.seedsindia.org)

XI. Remarks for version upgrade

The upgraded version is clearer and easier to understand and follow.

Attached files:

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 33)

I. Heading

1. Title

Numerical Model for Tsunami Inundation and Making Tsunami Hazard Map

ID:	DRH 33
Hazard:	Tsunami
Category:	Implementation Oriented Technology (IOT)
Proposer:	Fumihiko Imamura
Country:	JAPAN;
Date posted:	27 March 2008
Date published:	14 January 2009

Tsunami generation and propagation by the simulation.

Contact
Fumihiko Imamura
Prof. of Tsunami Engineering, Disaster Control Research Center, Tohoku University
6-6-11 Aoba, Sendai 980-8579, Japan
Imamura@tsunami2.civil.tohoku.ac.jp
+81-22-795-7513

2. Major significance / Summary

Technology to simulate a tsunami inundation by TUNAMI-model providing the numerical code with the manual and to support making hazard map at each region for tsunami mitigation plan

3. Keywords

Tsunami simulation, inundation, hazard map

II. Categories

4. Focus of this information

Implementation Oriented Technology (IOT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Municipalities, Teachers and educators, Information technology specialists, Urban planners
5-2. Other users: Policy makers

6. Hazards focused

Tsunami

7. Elements at risk

Human lives, Human networks in local communities, Business and livelihoods, Infrastructure, Buildings, Urban areas, Rural areas, Coastal areas, River banks and fluvial basin, Agricultural lands

III. Contact Information

8. Proposer(s) information (Writer of this template)

Fumihiko Imamura
Prof. of Tsunami Engineering, Disaster Control Research Center, Tohoku University
6-6-11 Aoba, Sendai 980-8579, Japan
Imamura@tsunami2.civil.tohoku.ac.jp
+81-22-795-7513

9. Place where the technology/knowledge originated

JAPAN;

10. Names and institutions of technology/knowledge developers

Tsunami Engineering, Disaster Control Research Center, Tohoku University

11. Title of relevant projects if any

TIME (Tsunami Inundation Modeling Exchange) Project

12. References and publications

IOC/UNESCO MANURAL and GUIDES 35 "Numerical method of Tsunami Simulation with the Leap-frog Scheme", 1997,

http://ioc3.unesco.org/indotsunami/documents/6-2_imamura.pdf

Imamura, F: Tsunami counter-measures in Japan; could people evacuate after receiving a warning ?, Marine Habitats, KNOW RISK, International Strategy for Disaster Reduction, United Nation, Tutor Rose Pub., pp.222-223, 2005.

http://www.tsunami.civil.tohoku.ac.jp/hokusai3/J/projects/manual-ver-3.1.pdf

Imamura, F., K. Goto, S. Ohkubo, A numerical model for the transport of a boulder by tsunami. Journal of Geophysical Research, Ocean, Vol.113,C01008,doi:10,1029/2007JC004170, 2008

Abe, I., K. Goto, F. Imamura, K. Shimizu, 2007, Numerical simulation of the tsunami generated by the 2007 Noto Hanto earthquake and implications for unusual tidal surges observed in Toyama Bay. Earth, Planets and Space. Vol.60, pp.133-138, 2008

Maeno, F., and F. Imamura, Numerical investigations of tsunamis generated by pyroclastic flows from the Kikai caldera, Japan, Geophys.Res. Lett., 34, L23303, doi:10.1029/2007GL031222, 2007

Imamura, F., S. Koshimura, K.Goto, H. Yanagisawa and Y. Iwabuchi, Global disaster: The 2004 Indian ocean tsunami, Journal of Disaster Research, Vol.1.No.1, pp.131-135, 2006

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

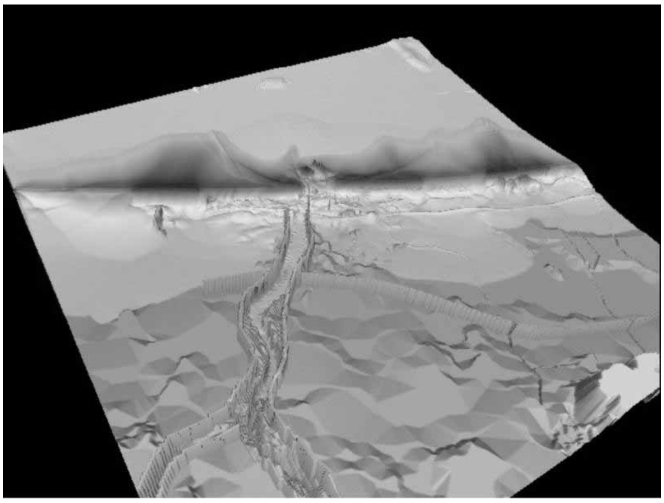
The TIME (Tsunami Inundation Modeling Exchange) started in 1991 is a joint project of IUGG and IOC/UNESCO in IDNDR. The Tsunami Engineering Laboratory, Disaster Control Research Center (DCRC) of Tohoku University, has been acting as the center of TIME, to transfer its technique of the tsunami numerical simulation to the countries which suffered or will suffer tsunami damages.

V. Description

15. Feature and attribute

The estimation and/or prediction of the tsunami inundation in each area is indispensable in order to make a plan for countermeasure against the tsunami disaster which has the possibility of the occurrence in the future and dealing in the area in the past. Since various numerical value models were proposed we selected the most expensive practical use and expensive including the reliability. And the preparation of the manual which is easy to use and the training was made.

Tsunami generation and propagation by the simulation. The snap shot is the propagation of the 1896 Meiji Sanriku Tsunami 10 minutes after the earthquake. The tsunami is one of the worst tsunami in the past, causing more than 22,000 death and recorded 38 meter of runup height.



Tsunami runup simulation. The tsunami front reaches the land and runup into the area. One of your advantage on the numerical simulation is stability on the wave front on the land and high accuracy of the inundation.

Community based hazard map as example. The map was made by the collaboration with Tohoku University, Higashi-matsushima city and Pacific consultant. The map provides not only the inundation area but also safety area and its direction.

16. Necessary process to implement

The computer facility to carry out the simulation by using TUNAMI, Fortran numerical code is necessary. Input data are digital bathymetry data, fault parameters. The digital data of bathymetry and topography to cover the target area should be ready to use. Maps and information at the target area will be able to be used to make the digital data.

17. Strength and limitations

In order to carry out the numerical simulation, the background and knowledge of wave/ fluid dynamics and FORTRAN is required.

18. Lessons learned through implementation if any

Technological transfer of the simulation was carried out in the 13 organization in 11 countries. And four young member research workers were invited in Tohoku university for the training and joint research on the tsunami mitigation. Report activities in ITSU (International Co-ordination Group for the Tsunami Warning System in the Pacific) gives the gratitude for the TIME –project every times. A manual is published as the 35th publication of IOC/UNESCO and it is being distributed. The argument of the report of the execution and the examination is made in the Tsunami subcommittee in IUGG (International Union of Geodesy and Geophysics).

VI. Resources required

19. Facilities and equipments required

20. Costs, organization, manpower, etc.

Free for non-profit purpose to transfer the code

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that is shown to be effective based on case studies/experiments in field sites.

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
TIME (Tsunami Inundation Modeling Exchange)

E1-2. Place
No. of institutes/university and countries to be transferred the code and manual is 39 and 21.The TIME (Tsunami Inundation Modeling Exchange) started in 1991 as a joint effort of IUGG and IOC/UNESCO during IDNDR. The Disaster Control Research Center (DCRC), Tohoku University, Japan has been acting as the center of TIME, to transfer numerical technique of tsunami simulation to the countries which suffered or will suffer tsunami hazards.

E1-3. Year
1995-2005

E1-4. Investor
Profs. Nobuo Shuto, Fumihiko Imamura and Dr. Shunichi Koshimura

E1-5. People involved

E1-6. Monetary costs incurred

E1-7. Total workload required
Name: Modesto Ortiz, researcher. Institute: Centro de Investigacion Cientifica y de Educacion Superior de Ensenada. Country: Mexico. Period: From May to November, 1993. Name: Gegar Sapta Prasetya, researcher. Institute: Coastal Engineering Laboratory,

LPTP-BPP Teknologi. Country: Indonesia. Period: From 15 October, 1995 to 25 November, 1995.Name: Nur, Adi Kristanto, researcher. Institute: Marine Geology Institute. Country: Indonesia. Period: From 2 October, 1996 to 31 March, 1997.

E1-8. Evidence of positive result
Several types of tsunami hazard maps have been made in the target area

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:
> Imamura_et_al_(2008)_JGR.pdf (PDF - 1045 Kb)
> EPS2184NT_typeset.pdf (PDF - 1008 Kb)
> 2007GL031222.pdf (PDF - 314 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

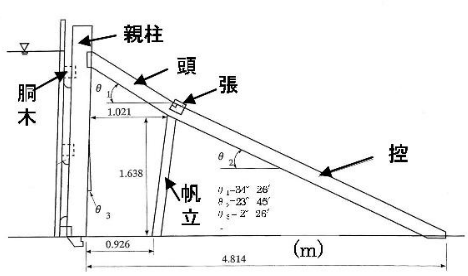
DRH-Asia Contents (DRH 36)

I. Heading

1. Title

Traditional Construction Method: the Saihiro Itabame Panel Dam

ID:	DRH 36
Hazard:	Flood
Category:	Transferable indigenous knowledge (TIK)
Proposer:	Masahiro GOTO
Country:	JAPAN/Ibaraki
Date posted:	03 April 2008
Date published:	09 June 2009



Sectional view of Itabame weir.

Contact
Goto Masahiro
Department of Rural Technologies, Research Team for Urban-Rural Interchange
griese@affrc.go.jp
TEL +81-29-838-7558

2. Major significance / Summary

The Saihiro Itabame Panel Dam is a wood frame weir 61 m wide and 2.3 m high built on the Yoro River in Chiba Prefecture to supply irrigation water. It combines 4 members: Oyabashira, Kashira, Hikae, Hotate, and scallops linked transversely by Hari. Its upstream surface is waterproofed by Uwaita, Shitaita, Makura and Dohgi. When the water rises, the stiffeners at both ends are removed to instantly overturn the dam, allowing the water stored upstream to discharge safely. This is a traditional technology incorporating our ancestors' wisdom and ingenuity.

3. Keywords

Panel dam, wood frame weir, traditional technology, supplying irrigation water, weir opening

II. Categories

4. Focus of this information

Transferable indigenous knowledge (TIK)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers
5-2. Other users:

6. Hazards focused

Flood

7. Elements at risk

Human lives, Rural areas

III. Contact Information

8. Proposer(s) information (Writer of this template)

Goto Masahiro
Department of Rural Technologies, Research Team for Urban-Rural Interchange
griese@affrc.go.jp
TEL +81-29-838-7558

9. Place where the technology/knowledge originated

JAPAN/Ibaraki
National Institute for Rural Engineering

10. Names and institutions of technology/knowledge developers

National Institute for Rural Engineering

11. Title of relevant projects if any

12. References and publications

Technical Report of the National Institute for Rural Engineering No. 204

13. Note on ownership if any

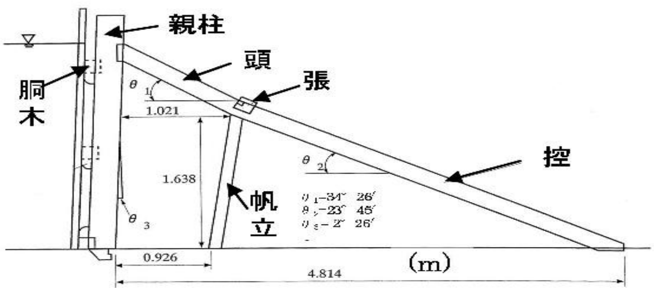
IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

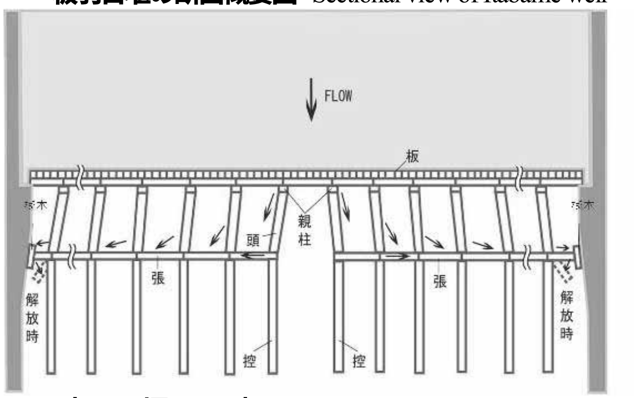
It is a facility for taking water from a river, but equipped with a mechanism for safely discharging stored water during flooding, it is sure to be used in regions where flooding and droughts occur.

V. Description

15. Feature and attribute



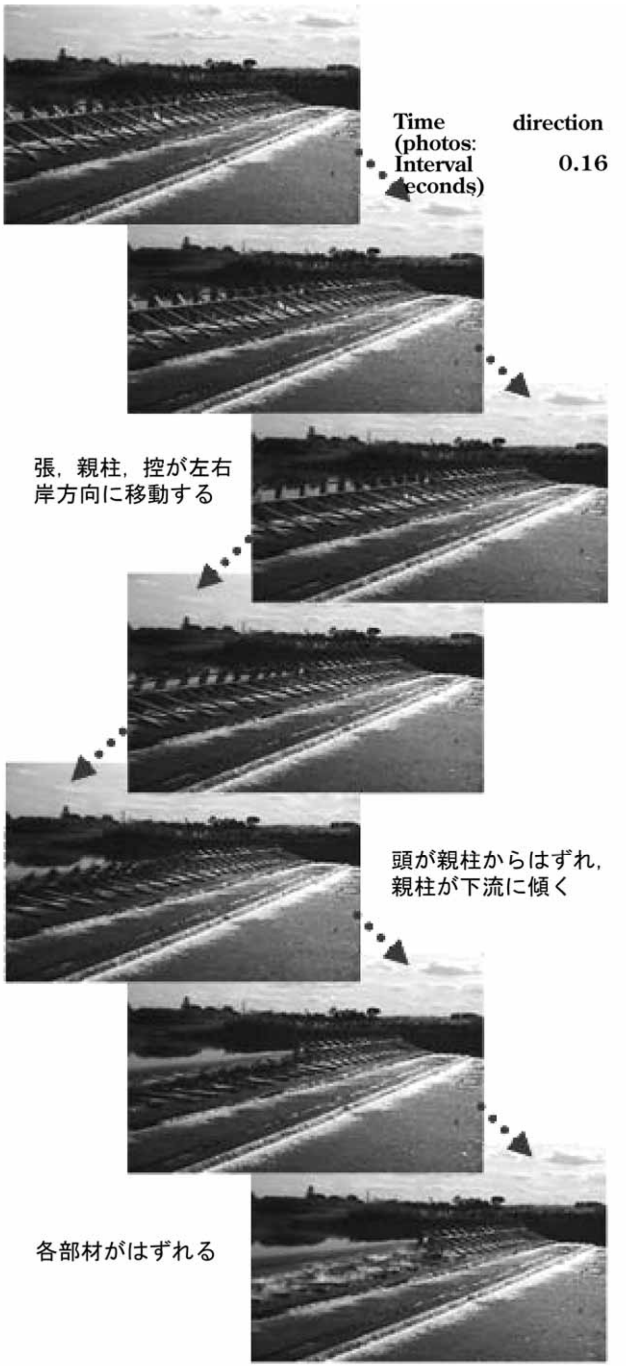
板羽目堰の断面概要図 Sectional view of Itabame weir



板羽目堰の平面概要図 Plane view of Itabame weir

胴木 = Dohgi
親柱 = Oyabashira
頭 = kashira
張 = hari
控 = hikae
帆立 = hotate

16. Necessary process to implement



張, 親柱, 控が左右岸方向に移動する Hari, Oyabashira, Hikae are moved to left - right bank direction
頭が親柱からはずれ、親柱が下流に傾く Kashira are shifted from newels so Oyabashira are inclined downstream
各部材がはずれる Members are shifted out of position

17. Strength and limitations

18. Lessons learned through implementation if any
It is a traditional technology, so technology is needed to make the wooden members.

VI. Resources required

19. Facilities and equipments required
Its members are made of wood so a nearby forest is needed. And because it is submerged, the wood must be very water resistant. To build a wooden frame weir on a river or canal, concrete work is needed as foundation work in order to install the wooden members on the riverbed.

20. Costs, organization, manpower, etc.
Precision woodworking is needed, but it is possible to make a duplicate of the Saihiro Itabame Panel Dam. It would cost several million yen.

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?
It is a technology/knowledge that has fair applicability demonstrated by implementation in one or more field sites.

23. Notes on the applicability if any
PR for traditional technology

IX. Application examples

No.1
E1-1. Project name if available

E1-2. Place
JAPAN/Chiba prefecture

E1-3. Year

E1-4. Investor
government

E1-5. People involved

E1-6. Monetary costs incurred

E1-7. Total workload required

E1-8. Evidence of positive result

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

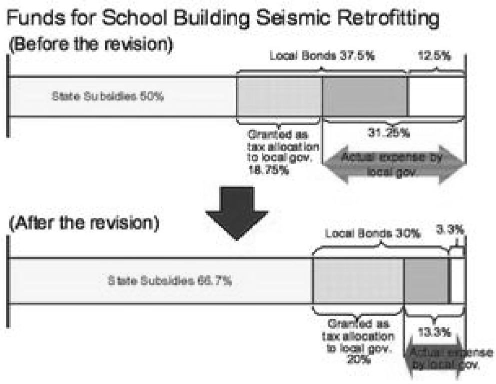
DRH-Asia Contents (DRH 38)

I. Heading

1. Title

Promoting Earthquake Resistant School Buildings in Japan- Policies, National Subsidies and Prioritization of Vulnerable School Buildings -

ID:	DRH 38
Hazard:	Earthquake
Category:	Process Technology (PT)
Proposer:	MEXT Shisetsu Bousai
Country:	JAPAN;
Date posted:	19 May 2008
Date published:	02 January 2009



Funds for School Building Seismic Retrofitting.

Contact
FUJII, Takashi
Director,
Office for Disaster Prevention, Department of Facility Planning and Administration,
Ministry of Education, Culture, Sports, Science and Technology, Japan (MEXT)
3-2-2 Kasumigaseki, Chiyoda-ku, Tokyo Zip 100-8959
Tel: +81-3-6734-3036
Fax: +81-3-6734-3689
Email: bousai@mext.go.jp

2. Major significance / Summary

Making schools safe against earthquakes is a crucial issue in Japan because earthquake can occur anywhere in the country. Ministry of Education, Culture, Sports, Science and Technology, Japan (MEXT), promotes making school buildings earthquake-resistant with the use of the national subsidy system and the "Guidelines for the Promotion of Earthquake-Resistant School Buildings" with which local municipalities can systematically prioritize and plan seismic retrofitting of school buildings.

3. Keywords

Earthquake resistant school buildings, seismic retrofitting

II. Categories

4. Focus of this information

Process Technology (PT)

5. Anticipated Users

5-1. Practitioners: Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.)
5-2. Other users: Policy makers

6. Hazards focused

Earthquake

7. Elements at risk
Human lives, Buildings

III. Contact Information

8. Proposer(s) information (Writer of this template)
FUJII, Takashi
Director,
Office for Disaster Prevention, Department of Facility Planning and Administration,
Ministry of Education, Culture, Sports, Science and Technology, Japan (MEXT)
3-2-2 Kasumigaseki, Chiyoda-ku, Tokyo Zip 100-8959
Tel: +81-3-6734-3036
Fax: +81-3-6734-3689
Email: bousai@mext.go.jp

9. Place where the technology/knowledge originated
JAPAN;

10. Names and institutions of technology/knowledge developers
Ministry of Education, Culture, Sports, Science and Technology, Japan (MEXT)

11. Title of relevant projects if any

12. References and publications

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice
In Japan, earthquakes can occur anywhere in the country. In 1981, the reinforced Earthquake-Proof codes of the Japanese Building Standard Law, known as the "New Earthquake-Proof Standards", were enacted. Since then, Ministry of Education, Culture, Sports, Science and Technology, Japan (MEXT), has been promoting to make school buildings built before 1981 earthquake resistant.

But when the Great Hanshin-Awaji disaster occurred in 1995, many school buildings built before the enforcement of the New Earthquake-Proof Standards received severe damages because they had not been reinforced for earthquake resistance.

Devastating damage

A collapsed column

Following the Great Hanshin-Awaji disaster, a new law to promote seismic rehabilitation was enacted by the Ministry of Construction and under this law, owners of publicly used buildings (including school buildings) have to make efforts to make buildings earthquake resistant.

Also, the Special Measures Law on Earthquake Disaster Prevention was passed for the purpose of preventing earthquake disasters through promoting research concerning earthquakes and establishing special financial support for earthquake countermeasures taken by local governments. With this law, the national subsidy rates for seismic reinforcement projects in public school buildings were raised from 1/3 to 1/2.

But despite these events, a survey carried out by MEXT in fiscal year 2002 showed that seismic diagnosis was carried out on only 30 percent of buildings built under the pre-1981 Earthquake-Proof Standards, and only about 45 percent of all public primary and junior high school buildings had earthquake resistance. Public school buildings had not been improved satisfactorily and there was a need to promote earthquake more strongly.

V. Description

15. Feature and attribute

Promoting Earthquake Resistance

The slow progress in the improvement of earthquake resistance in school buildings is due to two primary factors;

(1) Many municipalities possess many numbers of school buildings and making all the buildings earthquake resistant at once is difficult, due to financial straits and lack of manpower.

(2) There were no methods for forming earthquake resistance promotion plans including ways to assess the priority of improvement projects

Taking this situation into consideration, MEXT called together a council of experts in October 2003 to consider a way to promote earthquake resistance in the numerous school buildings under the jurisdiction of the local governments. The outcomes of the councils' discussions were submitted to MEXT in April 2003 in a report entitled "Promotion of Earthquake-Resistant School Buildings". In order to promote earthquake resistance, following 7 propositions were made in the report: (1) Develop a guideline for promotion of earthquake resistance based on the report (2) Raise awareness of the responsibility as establishers of schools to take action to make schools earthquake resistant. (3) Implement budgetary measures on both national and local level (4) Provide substantial information concerning the promotion of earthquake resistance in school facilities (5) Promote the development of reinforcement methods fit for use in school buildings (6) Further promote academic research on earthquake mechanism (7) Promptly take emergency restoration measures after earthquakes.

Guidelines for the Promotion of Earthquake-Resistant School Buildings

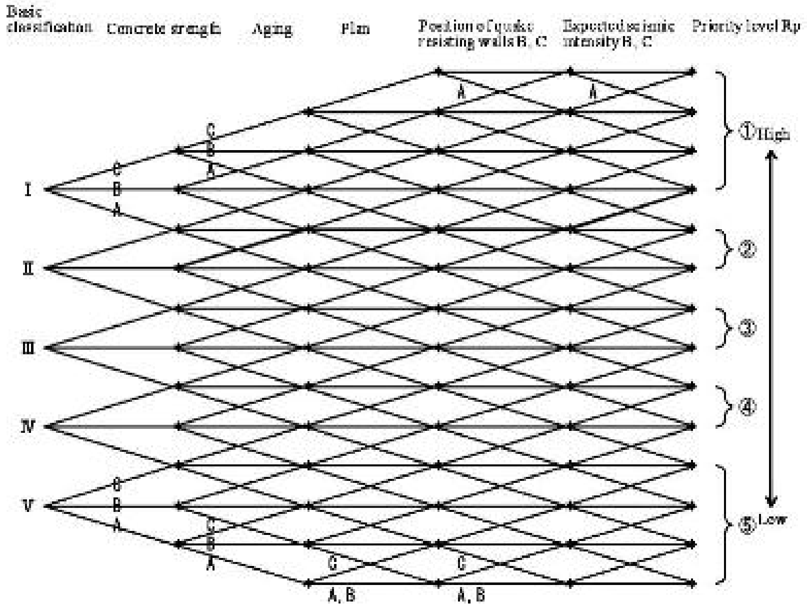
Following the proposition in the report, the "Guidelines for the Promotion of Earthquake-Resistant School Buildings" was drawn up by MEXT in July 2003.

In the "Guidelines for the Promotion of Earthquake-Resistant School Buildings", the basic approach to promoting earthquake-resistant school buildings is described.

The basic policy for promoting earthquake resistant school buildings are:

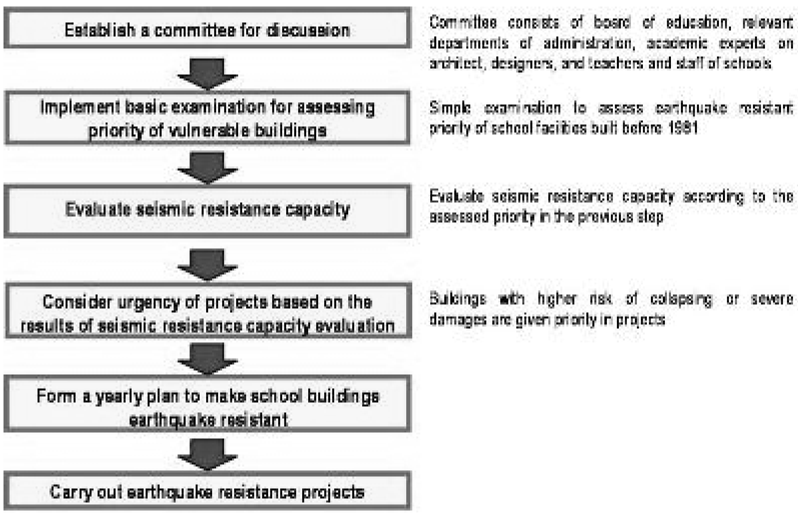
(1) Prioritize earthquake resistance measures for school facilities with high risk of collapsing or severe damages (2) Implement seismic resistance capacity evaluation, promptly (3) Form a plan for promoting earthquake resistance, promptly (4) Disclose results of seismic resistance capacity evaluation and plans for promoting earthquake resistance (5) Check and take measures for the earthquake resistance of non-structural elements.

Also, a systematic method for prioritizing vulnerable buildings is presented. This methods takes into account the school buildings' construction year as the basic classification factor and by using 5 correction items (concrete strength, aging, plan, position of earthquake resisting walls, expected seismic intensity), the priority level of a school building is ranked according to vulnerability; level 1 (high priority) through level 5 (low priority). Using this method, local governments and school establishers possessing numerous school buildings can determine which building needs priority in seismic diagnosis.



Assessment flowchart of priority by correction items

The guideline also displays how to evaluate the results of the school building's seismic diagnosis to determine the urgency of earthquake resistance projects, along with points to bear in mind when devising a plan for promoting seismic resistance in school buildings.



MEXT distributed the guidelines in May 2003 and urged municipal governments, which are responsible for school buildings, to promote school building retrofitting using the guidelines.

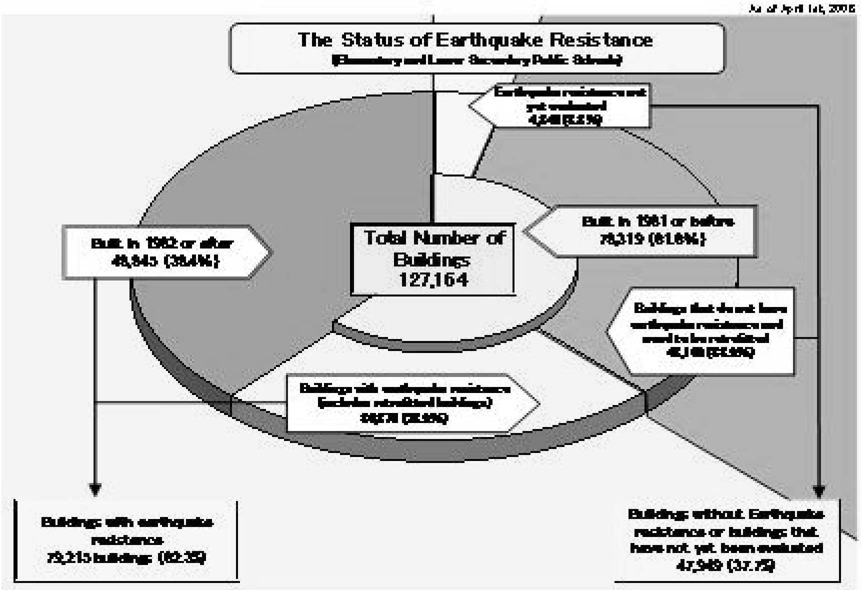
Budgetary Measures

In addition, MEXT prepared a budget of approximately 100 billion Japanese yen every year for the improvement of school buildings, emphasizing seismic retrofitting for municipal government buildings (115 billion Japanese yen in the 2008 fiscal year).

Impact

The following pie chart shows the result of the April 2008 MEXT survey on earthquake resistance situation of public primary and junior high school buildings in Japan.

As a result of the above mentioned measures, by 2008, seismic diagnosis was carried out on approximately 96 per cent of buildings built before 1981. Results also showed that of all public primary and junior high school buildings, about 62 per cent of existing school building now have earthquake resistance.

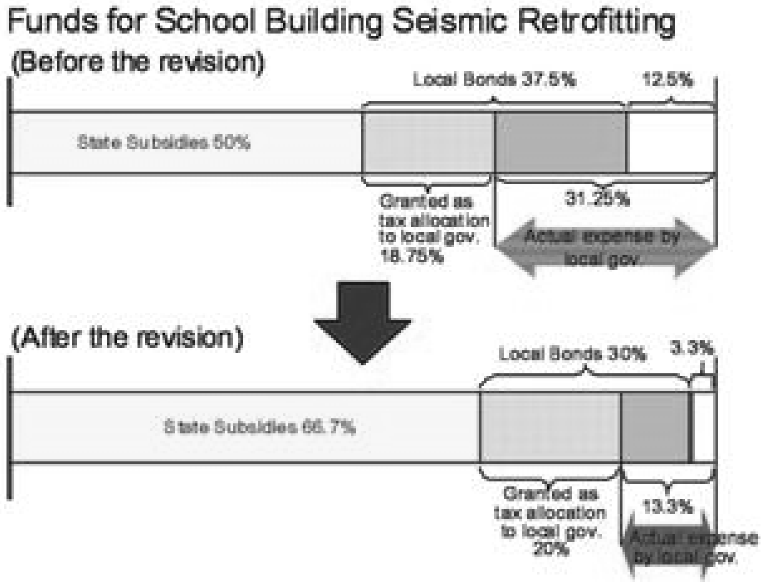


16. Necessary process to implement

Budgetary Measures

Because retrofitting school facilities is costly, budgetary measures is essential for progress. Not only securing enough budgets for subsidies, but other measures such as reforming the subsidy system for a more flexible use by the local municipality, have also been taken. But still, the progress of making schools earthquake resistant is not fast enough and MEXT is making further efforts. In December 2007, it was estimated that approximately 10,000 buildings were at high risk of collapsing in the event of a large scale earthquake and the Japanese government made a strong commitment to making these buildings earthquake resistant within the next 5 years (starting from year 2008) and called on local governments to carry out seismic retrofitting of these facilities. Since April 2008, MEXT has been carrying out a nationwide promotion tour.

In order to encourage local governments to accelerate seismic retrofitting, the national government revised the Special Measures Law on Earthquake Disaster Prevention, in June 2008. Under the revised law, the government expanded its fiscal measures by raising the portion of costs covered by its subsidies to local governments, for the purpose of making public elementary and lower secondary school buildings earthquake resistant. (This expansion of subsidies is applicable to the reinforcement and reconstruction of school buildings that are at high risk of collapsing in the event of a large scale earthquake.) With this revision, the actual expense that local governments share is lessened considerably.



Furthermore, the Minister of Education, Culture, Sports, Science, and Technology, together with the Minister of State for Disaster Management, and the Minister of Land, Infrastructure, Transport and Tourism are urging local governments to accelerate efforts to make school buildings earthquake resistant.

In August 2008, the Japanese Prime Minister decided the "Comprehensive Measure for Pursuing Life Security" in which states the accelerating of making school buildings earthquake resistant. In accordance with this policy, MEXT requested each municipality to accelerate its retrofitting of 10,000 vulnerable public school buildings to within four years, one year sooner than the initial five year time frame.

MEXT secured its source of funding for such operations from the supplementary budget for fiscal 2008. Adding with the primary budget, the national budget for improving public school buildings for the FY 2008 totals to approximately 330 billion yen.

Shifting from Rebuilding to Retrofitting

Up until recently, old school buildings (built 30 or more years ago) were rebuilt rather than be retrofitted and refurbished. However, considering the urgent task of securing seismic safety in the enormous number of school buildings with the limited budget, a change in the basic concepts for school building development was needed. A report commissioned by MEXT in March 2005 proposed shifting to retrofitting and refurbishing of school buildings, which is less costly and takes less time in construction compared to rebuilding, as a way to secure safety and fulfill the needs of the educational curriculum. MEXT has taken in the proposal and now promotes retrofitting and refurbishing school buildings unless there is a specific reason that prevents a building from being retrofitted, such as inefficient strength of concrete in a RC building.

Arousing Awareness

In Japan, municipal governments are responsible for public school buildings. Though the national government funds partial of the cost for retrofitting school buildings through grants, the rest of the costs must be budgeted by local municipalities. Therefore it is necessary to arouse awareness of the importance of seismic resistance in school buildings in order to promote them.

Disclosure of the rate of schools that have been evaluated for seismic resistance capacity and the rate of schools with seismic resistance helps arouse awareness in the community. Since 2006, MEXT began disclosing the results and ranks of the yearly survey of each municipality. This allowed the municipalities to see how high or low their results were compared to other municipalities. Some local governors were motivated to make more effort in seeing their status compared to neighboring municipalities.

MEXT has urged local governments to disclose the seismic resistance capacity evaluation results and plans for retrofitting of each school so that the local community will know and understand their schools status. In some municipalities, voices from the local community that aroused with the disclosure of such information have triggered local governors to make more effort in making their schools safe. Taking a step further, with the revision of the Special Measures Law on Earthquake Disaster Prevention, the Japanese government has made it compulsory for the local governments to evaluate the seismic capacity of school buildings and disclose the results.

Sufficient and Adequate Information

MEXT cooperating with architectural experts, conducted research and study of earthquake resistance for school facilities to establish seismic resistance capacity evaluation methods for school facilities, present methods for seismic retrofitting, and also compile examples of seismic retrofitted school facilities that municipalities can use as reference.

Also, MEXT established a consultation service where municipalities and school facility designers can seek technical advice.

17. Strength and limitations

Strength

The approach taken here emphasizes on prioritization and planning. The guideline emphasizes prioritization and urgency based on vulnerability assessment and also stresses the need to develop yearly plans for earthquake resistance projects which can be used to help in making administrative decisions. Combined with efficient budgetary measures, municipalities can make plans and take action in making schools safe against earthquakes, systematically.

Limitations

The actual implementation of seismic resistance measures in school buildings is the responsibility of the municipal governments; therefore, the progress of the promotion of earthquake resistance relies on the motivation and decisions of municipal governments. Though MEXT has taken measures to promote seismic safety of schools in all of Japan, due to the local financial and other situations, the progress varies largely between municipals.

18. Lessons learned through implementation if any

To promote earthquake resistance in school buildings, it is important to recognize the various factors the problem withholds in various levels. The measures introduced here is an approach taken on the national level.

However, to make it effective, consideration is needed towards the factors on the local level. Factors such as integration of schools in low population areas, methods for construction while using the building, educational needs of the local community, and other various local circumstances, combined and complicated, must be taken into consideration to produce material results. In the nation wide promotion tour, MEXT officials meet with the municipal government officials to promote and persuade local governments directly to take action. Meeting with local authorities has helped MEXT know the various situations the local municipalities face and in some cases, meeting face to face with local governors has helped in persuading municipalities to make more effort in making schools safe against earthquakes.

VI. Resources required

19. Facilities and equipments required

20. Costs, organization, manpower, etc.

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that Others
Method for promoting a policy.

23. Notes on the applicability if any

The approach and the concept of systematical prioritization may be applicable in other countries. However, the actual technology for prioritization may not be applicable in other countries because it is designed specifically for school buildings in Japan.

IX. Application examples

No.1

E1-1. Project name if available
Model Projects for Promoting the Forming of Earthquake Resistance Promotion Plans for School Facilities

E1-2. Place
In order to promote "Guidelines for the Promotion of Earthquake-Resistant School Buildings" and its concept, MEXT has aided several local municipalities throughout Japan through model projects to form earthquake resistance promotion plans for school facilities. Each year, 5 to 10 municipalities or school establishers were selected as model project participants. Each participant examined their school facilities and gave each school building priority ranks according to the method presented in the "Guidelines for the Promotion of Earthquake-Resistant School Buildings".
The resulting priority ranks of each school building will be used to form plans for retrofitting school buildings.

E1-3. Year
2003~2007

E1-4. Investor
MEXT

E1-5. People involved
Municipalities that participated in the Model Project for each year is as follows
2003 Toyonaka-city (Osaka Pref.), Tachikawa-city (Tokyo Pref.)
2004 Hokkaido Prefecture, Muroran-city (Hokkaido Pref.), Tomakomai-city (Hokkaido Pref.), Hachinohe-city (Aomori Pref.), Hitachinaka-city (Ibaraki Pref.)

2005 Otaru- city (Hokkaido Pref.), Kushiro- city (Hokkaido Pref.), Nanai- city (Hokkaido Pref.), Hitachi- city (Ibaraki Pref.), Akitakada- city (Hiroshima Pref.), Uki- city (Kumamoto Pref.), Minamiaso-village (Kumamoto Pref.), Sasebo- city (Nagasaki Pref.)

2006 Wakkanai- city (Hokkaido Pref.), Date- city (Hokkaido Pref.), Naka- city (Ibaraki Pref.), Ibaraki-town (Ibaraki Pref.), Shirosato-town (Ibaraki Pref.), Nara Prefecture, Zenntsuji- city (Kagawa Pref.), Nagasaki- city (Nagasaki Pref.), Shin-Kamigoto- city (Nagasaki Pref.), Amakusa- city (Kumamoto Pref.), Minamata- city (Kumamoto Pref.)
2007 Nanyo-city (Yamagata Pref.), Ikeda-city (Osaka Pref.), Tsushima-city (Nagasaki Pref.), Joso-city (Ibaraki Pref.)

E1-6. Monetary costs incurred
The total cost MEXT funded for model projects each fiscal year is as follows:

2003	approx.	18,200 thousand yen
2004	approx.	19,200 thousand yen
2005	approx.	64,200 thousand yen
2006	approx.	88,400 thousand yen
2007	approx.	22,800 thousand yen
total of 5 years	approx.	212,800 thousand yen

Costs of the model projects consist of costs for (1) setting up committee, (2) survey and evaluation of school buildings, (3) forming earthquake resistance promotion plans. The cost for each model project varies with each municipality.

E1-7. Total workload required
Each model project was carried out within each fiscal year.

E1-8. Evidence of positive result
The process and results of the model projects were collected into reports which MEXT distributed throughout Japan for other local authorities to use as reference.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:
> Public_fiscal_resources_breakdown.ppt (PPT - 59 Kb)
> PT38_2-3.jpg (JPG - 119 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

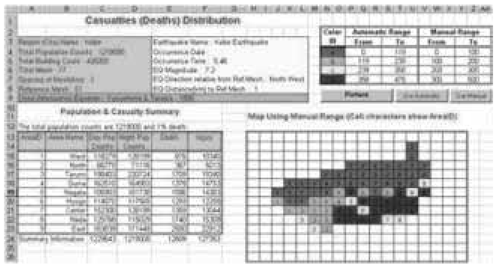
DRH-Asia Contents (DRH 39)

I. Heading

1. Title

RADIUS Program for Earthquake Damage Estimation

ID:	DRH 39
Hazard:	Earthquake
Category:	Implementation Oriented Technology (IOT)
Proposer:	Kenji Okazaki
Country:	Other; UN/IDNDR (United Nation/ International Decade for Natural Disaster Reduction)
Date posted:	09 June 2008
Date published:	09 September 2008



Casualty distribution.

Contact
Kenji Okazaki
Professor
National Graduate Institute for Policy Studies (GRIPS)
7-22-1 Roppongi, Minato-ku, Tokyo, 106-8677 Japan
Tel: 03-6439-6214 Fax: 03-6439-6010
Email: okazakik@grips.ac.jp

2. Major significance / Summary

This simplified computer program aims to present earthquake damage estimation of any cities, i.e. building damage and casualty in a manner that is easily understood by a wide range of users, even without engineering knowledge. This program aids users in understanding the seismic vulnerability of their own cities and learning how to reduce the possible damage and prepare for the probable earthquakes.

3. Keywords

Earthquake, Damage estimation, Cities

II. Categories

4. Focus of this information

Implementation Oriented Technology (IOT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, NGO/NPO project managers and staff, International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Commercial entrepreneurs, Financing and insurance business personnel, Experts

5-2. Other users: Policy makers, Motivated researchers, Local residents

6. Hazards focused

Earthquake

7. Elements at risk

Human lives, Infrastructure, Buildings, Urban areas

III. Contact Information

8. Proposer(s) information (Writer of this template)

Kenji Okazaki
Professor
National Graduate Institute for Policy Studies (GRIPS)
7-22-1 Roppongi, Minato-ku, Tokyo, 106-8677 Japan
Tel: 03-6439-6214 Fax: 03-6439-6010
Email: okazakik@grips.ac.jp

9. Place where the technology/knowledge originated

Other; UN/IDNDR (United Nation/ International Decade for Natural Disaster Reduction).

10. Names and institutions of technology/knowledge developers

Kenji Okazaki, UN Secretariat of International Decade for Natural Disaster Reduction (IDNDR)
Fumio Kaneko, Oyo Corporation

11. Title of relevant projects if any

RADIUS (Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters) Project

12. References and publications

Kenji Okazaki et al, "RADIUS - Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters" 2000, UN IDNDR Secretariat, Geneva

13. Note on ownership if any

This program is free software, maintained by Oyo Corporation.

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

Urban seismic risk is rapidly increasing, particularly in developing countries. In order for earthquake disaster reduction, it is essential for urban people to understand how their city is vulnerable and how severely the city would be damages by probable earthquakes. Although damage estimation is the first step for disaster risk management, only the experts and engineers were able to estimate disaster damage in the past. If the stakeholders for disaster reduction, e.g. policy makers, government engineers, NGO staff, community leaders and residents, could easily understand possible damage of their city, it would be quite useful for them to raise awareness, convince people to act against disasters, foster feeling of ownership of problems and actions, and develop policies and initiatives for earthquake disaster reduction. This program was developed as an educational and training tool to help the stakeholders understand the seismic vulnerability of their own cities and learn how to manage disaster risk.

V. Description

15. Feature and attribute

This simplified computer program is a practical tool to present earthquake damage estimation for cities. This program requires input of a simple data-set and provides visual results with user-friendly prompts and help functions. Minimum input data are population and building types by ward or district in a city and a scenario earthquake. Users can apply either a user defined earthquake or a historical earthquake such as Tangshan (1976, China), Kobe (1995, Japan), or Kocaeli (1999, Turkey) as a hypothetical scenario earthquake. Optional input data, if available, are ground types, and lifeline facilities. Outputs are seismic intensity (MMI), building damage, lifeline damage and casualties by ward, which are shown with tables and maps. GIS information is also applicable.

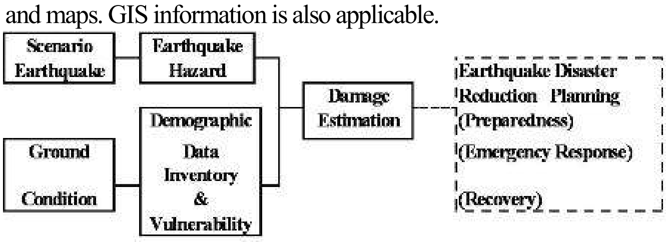


Fig. 1 Flow of damage estimation of the RADIUS program

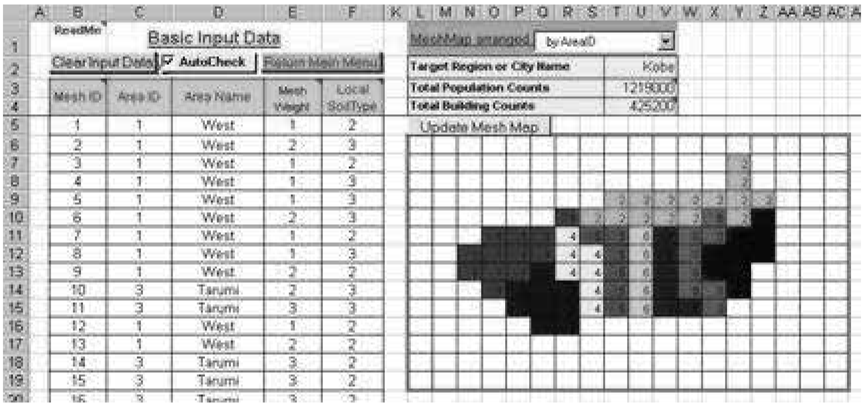


Fig. 2 Inputting demographic data and soil type

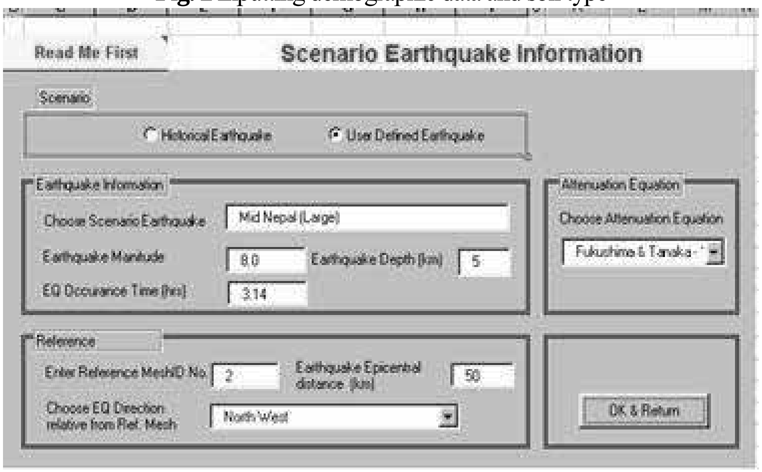
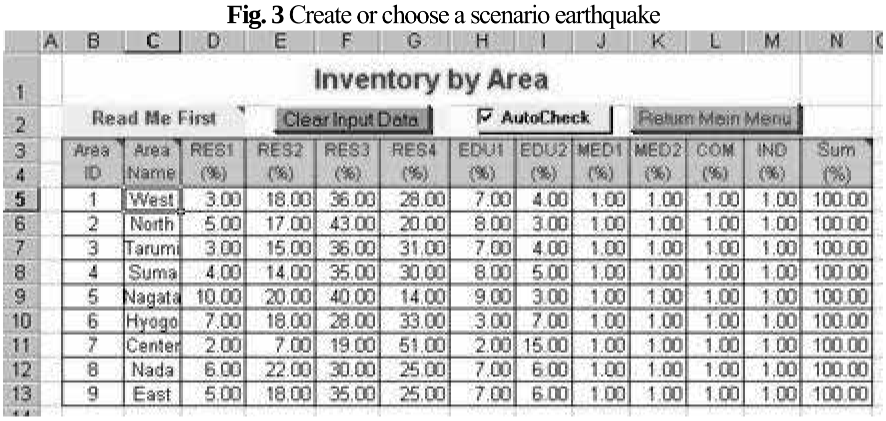


Fig. 3 Create or choose a scenario earthquake



Inventory by Area

Area ID	Area Name	RES1 (%)	RES2 (%)	RES3 (%)	RES4 (%)	EDU1 (%)	EDU2 (%)	MED1 (%)	MED2 (%)	COM (%)	IND (%)	Sum (%)
1	West	3.00	18.00	36.00	28.00	7.00	4.00	1.00	1.00	1.00	1.00	100.00
2	North	5.00	17.00	43.00	20.00	8.00	3.00	1.00	1.00	1.00	1.00	100.00
3	Tarumi	3.00	15.00	36.00	31.00	7.00	4.00	1.00	1.00	1.00	1.00	100.00
4	Suma	4.00	14.00	35.00	30.00	8.00	5.00	1.00	1.00	1.00	1.00	100.00
5	Nagata	10.00	20.00	40.00	14.00	9.00	3.00	1.00	1.00	1.00	1.00	100.00
6	Hyogo	7.00	18.00	28.00	33.00	3.00	7.00	1.00	1.00	1.00	1.00	100.00
7	Center	2.00	7.00	19.00	51.00	2.00	15.00	1.00	1.00	1.00	1.00	100.00
8	Nada	6.00	22.00	30.00	25.00	7.00	6.00	1.00	1.00	1.00	1.00	100.00
9	East	5.00	18.00	35.00	25.00	7.00	6.00	1.00	1.00	1.00	1.00	100.00

Fig. 4 Create the Building Inventory (by observation)

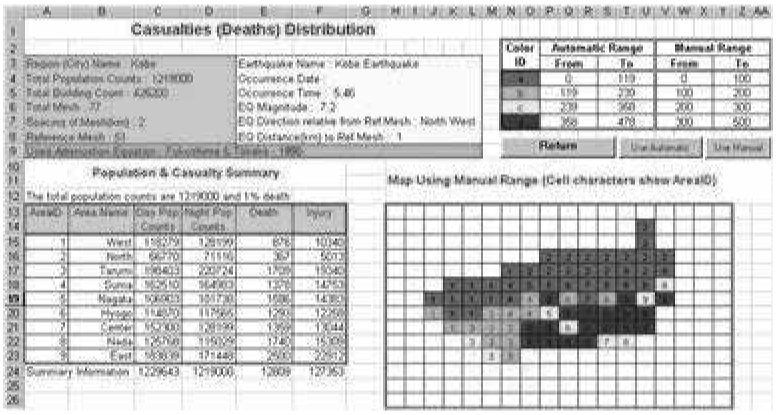


Fig. 5 Casualty distribution

16. Necessary process to implement

Collection of the basic data, i.e. total population and ward areas, building types distribution in every ward or district of a city. For buildings types, an inventory should be developed. Additional collection of data such as a scenario earthquake, ground types, and lifeline facilities will enhance the accuracy of the estimation. Please contact Prof. Kenji Okazaki (okazakik@grips.ac.jp) or Mr. Fumio Kaneko (kaneko@oyointer.com) to obtain the program

17. Strength and limitations

This program can be used by any interested people, i.e. policy makers, government engineers, NGO staff, community leaders and residents, to understand the seismic vulnerability of their own cities and learn how to reduce the possible damage and prepare for the probable earthquakes. It would greatly help local people to promote earthquake disaster reduction activities. On the other hand, the accuracy level of the results is limited, and the result should be regarded as a preliminary estimation.

18. Lessons learned through implementation if any

- This program is widely used in the world.
- It is good as an educational and training tool

VI. Resources required

19. Facilities and equipments required

PC with "Excel" program

20. Costs, organization, manpower, etc.

No cost, no manpower

VII. Message from the proposer if any

21. Message

This program should be used as an educational tool to understand the process of seismic damage estimation and how the seismic risk can be reduced at city level.

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

It can be applied to any city in the world as the first step for earthquake damage estimation

---

IX. Application examples

No.1

E1-1. Project name if available
RADIUS (Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters) Project

E1-2. Place
RADIUS pilot projects were carried out in the 9 cities, namely Addis Ababa (Ethiopia), Antofagasta (Chile), Bandung (Indonesia), Guayaquil (Ecuador), Izmir (Turkey), Skopje (TFYR Macedonia), Tashkent (Uzbekistan), Tijuana (Mexico), and Zigong (China). The RADIUS program was developed, based on these pilot projects.

E1-3. Year
1997-99

E1-4. Investor
UN/IDNDR Secretariat

E1-5. People involved
-Kenji Okazaki, Manager, IDNDR Secretariat,

Assisting Institutions
-Fumio Kaneko, Rajib Shaw, Shukyo Segawa, Jichun Sun (OYO Group, Japan)
-Philippe Masure, Pierre Mouroux (BRGM, Bureau de Recherches Geologiques et Minieres, France
-Carlos Villacis, Cynthia Cardona (GHI, GeoHazards International, USA)

Advisors
-Dr. Anand S. Arya, Professor Emeritus, University of Roorkee, India - Dr. Jack Rynn, Director, Centre for Earthquake Research Australia (CERA), Australia
-Dr. Tsunehisa Tsugawa, Senior Chief Research Engineer, Kajima Technical Research Institute, Japan
-Dr. Mohamed Belazougui, Director of CGS, Algeria
-Dr. Victor Davidovici, French Bureau de Controle SOCOTEC, France
-Ms. Shirley Mattingly, Former Chair of the Emergency Management Committee City of Los Angeles, USA
-Prof. Carlos E. Ventura, Dept. of Civil Engineering, University of British Columbia, Canada

Addis Ababa, Ethiopia
-Admitachew Sebhat, Expert, Foreign Relation and Development Cooperation Bureau
-Kifle Eshete, Urban Works and Urban Dept. Bureau,

Antofagasta, Chile
-Cesar Castillo Lilayu, Intendente II Region, Antofagasta
-Mario Pereira Arredondo, Geologist, Geological Science Department Director, U.C.N.

Bandung, Indonesia
-Kamalia Purbani, Co-Project Manager, RADIUS Project
-Krishna S. Pribadi, Prof. Institute for Research, Bandung Institute of Technology

Guayaquil, Ecuador
-Arq. Arguello, Director Plan de Desarrollo Urbano Cantonal
-Ing. Jaime Argudo, Director de Proyectos, IIFIUC-Universidad Catolica

Izmir, Turkey
-Fugen Selvitopu, Director, Department of Construction, Metropolitan Municipality of Izmir
-Muzaffer Tuncag, Head of Technical Committee of Chamber of Civil Engineering,

Skopje, TFYR of Macedonia
-Naum Dimitrovski, Councilor ny Grad Skopje (Skopje Town Assembly)
-Zoran Milutinovic, Head, Section for Risk and Disaster Management - RDM, Institute for Earthquake engineering and Engineering Seismology, University "St. Cyril and Methodius"

Tashkent, Uzbekistan
-Athamhon Djalilovich Mirdjalilov, First Deputy of Mayor (khokim) of Tashkent City
-Academician Tursunbay Rashidovich Rashidov, Head of Laboratory, Institute of Mechanics and Seismic Resistant Constructions
-Shamil Abdullaevich Khakimov, Head of Department, Uzbek Research Institute of Typical and Experimental Design

Tijuana, Mexico
-Antonio Rosquillas Navarro, Director de Proteccion Civil
-M.C. Luis H.Mendoza Garcilazo, Scientific Researcher, Centro de Investigacion Cientifica y Educacion Superior de Ensenada (CICESE), Earth Sciences Division, Seismology Dept.

Zigong City, Sichuan Province, China
-Xu Rongxuan, Vice-Mayor, Zigong
-Han Weibin, Research Professor, Deputy Director of Seismological Bureau of Sichuan Province, China

And many other people.

E1-6. Monetary costs incurred
US$ 2.5 million (all the activities under the RADIUS project)

E1-7. Total workload required
About 2 years

E1-8. Evidence of positive result
Earthquake Damage Scenario and Action Plan were developed in each city through active discussions at workshops and interviews. The workshops were widely covered by mass media and the outcome was widely distributed, greatly raising public awareness. Some local partnership sustained and efforts continued even after the project. Some examples are as follows. - Skopje adopted RADIUS recommendations in Master Plan. - Guayaquil created a new Division for Disaster Mitigation. - Bandung changed its building permit process. - Antofagasta generated US$ 1 million to remove schools from Tsunami areas. - Tijuana created an NGO called RADIUS and gathered periodically. - Experience was transferred to neighboring cities.

Information dissemination


自贡日报
ZIGONG RIBAO
Актуально
ВЫЙТИ ЗА "РАДИУС" БЕДЫ
Actualidad
AVANZA PROYECTO RADIUS

Press coverage in Zigong   Tashkent   Front-page news (Guayaquil)

An NGO called RADIUS in Tijuana

No.2

E2-1. Project name if available
Earthquake Damage Estimation of Kathmandu City (study)

E2-2. Place
Kathmandu City, Nepal

E2-3. Year
2006

E2-4. Investor
Mr. Janak Bahadur CHAND, Department of Mines and Geology, Nepal

E2-5. People involved

E2-6. Monetary costs incurred

E2-7. Total workload required

E2-8. Evidence of positive result
The result of summarized total casualty within the Kathmandu Metropolitan area

Area	Area Name	Day Pop Counts	Night Pop Counts	Death	Injury
1	north	132073	190104	439	7776
2	East	113984	146179	507	7986
3	center	86808	131652	256	4947
4	city core	31686	36591	174	2217
5	West	51401	74213	457	6214
Summary Information		415952	578738	1832	29142

The result can be used to raise awareness and improve the disaster risk management of the city.

No.3

E3-1. Project name if available
Earthquake Damage Estimation of Tabuk City (study)

E3-2. Place
Tabuk City, Saudi Arabia

E3-3. Year
2007

E3-4. Investor
Mr. Abdulrahman Abdullah Mohammad AL- HASAWI
Director, Civilian Protection, Ministry of Interior, Saudi Arabia

E3-5. People involved

E3-6. Monetary costs incurred
NA

E3-7. Total workload required
(One person for 1-2 weeks)

E3-8. Evidence of positive result
The result of summarized total casualty of Tabuk City (in case of M7.3 earthquake).

The total population counts are 279700 5.2%injuried

Area	Area Name	Day Pop Counts	Night Pop Counts	Death	Injury
1	west	44585	71442	426	4023
2	north	23149	37309	240	2369
3	city center	52940	92130	588	6079
4	east	28653	53069	138	1509
5	south	13600	25750	68	720
Summary Information		162928	279700	1460	14700

The result can be used to raise awareness and improve the disaster risk management of the city.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

This program was developed in 1999, and has been improved since then. So far, there has been no strong earthquake in cities where the program was applied. Any upgrading proposals of the program from the users would be welcome and appreciated.

Attached files:

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 40)

I. Heading

1. Title

Nonstructural Seismic Retrofitting for School Buildings in Japan -Publication of a Reference Book -

ID:	DRH 40
Hazard:	Earthquake
Category:	Implementation Oriented Technology (IOT)
Proposer:	Takayuki Nakamura
Country:	JAPAN;
Date posted:	24 September 2008
Date published:	07 November 2008

Damage Conditions and Retrofitting; Case 9.

Contact
(1) Koichi SHINPO (NIER)
Director, Educational Facilities Research Center, National Institute for Educational Policy Research (NIER)
shinpo@nier.go.jp, TEL: -81-3-6733-6990

(2) Masao YAMAKAWA (MEXT)
Director, Office for Disaster Prevention, Ministry of Education, Culture, Sports, Science and Technology (MEXT)
m-yama@mext.go.jo, TEL: -81-3-6734-2290

(3) Takayuki NAKAMURA (Hokkaido University)
Director, Facilities Department, Hokkaido University
s-bucho@facility.hokudai.ac.jp, TEL: -81-11-706-2063

2. Major significance / Summary

Securing the safety of school buildings and facilities against earthquakes is important, because children spend a large part of the day studying and playing at schools, which also act emergency evacuation facilities for the local community. NIER published a reference book for retrofitting nonstructural members of school buildings under the cooperation with MEXT. The book includes many nonstructural seismic retrofitting examples with various pictures, charts and plans. Even though the readers don't have enough technical knowledge and information about nonstructural seismic retrofitting, they can easily understand what are critical for retrofitting the nonstructural members of existing school buildings.
Readers are encouraged to access the full text of the Reference Book at the website (http://www.nier.go.jp/shisetsu/pdf/e-jirei.pdf)
NIER: National Institute for Educational Policy Research
MEXT: Ministry of Education, Culture, Sports, Science and Technology

3. Keywords

Nonstructural seismic retrofitting, School buildings

II. Categories

4. Focus of this information

Implementation Oriented Technology (IOT)

5. Anticipated Users
5-1. Practitioners: Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.)
5-2. Other users: Policy makers

6. Hazards focused
Earthquake

7. Elements at risk
Human lives, Buildings

III. Contact Information

8. Proposer(s) information (Writer of this template)
(1) Koichi SHINPO (NIER)
Director, Educational Facilities Research Center, National Institute for Educational Policy Research (NIER)
shinpo@nier.go.jp, TEL: -81-3-6733-6990

(2) Masao YAMAKAWA (MEXT)
Director, Office for Disaster Prevention, Ministry of Education, Culture, Sports, Science and Technology (MEXT)
m-yama@mext.go.jo, TEL: -81-3-6734-2290

(3) Takayuki NAKAMURA (Hokkaido University)
Director, Facilities Department, Hokkaido University
s-bucho@facility.hokudai.ac.jp, TEL: -81-11-706-2063

9. Place where the technology/knowledge originated
JAPAN;

10. Names and institutions of technology/knowledge developers
National Institute for Educational Policy Research (NIER)
Ministry of Education, Culture, Sports, Science and Technology (MEXT)

11. Title of relevant projects if any

12. References and publications

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice
With the introduction of the new seismic codes (1981) in the Building Standard, seismic retrofitting of buildings has made progress. For school buildings and facilities, Ministry of Education, Culture, Sports, Science and Technology (MEXT) has established the Guideline for Improving the Seismic Resistance of School Facilities (July 2003). At the investigative research cooperator meeting for establishing the Guideline for Improvement of School Facilities, which was held in March 2005, a proposal was made for the urgent improvement of seismic resistance in school buildings and facilities. Through these efforts, damages to the school main structure from earthquakes would be reduced. However, when retrofitting is insufficient, nonstructural members, such as ceiling material, equipment, and various fixtures could fall or topple, and could cause significant harm to children and others. In recent years, people have been harmed by falling nonstructural members from earthquakes, such as from the Geiyo Earthquake (March 2001), Mid-Niigata Prefecture Earthquake (October 2004) and the Fukuoka Prefecture West Offshore Earthquake (March 2005). It is still fresh in our memories that many people, who were inside a sports facility, were hurt from falling ceiling material during the earthquake (Magnitude 7.2, maximum seismic intensity 6 lower), that occurred in August 16, 2005, with a hypocenter off the coast of Miyagi Prefecture. This reference book is based on the "Investigative Survey Report on the Seismic Inspection of Nonstructural Members in School Facilities" (March 2002) (hereafter called the "Academic Report on Nonstructural Members"), which MEXT commissioned the Architectural Institute of Japan to develop. The examples of nonstructural seismic retrofitting in school buildings and facilities show the conditions of damages from previous earthquakes, as well as retrofitting examples, by using photos and illustrations to make them easier to understand. It is hoped that this case study, together with the "Academic

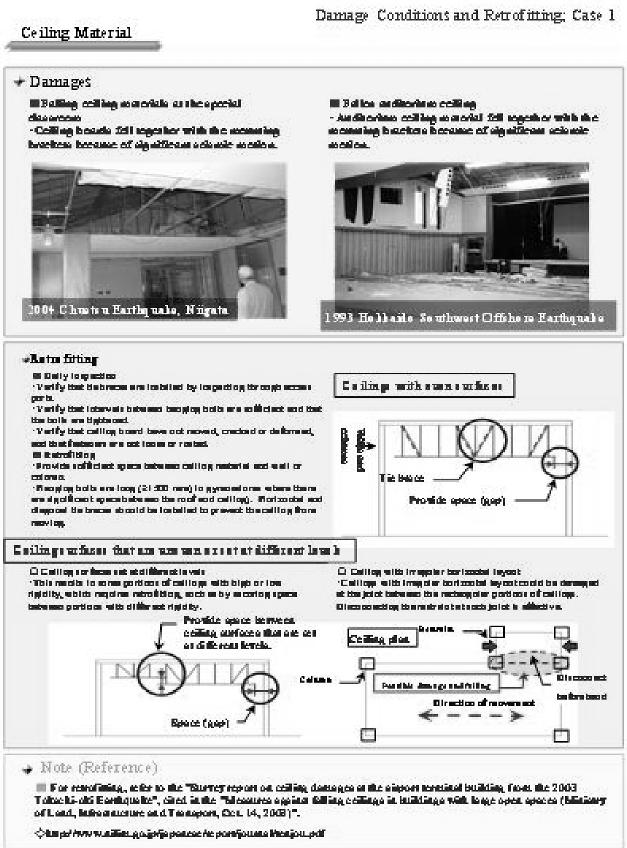
Report on Nonstructural Members", will help increase the awareness among school founders, administrators, teachers and staff, toward the need for seismic retrofitting of non-structural members as well as toward retrofitting methods.

V. Description

15. Feature and attribute

The following 19 case studies of nonstructural members are shown in this reference book. These members are relatively prone to damages by earthquakes. Nonstructural seismic retrofitting of such items is thought to be possible with low costs through daily inspections.

1. Ceiling material
2. Window and windowpane
3. Exterior wall and siding (concrete block and ALC walls)
4. Lighting fixture
5. Outdoor unit (air conditioner and heating unit)
6. Elevated water tank and cooling tower
7. Chimney
8. Refrigerator
9. Bookshelf and locker
10. TV and computer
11. Piano
12. Machine tool
13. Storage shelves in special classes
14. Gymnasium equipment and facility
15. Shoe locker
16. Wall and gate post
17. External staircase and surroundings
18. Retaining wall
19. Other items



Damage Conditions and Retrofitting; Case 9

Bookshelf and Lockers

Damages

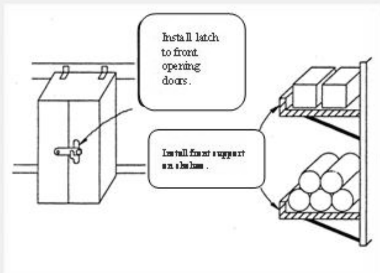
■ Prevent overturning of bookshelves and lockers, and prevent contents from bursting out.

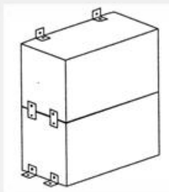
- Overturned bookshelves and lockers by the seismic motion. The contents burst out and were scattered over the floor.

Retrofitting

■ Fixing and securing bookshelves and lockers

- Fix bookshelves and lockers to sturdy wall, beam or ceiling with metal brackets.
- Interconnect the top of tall and shallow bookshelves.
- Bookshelves or lockers that are stacked should be fixed at the base and at the joint.
- Install a latch at the center of front opening doors.





Note (Reference)

■ Countermeasures that are shown are excerpt from the "Disaster Management Manual", Institute of Industrial Science, University of Tokyo (April 2002)

16. Necessary process to implement

Arousing Awareness

In Japan, municipal governments are responsible for public school buildings. Though the national government funds approximately two-thirds of the cost for retrofitting school buildings through grants, the one-third of the costs must be budgeted by local municipalities. Therefore, it is necessary to arouse awareness of the importance of seismic resistance in school buildings in order to promote them. For this purpose, the results of the yearly survey done by MEXT concerning the seismic resistance capacity evaluation rates and seismic resistance rates of public schools of each municipality is disclosed. Also, MEXT urges local authorities to disclose the seismic resistance capacity evaluation results and plans for retrofitting of each school.

Sufficient and Adequate Information

MEXT cooperating with architectural experts, conducted research and study of earthquake resistance for school buildings to establish seismic resistance capacity evaluation methods for school buildings, present methods for seismic retrofitting, and also compile examples of seismic retrofitted school buildings that municipalities can use as reference. Also, MEXT established a consultation service where municipalities and school building designers can seek technical advice.

Budgetary Measures
Because retrofitting school buildings is costly, budgetary measures is essential for progress. Not only securing enough budgets for subsidies, but other measures such as reforming the subsidy system for a more flexible use by the local municipality, have also been taken.

17. Strength and limitations

Strength
The purpose of this reference book is to enlighten the general public and those who are in charge of school buildings and facilities with understandable manners. There are many pictures, charts and plans in this reference book, so the readers can easily understand what are necessary for retrofitting the nonstructural members of existing school buildings.
Limitations
In order to apply the technologies shown in this reference book to other real cases, more detailed investigations and analyses about the real case are necessary. Especially, when these technologies are applied to the cases in foreign countries, more careful attention to the regional characteristics and social backgrounds ought to be paid.

18. Lessons learned through implementation if any

It is costly to retrofit vulnerable school buildings, and municipalities have to address other public needs; therefore there is a difficult condition to assign higher budgets to school buildings. Under these budget constraints, it is critical to develop cheaper technologies for retrofitting the nonstructural members of existing school buildings.

VI. Resources required

19. Facilities and equipments required

20. Costs, organization, manpower, etc.

VII. Message from the proposer if any

21. Message

Many people tend to pay attention to only the structural seismic retrofitting, however the retrofitting of nonstructural members such as ceiling materials, windowpanes, bookshelves, lockers, etc. is also critical. Even though the structures of school buildings are not seriously damaged by earthquake, children can be killed or injured by the fall of nonstructural members. Therefore, the importance of retrofitting the nonstructural members should be acknowledged among the people who are in charge of school buildings and facilities.

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

The technologies introduced in this reference book are thought to be applicable to other regions in the world. However, in that case, more careful attention to the regional characteristics such as building materials, structural components, skills of construction workers, etc. should be paid.

IX. Application examples

X. Other related parallel initiatives if any

19 case studies shown in this reference book can be seen at the following website. (http://www.nier.go.jp/shisetsu/pdf/e-jirei.pdf)

XI. Remarks for version upgrade

Attached files:

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 41)

I. Heading

1. Title

Seismic Retrofitting for School Buildings in Japan- Publication of a Reference Book -

ID:	DRH 41
Hazard:	Earthquake
Category:	Implementation Oriented Technology (IOT)
Proposer:	Takayuki Nakamura
Country:	JAPAN;
Date posted:	24 September 2008
Date published:	07 November 2008

Installing Steel Bracing

Contact

(1) Masao YAMAKAWA (MEXT)
Director, Office for Disaster Prevention, Ministry of Education, Culture, Sports, Science and Technology (MEXT)
m-yama@mext.go.jp, TEL: -81-3-6734-2290

(2) Koichi SHINPO (NIER)
Director, Educational Facilities Research Center, National Institute for Educational Policy Research (NIER)
shinpo@nier.go.jp, TEL: -81-3-6733-6990

(3) Takayuki NAKAMURA (Hokkaido University)
Director, Facilities Department, Hokkaido University
s-bucho@facility.hokudai.ac.jp, TEL: -81-11-706-2063

2. Major significance / Summary

Earthquakes can occur anywhere and at any time in Japan. Improving the seismic resistance of school buildings is a pressing issue, because children spend a large part of their daily lives in school. MEXT published a reference book for retrofitting school buildings under the cooperation with NIER. The book includes many seismic retrofitting examples with various pictures, charts and plans. Even though the readers don't have enough technical knowledge and information about seismic retrofitting, they can easily understand what are critical for retrofitting existing school buildings.
Readers are encouraged to access the full text of the Reference Book at (http://www.nier.go.jp/shisetsu/pdf/etaishinjirei.pdf)
MEXT: Ministry of Education, Culture, Sports, Science and Technology
NIER : National Institute for Educational Policy Research

3. Keywords

Seismic retrofitting, School buildings

II. Categories

4. Focus of this information

Implementation Oriented Technology (IOT)

5. Anticipated Users

5-1. Practitioners: Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.)

5-2. Other users: Policy makers

6. Hazards focused
Earthquake

7. Elements at risk
Human lives, Buildings

III. Contact Information

8. Proposer(s) information (Writer of this template)
(1) Masao YAMAKAWA (MEXT)
Director, Office for Disaster Prevention, Ministry of Education, Culture, Sports, Science and Technology (MEXT)
m-yama@mext.go.jp, TEL: -81-3-6734-2290

(2) Koichi SHINPO (NIER)
Director, Educational Facilities Research Center, National Institute for Educational Policy Research (NIER)
shinpo@nier.go.jp, TEL: -81-3-6733-6990

(3) Takayuki NAKAMURA (Hokkaido University)
Director, Facilities Department, Hokkaido University
s-bucho@facility.hokudai.ac.jp, TEL: -81-11-706-2063

9. Place where the technology/knowledge originated
JAPAN;

10. Names and institutions of technology/knowledge developers
Ministry of Education, Culture, Sports, Science and Technology (MEXT), National Institute for Educational Policy Research (NIER)

11. Title of relevant projects if any

12. References and publications

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice
In recent years, there have been frequent large earthquakes in Japan, such as the 2004 Mid-Niigata Prefecture Earthquake and the 2005 Fukuoka Seihou-oki Earthquake. It is hard to tell when and where such earthquakes could occur in Japan. Improving the seismic resistance of school buildings has become a pressing issue, because children spend a large part of their daily lives in school, and such schools secure the safety of children as well as act as emergency evacuation facilities for local communities. Therefore, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) has taken measures for early application of seismic retrofitting on school buildings. This was by producing the "Guideline for Promoting the Seismic Retrofitting of School Facilities" to tackle the retrofitting of school buildings. Furthermore, there is great demand for the effective, efficient and systematic improvement of school buildings under the tight fiscal situation of the government and regional authorities. There is a need to study methods for more effective improvements, such as by shifting from the replacement of buildings to the seismic retrofitting and refurbishment of buildings in the future. However, the general public and those in charge of school buildings are usually not acquainted with seismic retrofitting, and there were opinions that it is difficult to imagine what retrofitting is about and how much it would cost.

Therefore, MEXT commissioned the Research Institute of Educational Facilities in 2005, and performed the "Investigative research on seismic retrofitting of school facilities". Then, MEXT published a reference book on school buildings to resist earthquakes, based on the survey on examples of seismic retrofitting methods throughout Japan. This reference book is intended to make it easier to understand for those who are not specialized in architecture, and to contribute in improving the understanding of the importance of seismic retrofitting as well as for further applications of seismic retrofitting.

Collapsed Column

Fallen Roof

Steel Bracings

Steel Bracings (Details)

V. Description

15. Feature and attribute

After introducing some examples of school buildings damaged by recent major earthquakes and explaining about the background information of seismic retrofitting, this reference book shows the following examples of retrofitted school-buildings. - Retrofitting structures with steel bracings and seismic shear walls - Retrofitting by installing steel bracings and structural slits - Retrofitting of structures with steel tube bracings - Retrofitting the structure by replacing the roof - Retrofitting of structure with steel tube bracings and seismic shear walls- Retrofitting the structure by installing external steel bracings and seismic shear walls - Retrofitting structures by installing steel frame bracings and bracings along the roof - Retrofitting structures by installing external horizontal steel truss Each example above-mentioned describes the outline of seismic retrofitting method, the approximate cost, the effectiveness of retrofitting, the design for retrofitting, the explanation of keyword for retrofitting, etc. In addition to these examples, the reference book includes simple description of other 14 seismic retrofitting cases.

16. Necessary process to implement

Arousing Awareness

In Japan, municipal governments are responsible for public school buildings. Though the national government funds approximately two-thirds of the cost for retrofitting school buildings through grants, the one-third of the costs must be budgeted by local municipalities. Therefore, it is necessary to arouse awareness of the importance of seismic resistance in school buildings in order to promote them. For this purpose, the results of the yearly survey done by MEXT concerning the seismic resistance capacity evaluation rates and seismic resistance rates of public schools of each municipality is disclosed. Also, MEXT urges local authorities to disclose the seismic resistance capacity evaluation results and plans for retrofitting of each school.

Sufficient and Adequate Information

MEXT cooperating with architectural experts, conducted research and study of earthquake resistance for school buildings to establish seismic resistance capacity evaluation methods for school buildings, present methods for seismic retrofitting, and also compile examples of seismic retrofitted school buildings that municipalities can use as reference. Also, MEXT established a consultation service where municipalities and school building designers can seek technical advice.

Budgetary Measures

Because retrofitting school buildings is costly, budgetary measures is essential for progress. Not only securing enough budgets for subsidies, but other measures such as reforming the subsidy system for a more flexible use by the local municipality, have also been taken.

17. Strength and limitations

Strength

The purpose of this reference book is to enlighten the general public and those who are in charge of school buildings with understandable manners. There are many pictures, charts and plans in this reference book, so the readers can easily understand what are necessary for retrofitting existing school buildings.

Limitations

In order to apply the technologies shown in this reference book to other real cases, more detailed investigations and analyses about the real case are necessary. Especially, when these technologies are applied to the cases in foreign countries, more careful attention to the regional characteristics and social backgrounds ought to be paid.

18. Lessons learned through implementation if any

It is costly to retrofit vulnerable school buildings, and municipalities have to address other public needs; therefore there is a difficult condition to assign higher budgets to school buildings. Under these budget constraints, it is critical to develop cheaper technologies for retrofitting existing school buildings.

VI. Resources required

19. Facilities and equipments required

20. Costs, organization, manpower, etc.

VII. Message from the proposer if any

21. Message

It is clear that school buildings should be built to withstand earthquakes. In addition, since school buildings are places where many children spend the most part of the day to study and live, it is also crucial to maintain school buildings safer and more healthy conditions. Therefore, the improvement of educational circumstances ought to be paid attention at the time of retrofitting school buildings.

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

The technologies introduced in this reference book are thought to be applicable to other regions in the world. However, in that case, more careful attention to the regional characteristics such as building materials, structural components, skills of construction workers, etc. should be paid.

IX. Application examples

No.1

E1-1. Project name if available
Retrofitting Structures with Steel Bracings and Seismic Shear Walls

E1-2. Place
Niigata Prefecture, Toukamachi Sougou Senior High School

E1-3. Year
2004-2005

E1-4. Investor
Niigata Prefecture

E1-5. People involved

E1-6. Monetary costs incurred
Total Cost: 173.5 million yen Cost for retrofitting: Steel bracings: 254,000 yen/m^2, RC Wall: 140,000 yen/m^2

E1-7. Total workload required

E1-8. Evidence of positive result
Is value (Structural seismic performance index): Before: Isx=0.30, Isy=0.69
After : Isx=1.01, Isy=0.88

After retrofitting (Inside view)

Before retrofitting (Outside view)

No.2

E2-1. Project name if available
Retrofitting by Installing Steel Bracings and Structural Slits

E2-2. Place
Niigata Prefecture, Toukamachi Senior High School

E2-3. Year
2003-2005 (3 months/each year)

E2-4. Investor
Niigata Prefecture

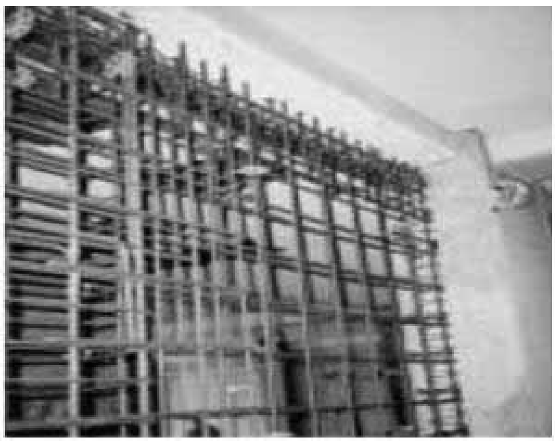
E2-5. People involved

E2-6. Monetary costs incurred
Total cost: 343.8 million yen Cost for retrofitting: Install steel bracings: 125,000 yen/m^2, Install RC wall: 88,000 yen/m^2, Steel jacket reinforcement of columns: 254,000 yen/each, Carbon fiber jacket reinforcement of columns: 385,000 yen/each

E2-7. Total workload required

E2-8. Evidence of positive result
Is value (Structural seismic performance index): Before: Isx=0.42, Isy=0.39
After : Isx=0.80, Isy=0.75

Installing Steel Bracing



Adding Seismic Shear Wall

Carbon Fiber Reinforcement

Steel Jacket Reinforcement

No.3

E3-1. Project name if available
Retrofitting of Structures with Steel Tube Bracings

E3-2. Place
Niigata Prefecture, Kawaguchi Junior- High School Gym

E3-3. Year
1997

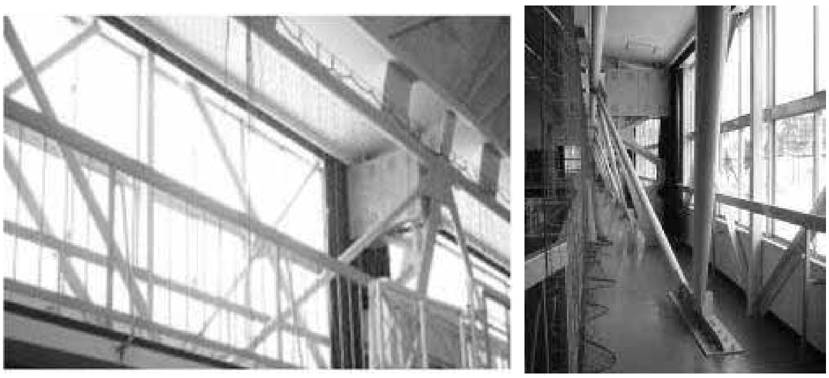
E3-4. Investor
Kawaguchi Town

E3-5. People involved

E3-6. Monetary costs incurred
Total Cost: 101.7 million yen Cost for retrofitting: Steel bracings: 10,000 yen/m^2

E3-7. Total workload required

E3-8. Evidence of positive result
Is value (Structural seismic performance index):
Before: Isx=0.08, Isy=0.70
After : Isx=0.73, Isy=0.70



Steel Tube Bracings

X. Other related parallel initiatives if any

Other 19 examples of retrofitting school buildings can be seen at the following website.
(http://www.nier.go.jp/shisetsu/pdf/e-taishinjirei.pdf)

XI. Remarks for version upgrade

Attached files:

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 44)

I. Heading

1. Title

Dujiangyan Project

ID:	DRH 44
Hazard:	Flood , Drought
Category:	Transferable indigenous knowledge (TIK)
Proposer:	Weihua FANG
Country:	CHINA;
Date posted:	29 December 2008
Date published:	16 March 2009

Flying Sand Fence

Contact
Weihua FANG, Xingchun ZHONG, Fei HE, Hong XU
Position : Associate Professor
Affiliation: Academy of Disaster Reduction and Emergency Management, MOCA & MOE, China; Beijing Normal University
Address: No. 19 Xinjiekouwai Avenue, Haidian District, Beijing, 100875, China.
E-mail: fang@ires.cn
Tel: 86-10-58802283
Fax: 86-10-58802158

2. Major significance / Summary

Dujiangyan Project, which consists of Fish Mouth Water-dividing Dam, Flying Sand Fence and Bottle-Neck Channel, is a hydraulic engineering with a history more than 2000 years. It is still being used today for flood disaster prevention, sediment control and irrigation. Its completion changed Chengdu Plain from a disaster-prone area to affluent area honored as "The Land of Abundance"

3. Keywords

Dujiangyan, Drought, Flood, Sediment control, Irrigation

II. Categories

4. Focus of this information

Transferable indigenous knowledge (TIK)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.), International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Experts, Teachers and educators, Architects and engineers
5-2. Other users: Motivated researchers

6. Hazards focused

Flood, Drought

7. Elements at risk

Human lives, Infrastructure, River banks and fluvial basin, Agricultural lands

III. Contact Information

8. Proposer(s) information (Writer of this template)

Weihua FANG, Xingchun ZHONG, Fei HE, Hong XU
Position : Associate Professor
Affiliation: Academy of Disaster Reduction and Emergency Management, MOCA & MOE, China; Beijing Normal University
Address: No. 19 Xinjiekouwai Avenue, Haidian District, Beijing, 100875, China.
E-mail: fang@ires.cn
Tel: 86-10-58802283
Fax: 86-10-58802158

9. Place where the technology/knowledge originated

CHINA;
At 30° 58′ 56″ N, 111° 25′ 10″ E; 45 km north of Chengdu, in Sichuan Province, Southwest of China.

10. Names and institutions of technology/knowledge developers

Li Bing, who lived in the 3rd century BC, organized local people with his son to build Dujiangyan hydraulic engineering during he served as the procurator of Shu State (Sichuan province today).

11. Title of relevant projects if any

12. References and publications

1. Guo Wentao. Drought Principles and Historical Experience of Drought Prevention in Shangqiu Areas. History of Chinese Agriculture. 1993, 12 (1): 93-104
2. Li Keke, Li Peihong. Dujiangyan - Great Achievement of Chinese Trditional Hydraulic Culture. China Water Resources, 2004, 18:75-78.
3. Si Maqian, SHIJI (historical records), 91 B.C.
4. Shouyi BAI (eds.), General history of China, 2004, Shanghai People’s Press.
5. Su Renqiong, Yang Qinye.Treatment Policy to Comprehensively Harness the Disaster Environment in the Yellow River Basin. Yellow River, 1996,11: 16-20
6. Wang Wenkai, Wang Chao, Liu Airong. Disaster Reduction in China, 1999,9 (2): 19-22.
7. Xiao Kaiqian. Flooding Disasters and Prevention Strategies in Dujiangyan Irrigation Regions of the Outer River. Sichuan Water Resources, 1998, 3:26-29
8. Xiong Dacheng. Summaries of Sediment Control Theory and Experience of Dujiangyan Project. Chengdu Water Resources, 1998, 3:29-39.
9. Zhao Ji, Geography of China, 2001, Higher Education Press.
10. Zhao Shuling. Study the Disasters in the Yellow River Reach from the Historical Perspectives. Journal of North China Institute of Water conservancy and Hydroelectric Power (Social Science), 2002, 18 (1):51-54.
11. Zhang Jiacheng. Scientific Thought of Water Controlling in Ancient China. Advances in Water Science, 1996, 7 (2): 158-162.
12. Zhong Deyu, Zhang Hongwu. Extended 2-D Numerical Model for Alluvial River Considering Transverse Transport of Sediment and Bank Erosion due to Secondary Flow in River Bends. Journal of Hydraulic Engineering, 2004, 7: 14-20.
13. http://it.chinahw.net/homepage/2006/baman/homepage/08xinjiang/01xinjiang/01.htm
14. http://www.travelchinaguide.com/attraction/xinjiang/turpan/karez.htm
15. http://blog.cersp.com/2005/11/06/165519.jpg
16. http://www.cdbot.chengdu.gov.cn
17. http://www.dujiangyan.com.cn
18. http://www.djy.gov.cn
19. http://www.cs.iastate.edu
20. http://www.17u.com/destination/s_detail_1731.html

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

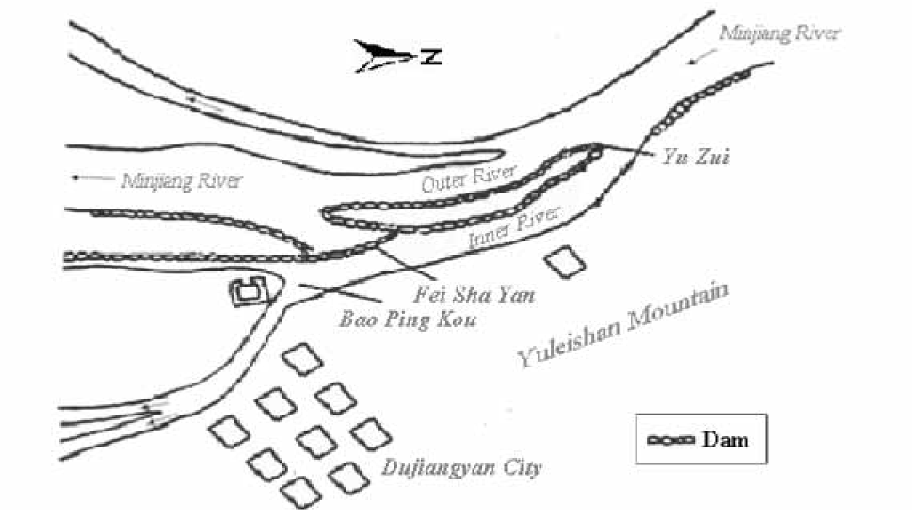
Dujiangyan Region is a transition belt from Tibetan Plateau to Chengdu Plain. It is a high risk region of earthquakes. Broken rock layers and alternating mountains and valleys lead to high complexity of topography. Subtropical zone humid climate in this region brings annual average rainfall of 1,244 mm, 70 % of which comes from June to September. Strong rainstorms together with the complex topography can easily lead to disasters, such as landslides, debris flows and floods.

During Summer and Autumn, especially after a rainstorm, feculent water with mixed sand and stones in the Minjiang River often surges and rushes out from the mountain areas. According to data since 1936, mean annual discharge of Minjiang River at Dujiangyan is 500 m^3/s and historically maximum discharge is 7,700 m^3/s. The annual total flow reaches 15 billion m^3.

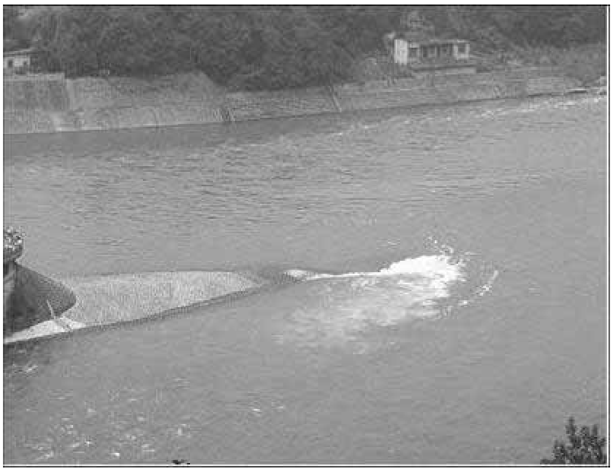
V. Description

15. Feature and attribute

Flood prevention, drought reduction and sediment control are the three major aims of the system. To achieve these aims, three complementary sub-projects are built and serve as an integrated systematic engineering.



1. **Fish Mouth Water-Dividing Dam** (**Yu Zui** in Chinese) was built to divide the Minjiang River into inner and outer river. The outer river is wider and functions as the main stream to discharge floods, while the inner one is deeper and diverts water to Chengdu Plain for irrigation.



2. Flying Sand Fence (**Fei Sha Yan** in Chinese) was built to keep runoff for irrigation stable. When water in the inner river exceeded its demand, the extra water could run over the Fence. It looks like an arc and this makes the inner channel little curved. The arc-shaped fence and channel can make sand and pebbles thrown back into the outer river together with the extra water. Roundabout Flow Theory was perfectly applied in this project.

3. Bottle-Neck Channel (Bao Ping Kou in Chinese**)** is a long and narrow canal dug through the *Yuleishan Mountain* which stops Minjiang River flowing eastward. This canal leads intake water from Inner River into Chengdu Plain to irrigate tens of thousands of hectares farmland.

16. Necessary process to implement

1. A dam should be built in the center of the river to divide the water.

2. A canal should be dug through the impediment hill to lead the water to where it is needed.

3. A spillway with a fence whose height is apposite should be built near the access of canal to make the water for irrigation stable and control the sediment.

17. Strength and limitations

Dujiangyan fully used the local topography that northwest was higher and southeast was lower. Water of Minjiang River is automatically converted and channeled into the irrigation canal. No extra power is needed besides the gravity. Dujiangyan Project has been designed and constructed to cope with both floods and draughts.

As a hydro junction, it has done great contribution on flood prevention, irrigation and shipping for over 2,260 years. It has also supplied water of productive and living use for people in Chengdu Plain.

However, its dependency on the topography also becomes the limitation that makes the engineering irreproducible.

The scale issue is also a limitation of this TIK. Consider the three sub-projects separately (A dam, a fence and a channel), each of them might just be an ordinary project. However, lacking any of them, the project will be much less effective than it is now. This means the function of the project is more than simply adding the function of its sub-projects. It is almost impossible to apply the whole project at smaller scale. However, the sub-project could be applied at a proper place to serve certain function, such as building a canal to split stream and lead water or building a fence to keep runoff stable.

18. Lessons learned through implementation if any

1. Site selection

The site selection of Dujiangyan Project took full account of natural environment, such as river depth and channel camber, and human technology, which made the Project a coordinated water management system. We should consider and fully use the natural conditions of a specific region when we design a project.

2. Simple Materials.

Dams and other structures of Dujiangyan Project are mainly constructed using pebbles, stones and bamboos. Sources of these simple materials are close to Dujiangyan Project. Pebbles and stones are easy to be collected from the river bed and banks. Bamboos are widely distributed in Dujiangyan Region, which are made to baskets to fill with pebbles and stones.

VI. Resources required

19. Facilities and equipments required

When Dujiangyan was firstly being built, iron tools was used to dig mountain. Fire was also used to burn the rocks to crack. Cages made by bamboo and filled with rocks and cobble stones were used to build the dam in the center of river.

Nowadays, such antique facilities and equipments can be replaced by modern facilities and equipments, such as excavator, dynamite, concrete and so forth.

20. Costs, organization, manpower, etc.

To complete Dujiangyan hydraulic engineering, thousands of local people were organized to work many years. This is due to the backward facilities and equipments at that time. Building such a project would be much easier today but would still cost highly.

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that Others

This project has been used for more than 2,000 years and is still being used effectively. It could not be totally duplicated anywhere due to the special prerequisites. However, knowledge and experience learned from this project are valuable.

23. Notes on the applicability if any

IX. Application examples

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) - DRH-Asia Contents (DRH 45)

I. Heading

1. Title

Karez Technology for Drought Disaster Reduction

ID:	DRH 45
Hazard:	Drought , Desertification , Climate change impact , Land degradation
Category:	Transferable indigenous knowledge (TIK)
Proposer:	Weihua FANG
Country:	CHINA;
Date posted:	30 December 2008
Date published:	16 March 2009

Small Reservoir.

Contact
Weihua FANG (Associate Professor), Fei HE (Phd. Candidate), Hong CHENG (Master Candidate)
Academy of Disaster Reduction and Emergency Management, MOCA & MOE, China; Beijing Normal University
No. 19 Xinjiekouwai Avenue, Haidian District, Beijing, 100875, China.
E-mail: fang@ires.cn
Tel: 86-10-58802283
Fax: 86-10-58802158

2. Major significance / Summary

Karez is a traditional irrigation water system with a long history in Xinjiang area of China which makes use of underground water efficiently. As a comprehensive system, Karez is primarily made up of vertical wells, underground canals, a surface canal and small reservoirs. It is still being used to supply water resources for irrigation, domestic uses and others.

3. Keywords

Karez, Drought, Irrigation.

II. Categories

4. Focus of this information

Transferable indigenous knowledge (TIK)

5. Anticipated Users

5-1. Practitioners: National governments and other intermediate government bodies (state, prefecture, district, etc.), International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Experts, Teachers and educators, Architects and engineers, Urban planners, Rural planners, Environmental/Ecological specialists
5-2. Other users: Local residents

6. Hazards focused

Drought, Desertification, Climate change impact, Land degradation

7. Elements at risk

Human lives, Infrastructure, Rural areas, Mountain slopes, Agricultural lands, Others
Livestocks and household assets

III. Contact Information

8. Proposer(s) information (Writer of this template)

Weihua FANG (Associate Professor), Fei HE (Phd. Candidate), Hong CHENG (Master Candidate)
Academy of Disaster Reduction and Emergency Management, MOCA & MOE, China; Beijing Normal University
No. 19 Xinjiekouwai Avenue, Haidian District, Beijing, 100875, China.
E-mail: fang@ires.cn
Tel: 86-10-58802283
Fax: 86-10-58802158

9. Place where the technology/knowledge originated

CHINA;
In Turpan depression, Northwest of China, in Xinjiang Aera.

10. Names and institutions of technology/knowledge developers

Karez Irrigation System is developed through community practices over time.

11. Title of relevant projects if any

The similar irrigation systems have been used in Iran and Afghanistan.

12. References and publications

1. SI Maqian, SHIJI (historical records), 91 B.C.
2. Shouyi BAI (eds.), General history of China, 2004, Shanghai People Press.
3. Xingqi ZHONG and Huaizhen CHU (eds.), Turpan Karez system, Xinjiang University Press, Page 5~19, 1993.
4. Ji ZHAO, Geography of China, 2001, Higher Education Press.
5. http://it.chinahw.net/homepage/2006/baman/homepage/08xinjiang/01xinjiang/01.htm .
6. http://www.travelchinaguide.com/attraction/xinjiang/turpan/karez.htm .
7. http://www.karez.org .
8. http://blog.cersp.com/2005/11/06/165519.jpg

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

Turpan is very dry in all seasons and very hot during spring, summer and autumn. The highest temperature recorded is 47.7 °C in summer. The annual sunshine duration is about 3,100 hours. High temperature and strong solar radiation result in high annual evaporation amounting to 2,800~3,000 mm. Turpan is in an inner land with total annual precipitation of only around 16~17 mm. Because of strong evaporation or the evapotranspiration process, precipitation (rain or snow) falling on the slope of the mountain would evaporate or seep underneath sand and soil before it can converge into a stream and reach the flat agricultural area along the foot of the mountain. Surface water is scarce in most areas. Under such tough circumstances, few plants or animals survive.

V. Description

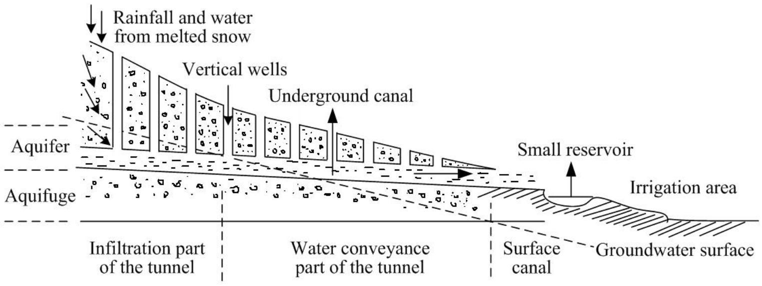
15. Feature and attribute

1. Support by Earth's Gravity. Since Karez takes advantage of topography to divert deep subsurface flow through an underground canal to land surface for gravity irrigation, the cost for water-lifting equipment and its maintenance are almost negligible.
2. Stable Outflow. The major water sources of the Karez system are melting snow and underground water. The underground canal can minimize high evaporation in the windy Turpan district hence, the impact of climate change is small. In addition, problems with sand blast can be avoided in the underground canal. All this makes the Karez system able to provide stable water resources, though total water volume may not be very large. As observed, there is a very stable population regardless of environment changes for thousands of years in Karez areas.
3. High Water Quality. Melting water from snow infiltrates and the soil provides a very good filter to remove polluted materials. Unlike water channels on land, the underground canal minimizes water pollution and at the same time is rich in minerals. The water quality is suitable for drinking and domestic use.

4. Construction with Simple Tools. Most Karez systems were built with simple tools and do not require complex equipment.

16. Necessary process to implement

Karez is a traditional irrigation water system with a long history in Xinjiang area of China which makes use of underground water efficiently. Where farmland is located in the mountainous area, it is built on an alluvial fan or plain. The structure of a complete Karez system can be complex but its basic structure is essentially composed of vertical wells, underground canal, surface canal, and small reservoirs.



1. **Vertical wells.** The major functions of vertical wells are for ventilation, proper orientation of the canal during construction and examination and repair of canals after construction. Besides for digging canals, vertical wells are also utilized to take out water from underground canals after the whole Karez system is completed. An aerial image of vertical wells is presented below.

2. **Underground and Surface Canals.** The majority of the canals are underground. The canals under the surface are generally a network of canals in order for underground water to accumulate (left image). When the underground canal reaches the farmland, it becomes a surface canal and is linked to a small reservoir or directly connected to a system of water channels for irrigation (right image).


3. **Small Reservoir** .Water resources are collected in small reservoirs which can be adjusted for water level and temperature. Constructing reservoirs increase the water level as well as temperature so that a larger area of farmland is irrigated.

17. Strength and limitations

The strength of Karez Technology are 1) collect waters from rainfall and melted snow, 2) provided stable water resources and 3) high quality water. As a result, it reduced drought disaster effectively.

On the other hand, the limitations of this technology are 1) cost is too high, 2) building time last several decades and 3) demand of manpower is more than thousands.

18. Lessons learned through implementation if any

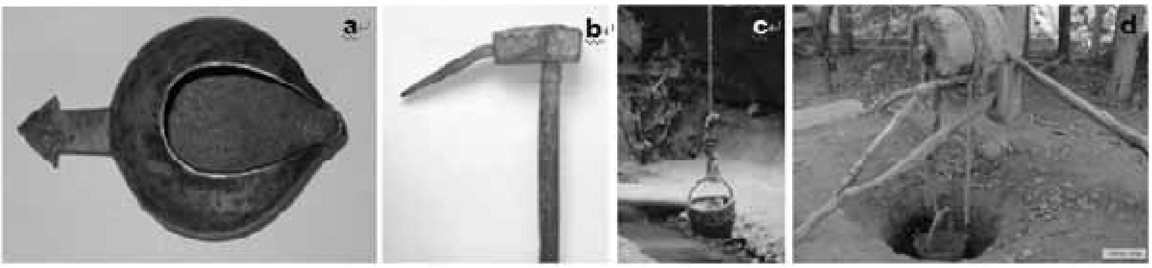
Karez Irrigation System is a great result and enormous project of the ancient Chinese people. Although building time must be shorter to construct by modern instruments at present, the cost is still highly.

VI. Resources required

19. Facilities and equipments required

A variety of simple tools can be utilized in building Karez systems, such as excavating hoe, planning hammer, basket, winch, and oil lamp. The excavating hoe and planning hammer are used for digging passages underground. The basket and winch are used for carrying soil and sand. Iron oil lamps with an arrow for orientation are used for digging underground canals. The lamp can also be conveniently fixed on canal walls.

Here are the pictures of equipments:



(a) traditional oil lamp with side-arrow, (b) excavating hoe, (c) basket, and (d) a modern sheave used in building Karez system.

20. Costs, organization, manpower, etc.

For Karez Technology is a famous system engineering in the world, consequently, costs are too high and the time of constructions continue many years. Furthermore the demand of manpower is much higher and continued for decades.

VII. Message from the proposer if any

21. Message

Karez Irrigation System is the great gift from Chinese Ancients. Karez provided an effective way the elemental resources of human lives. In the modern day, how to used other scientific technologies to building and maintaining is the new challenge of us.

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that

23. Notes on the applicability if any

IX. Application examples

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 48)

I. Heading

1. Title

Experiences Sharing and School Disaster Education: Implementation of Essay and Drawing Competition as School Disaster Education

ID:	DRH 48
Hazard:	Earthquake, Tsunami, Volcanic eruption, Landslide, Mudflow, Dust storm, Cold wave, Heat wave, Zud, Cyclone/Typhoon, Storm surge, Flood, Flash flood, Glacial Lake Outburst Flood (GLOF), Snow avalanches, Epidemic, Wildfire, Drought, Desertification, Climate change impact, Land degradation, Multi-hazard, Other
Category:	Process Technology (PT)
Proposer:	Koichi Shiwaku
Country:	PAKISTAN;
Date posted:	20 January 2009
Date published:	09 June 2009

Drawing competition

Contact

Koichi Shiwaku (Research Fellow, EDM-NIED), Muhammad Shakeel (President of STAR Foundation), Yukiko Takeuchi (Lecturer, Kyoto University), Rajib Shaw (Associate Professor, Kyoto University), Ayako Fujieda (PHD student, Kyoto University), and Jishnu Subedi

shiwaku@edm.bosai.go.jp

2. Major significance / Summary

Knowing experiences of past disasters as school disaster education is important for disaster reduction. Essay and drawing competition can be an opportunities to collect experience and share experiences among students. Such experiences are important materials for future generation to understand past disasters.

3. Keywords

education, Pakistan, school, teachers, students, earthquake

II. Categories

4. Focus of this information

Process Technology (PT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.), NGO/NPO project managers and staff, International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Teachers and educators, Environmental/Ecological specialists

5-2. Other users: Motivated researchers, Local residents

6. Hazards focused

Earthquake, Tsunami, Volcanic eruption, Landslide, Mudflow, Dust storm, Cold wave, Heat wave, Zud, Cyclone/Typhoon, Storm surge, Flood, Flash flood, Glacial Lake Outburst Flood (GLOF), Snow avalanches, Epidemic, Wildfire, Drought, Desertification, Climate change impact, Land degradation, Multi-hazard, Other
This technology can be utilized for reduction of any types of disasters.

7. Elements at risk

Human lives, Human networks in local communities, Business and livelihoods, Infrastructure, Buildings, Information and communication system, Urban areas, Rural areas, Coastal areas, River banks and fluvial basin, Mountain slopes, Agricultural lands, Cultural heritages, Others
This technology can cover any types of elements.

III. Contact Information

8. Proposer(s) information (Writer of this template)

Koichi Shiwaku (Research Fellow, EDM-NIED), Muhammad Shakeel (President of STAR Foundation), Yukiko Takeuchi (Lecturer, Kyoto University), Rajib Shaw (Associate Professor, Kyoto University), Ayako Fujieda (PHD student, Kyoto University), and Jishnu Subedi

shiwaku@edm.bosai.go.jp

9. Place where the technology/knowledge originated

PAKISTAN;
Bagh, AJK (Kashmir)

10. Names and institutions of technology/knowledge developers

Koichi Shiwaku, Research Fellow, EDM-NIED
Muhammad Shakeel, President of STAR Foundation
Yukiko Takeuchi, Lecturer, Kyoto University
Rajib Shaw, Associate Professor, Kyoto University
Ayako Fujieda, PHD student, Kyoto University
Jishnu Subedi

11. Title of relevant projects if any

Promotion of School Disaster Education in Affected Areas

12. References and publications

Experiences of Pakistan Earthquake of 2005: Student's Messages from Kashmir, EDM-NIED Publication, January 2009
Guidelines for School Disaster Education: Express and Extend Experiences, EDM-NIED Publication, January 2009

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

On October 8th 2005, an earthquake that measured 7.6 on the Richter scale hit the northern part of Pakistan, a part of the NWFP province of Pakistan and three districts of Azad Jammu & Kashmir. More than 73,000 people including more than 18,000 children died in this earthquake. 400,153 houses were destroyed or severely damaged. 2.8 million people lost their own houses.

It is necessary for people to reduce risks and impacts of future disasters. To reduce risks and impacts, people are needed to take action for disaster reduction. Disaster education plays important a role to solve this problem. Experiences are important for people. People who experienced disasters can realize importance of disaster management. But it is difficult for people who has not experienced disasters to "REALIZE" importance even if they "KNOW" importance. Therefore, how we use experience in school disaster education is important challenge for future disaster reduction.

V. Description

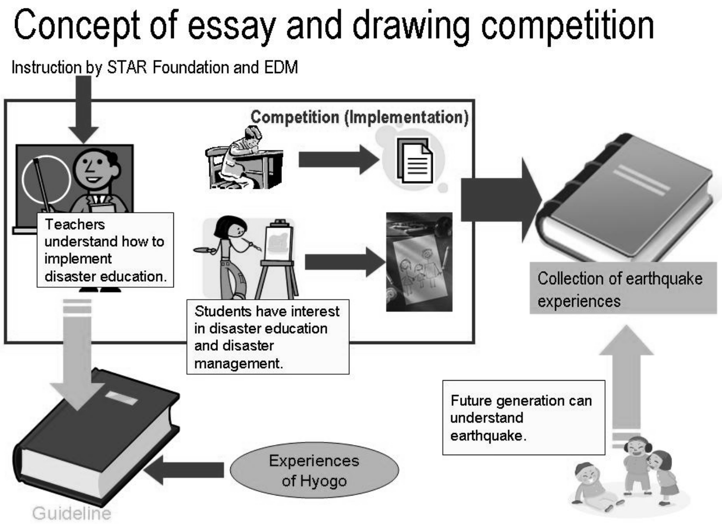
15. Feature and attribute

In the affected areas, current generation has actual disaster experiences. But future generation can not have experiences directly after long time passes. There are major issues to be solved on disaster management as below;

- People think disaster is just past event in the affected area
- People do no think disasters will come to them outside affected area

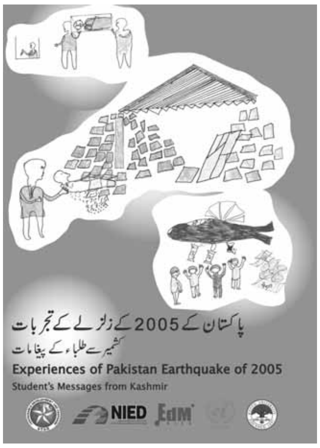
To solve above issues, it is necessary to utilize experiences or lessons of the past disasters and to transfer them to next generation. School disaster education can contribute to solving these issues.

Essay competition and drawing competition are famous activities in extra-curriculum education in schools especially in South Asian countries. This technology is combination of these activities and disaster education. In these competition, students are requested to write their own disaster experiences. It is an opportunities for students to express their experiences and for conductor (e.g. school teachers) to collect experiences. These experiences will be know by future children to know past disasters. These experiences are published as textbook for both present and future students. In addition, guidelines are also published for teachers to utilize the textbook.

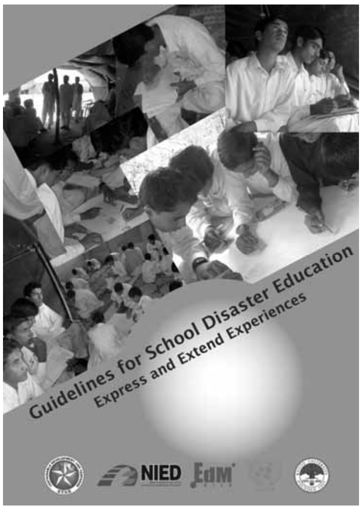


Features of this technology are following;

- Utilization of extra curriculum
- Provide awareness raising programs
- Can collect experiences to share among current students and transfer to next generation
- Specialized knowledge is not necessary to apply



Textbook includes essays and drawings. Present students can know other students feelings in disaster situation. Future children can know past disasters to think what they have to do for disaster reduction.

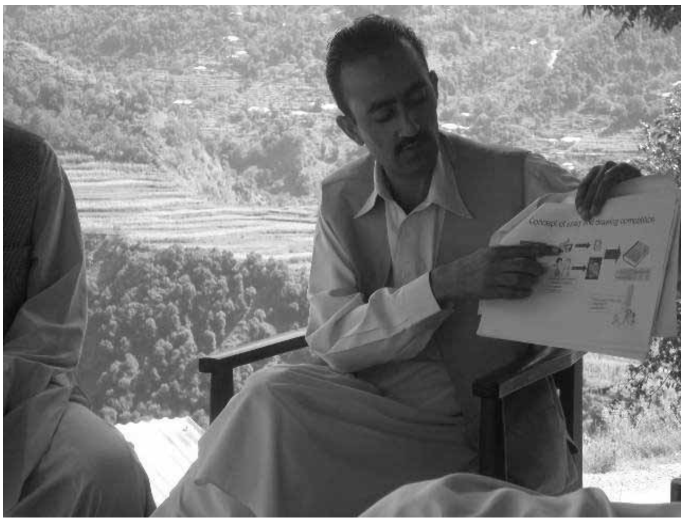


Guidelines provides 1) How to conduct competition and 2) how to utilize textbook. School teachers can use the guidelines to implement disaster education in their schools even if they do not have specialized knowledge on disaster management.

16. Necessary process to implement

Instruction to teachers

Before conducting competitions, teachers need to understand purpose of the activities. Education department, local NGO, or other specialized organization should provide instruction.



Instruction to students

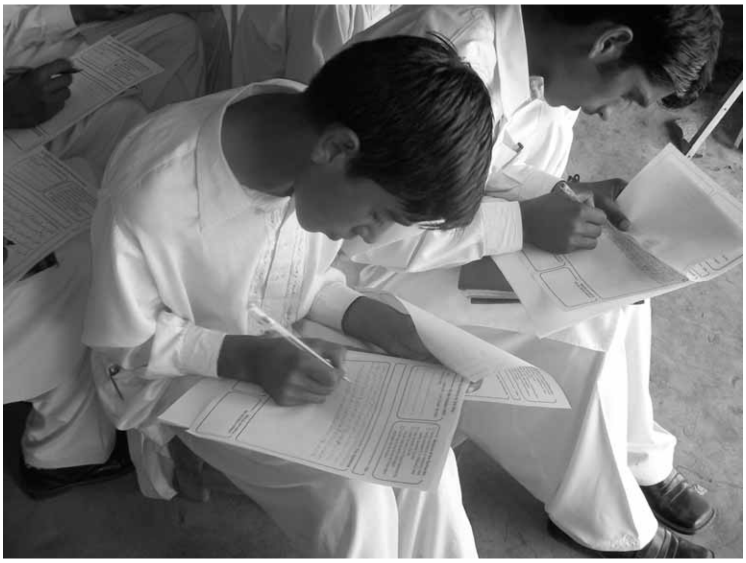
Students also need to know purpose of competition. It is preferable that teachers give instruction.

Group discussion

Before writing essays and drawing, it is better to have group discussion. Through group discussion, students can remember what happened in disaster situation and can write their own specific experience. In addition, group discussion contribute to raising cooperation with other people.

Writing essays and drawing

Students write essays and drawings. It is hoped that students write their own specific disaster experiences. General experiences are easy to imagine for future children. But many problems which is difficult to imagine happen when disasters occur. Specific problems are needed to be written to understand actual disaster situation.



Development of education materials

Essays and drawings need to be kept for future children in order to understand past disasters.

17. Strength and limitations

Strength

Essays and drawing competition is a tool to share experiences and to transfer them to future generation. It is not difficult to conduct these competitions. Therefore, any teachers can conduct competition as a part of school education and a part of disaster education.

Limitation

Competition is one of awareness raising program and is not program to provide knowledge on disaster management or natural hazards.

In the competition, students are requested to write their own disaster experiences. It means that students need to have experiences. Therefore, this technology can be applied in disaster affected areas but developed manual (textbook and guidelines) can be utilized in any areas.

18. Lessons learned through implementation if any

Combination of competition and disaster education was the first experiences for teachers in the affected area of Pakistan Earthquake of 2005. It was great opportunities for teachers to realize that extra curriculum can be utilize as disaster education and that they can conduct disaster education by themselves.

Students enjoyed competition. It is very important to implement disaster education, especially awareness raising.

VI. Resources required

19. Facilities and equipments required

Essay competition

- Pen
- Essay sheet
- Drawing competition
- Drawing tools
- Drawing sheet

20. Costs, organization, manpower, etc.

To give instruction, local organization is necessary. But competition can be implemented by schools without any large help from outside.

To implement this technology, it does not cost much. When schools conduct, they need to prepare some facilities to have competitions.

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that is shown to be effective based on case studies/experiments in field sites.

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
Promotion of School Disaster Education in Affected Areas

E1-2. Place
Two schools in Tehsil Bagh, AJK, Pakistan (affected area of Pakistan Earthquake of 2005)

E1-3. Year
2008

E1-4. Investor
Hyogo Earthquake Memorial 21st Century Research Institute

E1-5. People involved
Koichi Shiwaku, Research Fellow, EDM-NIED
Muhammad Shakeel, President of STAR Foundation
Yukiko Takeuchi, Lecturer, Kyoto University
Rajib Shaw, Associate Professor, Kyoto University

Ayako Fujieda, PHD student, Kyoto University
Jishnu Subedi

students
school teachers
local NGO staffs

E1-6. Monetary costs incurred

E1-7. Total workload required
Planning: 2 month
Arrangement by local NGO (1 month)
Implementation (competition): 2 days (1 day in one school)
Development of textbook and guidelines: (3 month)

E1-8. Evidence of positive result
Local NGO and teachers acquired ability to conduct disaster education. Students can share experiences of Paksitan Earthquake of 2005 among them.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:
> essay_drawing_competition.JPG (JPG - 100 Kb)
> SANY1161.JPG (JPG - 599 Kb)
> SANY1165.JPG (JPG - 535 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 49)

I. Heading

1. Title

Hazards Mapping and Assessment for Effective Community-based Disaster Risk Management or "READY" Project

ID:	DRH 49
Hazard:	Multi-hazard, Other
Category:	Process Technology (PT)
Proposer:	Renato Solidum
Country:	PHILIPPINES;
Date posted:	30 March 2009
Date published:	15 October 2009

Contact
Ms. Lenie Duran-Alegre
Civil Defense Officer/Project Monitoring Officer
Office of Civil Defense- National Disaster Coordinating Council
Department of National Defense
Camp General Emilio Aguinaldo, Quezon City, 1110 Philippines
e-mail: lenie017522@yahoo.com
Telefax nos: +632 9120441, 9125947

Dr. Renato U. Solidum, Jr.
Director, Philippine Institute of Volcanology and Seismology, Department of Science and Technology
Department of Science and Technology
CP Garcia Avenue, University of the Philippines Campus
Quezon City, 1101 Philippines
e-mail: solidr@phivolcs.dost.gov.ph
Tel :+632 9262611, Fax :+6329298366

2. Major significance / Summary

The project addresses the problem of disaster risk management (DRM) both at the national and local level. At the national level, the project aims to institutionalize and standardize DRM measures and processes by different organizations involved in the Project while management of the timing of project implementation and engagement with local government has been taken cared of. At the community level, it will address the availability of hazards maps, the lack of community based hazard monitoring and warning systems and the need to build up the capability of community leaders to implement activities and measures for disaster reduction. It also empowers the most vulnerable municipalities and cities in the country and enables them to prepare disaster risk management plans. The project develops a systematic approach to community based disaster risk management thru: (1) scientific multi-hazard mapping as the first step to risk assessment; (2) community based disaster preparedness and (3) initiation of mainstreaming of disaster risk reduction into the development planning process of the local government units. The Project targets 27 high risk provinces in the country to natural hazards.

3. Keywords

Multi-hazards mapping, community based disaster preparedness, community-based flood early warning systems (CBFEWS), community-based tsunami early warning system (CBEWS for Tsunami), Information, Education and Communication (IEC), Rapid Earthquake Damage Assessment Software (REDAS), disaster risk reduction (DRR), disaster risk management (DRM)

II. Categories

4. Focus of this information
Process Technology (PT)

5. Anticipated Users
5-1. Practitioners: Community leaders (voluntary base), Administrative officers, Experts, Architects and engineers, Information technology specialists, Others
5-2. Other users: Policy makers, Motivated researchers, Local residents

6. Hazards focused
Multi-hazard, Other
Multi-hazard covered by the Project refers to the following: A: Geological Hazards: Earthquake-related hazards: ground rupture, ground shaking, liquefaction, earthquake-induced landslide and tsunami. Volcanic-related hazards: pyroclastic flows, lahars
B: Hydro-meteorological hazards: rainfall-induced landslide, flooding/flashfloods and storm surge

7. Elements at risk
Human lives , Human networks in local communities , Business and livelihoods , Infrastructure , Buildings , Information and communication system , Urban areas , Rural areas , Coastal areas , River banks and fluvial basin , Mountain slopes , Agricultural lands , Cultural heritages
All the elements at risk identified above are included. Natural disaster knows no bound and limits, thus, its inclusion.

III. Contact Information

8. Proposer(s) information (Writer of this template)
Ms. Lenie Duran-Alegre
Civil Defense Officer/Project Monitoring Officer
Office of Civil Defense- National Disaster Coordinating Council
Department of National Defense
Camp General Emilio Aguinaldo, Quezon City, 1110 Philippines
e-mail: lenie017522@yahoo.com
Telefax nos: +632 9120441, 9125947

Dr. Renato U. Solidum, Jr.
Director, Philippine Institute of Volcanology and Seismology, Department of Science and Technology
Department of Science and Technology
CP Garcia Avenue, University of the Philippines Campus
Quezon City, 1101 Philippines
e-mail: solidr@phivolcs.dost.gov.ph
Tel :+632 9262611, Fax :+6329298366

9. Place where the technology/knowledge originated
PHILIPPINES;
Manila, Philippines

10. Names and institutions of technology/knowledge developers
Philippine Institute of Volcanology and Seismology (PHIVOLCS)
Philippine Atmospheric, Geophysical and Astronomical Administration (PAGASA)
Mines and Geosciences Bureau (MGB)
National Mapping Resource and Information Authority (NAMRIA)
Office of Civil Defense (OCD)

11. Title of relevant projects if any
Strengthening the Disaster Preparedness Capacities of the Municipalities of Real, Infanta and Nakar from Geologic and Meteorological Hazards (REINA Project)

12. References and publications

13. Note on ownership if any

The Project is owned by the Government of the Philippines

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

The Philippines was hit by successive four (4) tropical cyclones (Tropical Storm Muifa and Merbok, Tropical Depression Winne and Typhoon Nanmadol) in November and December of 2004. The affected areas were Visayas Islands and Luzon Island. The tropical cyclones triggered floods/flashfloods and landslides and together with the associated strong winds caused destruction and damage to homes, community buildings, agricultural crops, critical infrastructures and lifelines. The total affected population reached 3.6 million and damages to facilities, infrastructures and agriculture, excluding damaged and destroyed houses, amounted to US$ 78.2 million. One of the most severely affected areas is the triangular low-lying plain east of the Sierra Madre mountain range in Quezon province, where the municipalities of Real, Infanta and General Nakar (known as REINA) are located. Hundreds of people died in these areas because of landslides and flashfloods. The Government of the Philippines sought the assistance of UN Country team to help the Philippine government in its continued rigorous implementation of DRM and DRR programs, thus, the smaller scale REINA Project covering the three Quezon towns was started with similar aims as the scaled up and currently implemented READY Project.

V. Description

15. Feature and attribute

The Project aims to provide immediate, reliable information on the various geological and hydro-meteorological hazards that threaten communities. It is also meant to equip key stakeholder groups, particularly those in the target disaster prone areas, with capacities to prepare for and cope with the impact of natural disaster, strengthen coordination processes and procedures for effective risk reduction and start the process of mainstreaming risk reduction into local development planning. The project uses a multi-hazards, multi-disciplinary and multi-sectorial approach involving national government organizations and local governments. The Project is implemented by the National Disaster Coordinating Council (NDCC through the Office of Civil Defense as the executing agency with the Collective Strengthening of Community Awareness for Natural Disasters (CSCAND- a sub-committee on Preparedness of NDCC) Technical Working Group (TWG) headed by PHIVOLCS with PAGASA, MGB and NAMRIA as members. The CSCAND TWG members are the responsible agencies to deliver the required outputs of the project. In addition, at the local level, a Local READY Team, composed of regional or local employees of the involved national government agencies and representatives of local government, is also organized to follow-up activities and assists in the coordination aspect of the Project. Further sustainability is ensured with the assistance and institutionalization of the Local READY Team.

16. Necessary process to implement

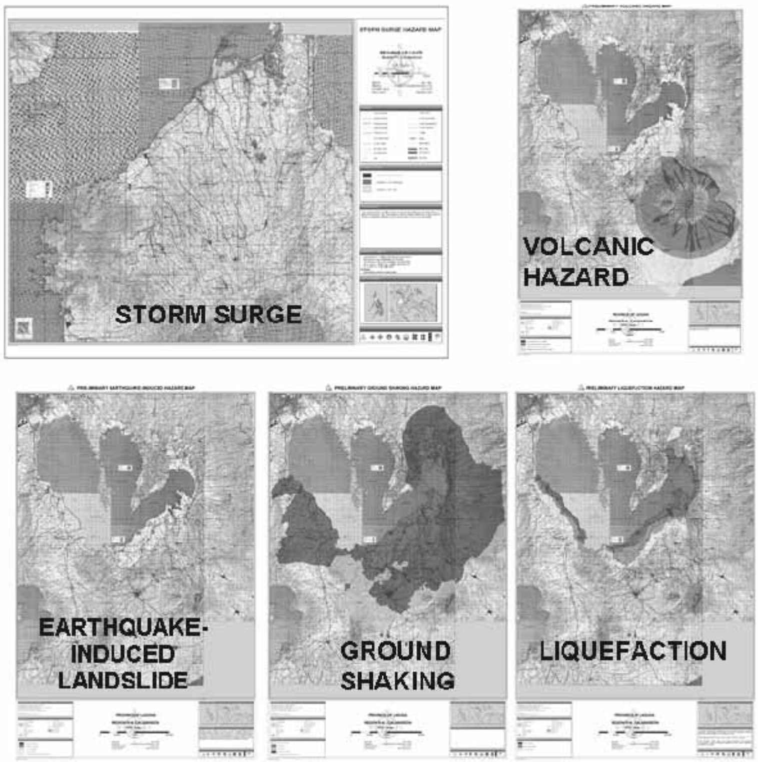
Component I. Multi-hazard identification and assessment (maps are targeted to be produced for the 27 target provinces in the country)

The natural hazards posing threat to concerned communities are documented in the form of multi-hazard maps. The mapping exercise involve the following process:

1. Table top analysis of the study area, including aerial photo and topographic map interpretation, remote sensing data analysis, mathematical modeling (especially for ground shaking, storm surge and tsunami hazard mapping) and literature research;
2. Production of preliminary hazard data interpretation and sometimes maps of these areas;
3. Field verification. Involves interviews with local residents to gather local knowledge about the concerned hazards, checking out of the landforms and geologic features to verify initial table top interpretation and conduct of surveys using various scientific, geodetic and rock/soil testing equipment.
4. Transformation of findings into preliminary hazard maps. Multi-hazard maps such as (1) earthquake-related hazards at 1:50,000 scale (i.e. ground rupture, ground shaking, liquefaction, earthquake-induced landslide and tsunami) (2) volcanic hazards also at 1:50,000 scale, (3) hydro-meteorological hazards, such as rain-induced landslide, floods/flashfloods both at 1:10,000 scale and storm surge at 1:50,000 scale are put into paper and digital form.
5. Peer review by the multi-agency mapping group (PHIVOLCS, PAGASA, NAMRIA and MGB) with the executing agency.

The accepted results are further transformed into digital format and integrated by NAMRIA. The integrated maps will then be presented to concerned local government units (LGUs) through the conduct of IEC campaign. Updates and further technical comments are then integrated for the finalization and printing of the maps for further information and distribution to target LGUs, government offices and decision-makers.

The following are examples of the finished multi-hazard maps:

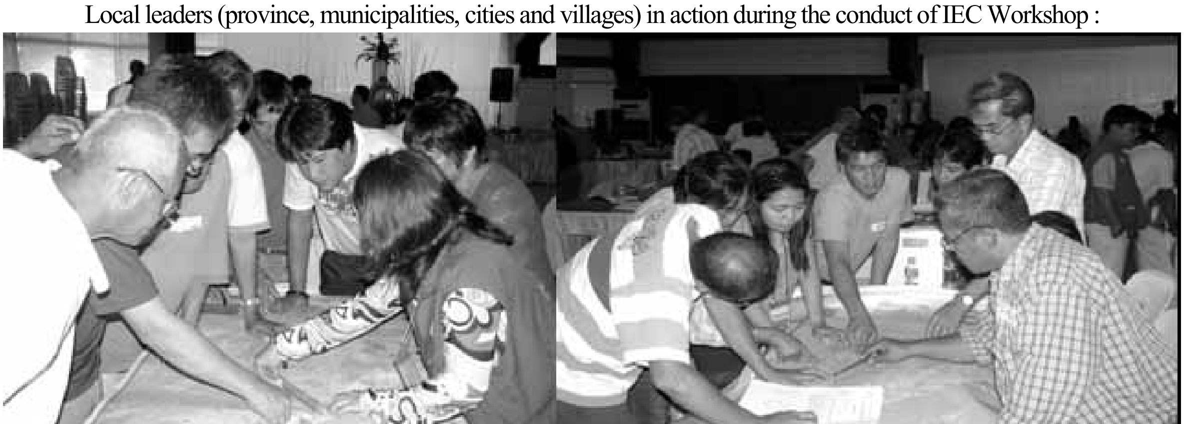


Component II: Community-based Disaster Preparedness

1. Development of Information, Education and Communication (IEC) strategies and materials for specific target groups

The Project's mapping result is presented to the concerned local government units (LGU) for their information and the maps itself are used for disaster risk management and development planning. In preparation to the IEC event, LGU coordination is done, the maps undergo peer review, dry run for lectures are done, conduct of IEC proper with media/press beefing/conference and the review/report of activity is finally done.

Local leaders (province, municipalities, cities and villages) in action during the conduct of IEC Workshop :



The Project also produced IEC materials, such as posters and flyers, with standard design and format and using the simplest of the technical terms for each hazards. Below are samples of such materials:

2. Establishment of Community-based Early Warning System

The community based early warning systems (CBEWS) for floods and tsunami is a cheap, non-structural mitigating system that empowers the concerned community to plan and act in the event of sudden onset events like floods/flashfloods and tsunami.

In all CBEWS activities, memoranda of agreements are forged between READY agencies and local communities for sustainability. Under the said agreements, the LGUs provide financial allocations for the operation and maintenance of the CBEWS to ensure the systems' sustainability.

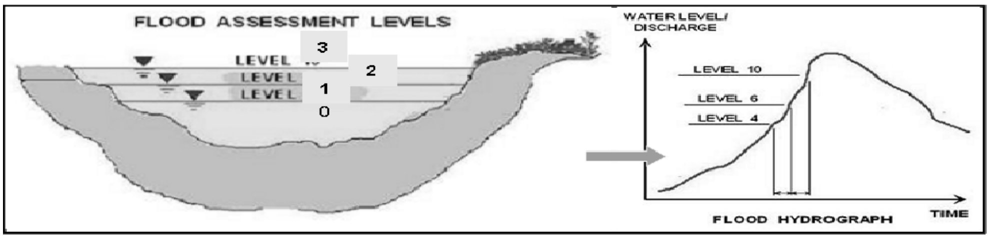
A. Community-based Flood early Warning System (CBFEWS)

For floods, a community based and river basin approach is employed and a network of rainfall and water level monitoring gauges in the river basin of concern is installed. The communities occupying each basin are linked together in one CBFEWS with strategically installed rain gauges and water level monitoring system.

The warning set up is based on source, path and depositional area. Site survey, installation of monitoring facilities, measurement of the depth or carrying capacities of rivers to establish flood warning levels, on-site and formal training of observers and volunteers and dry run or pilot testing of the system thru a flood drill with the flood prone communities are the procedures and activities undertaken. Volunteers identified by the LGU officials are mobilized to conduct readings. The volunteers/observers are trained to observe and transmit the data to the Disaster Operation Centers (DOC) of the city/municipality/village. The observed data are the basis for the LGUs to issue flood warnings, together with the weather forecasts for the local PAGASA (weather agency) station.

Issuance of warnings will be based on:

1. Assessment water levels



	Water Level	Meaning	Flood Warning
Level 1	**1.1 m**	**Awareness**	**READY**
Level 2	**1.5 m**	**Preparedness**	**GET SET**
Level 3	**2.0 m**	**Response**	**GO**

2. Threshold values of rainfall

Rainfall Values	Meaning	Flood Warning
Continuous rainfall with rainfall observation of 15mm - 20mm/hr	Awareness	READY
Rainfall observation is (60mm – 80mm)/3hrs	Preparedness	GET SET
Continuous rainfall for the last three hours and 3-hourly observation is 80mm/3hrs	Response	GO

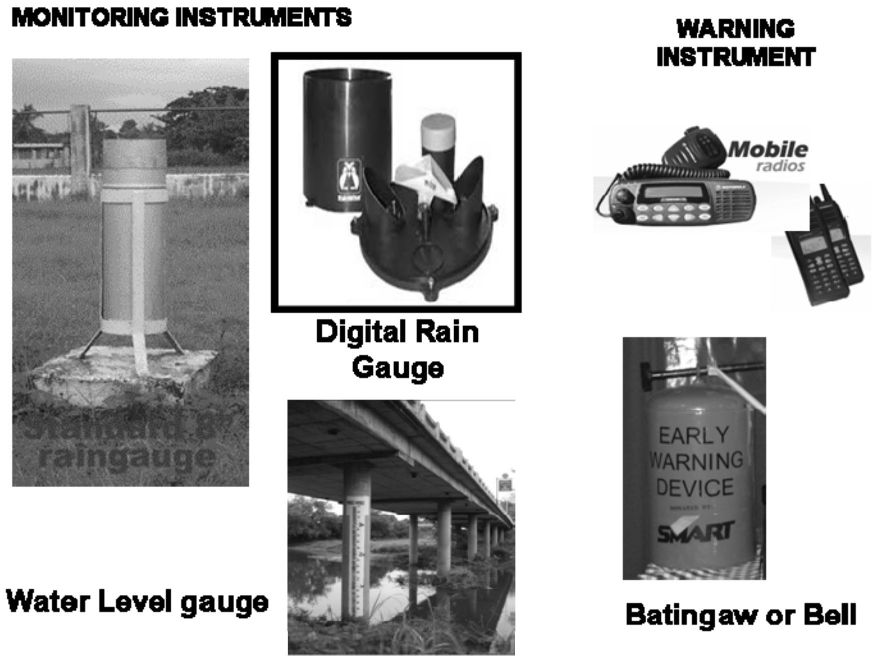
In brief, the major activities undertaken are:

(1) Consultation Meeting with LGUs where the benefits of a CBFEWS, activities to be undertaken in the implementation phase, role & responsibilities of stakeholders and the agreement on the establishment of the CBFEWS are all explained to the LGU concerned.

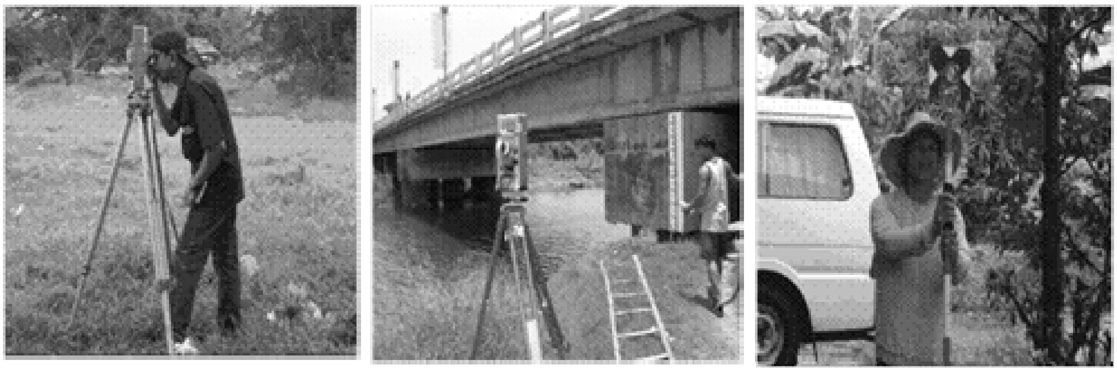
(2) Ocular survey of Proposed Sites

Sample of the result of site survey where strategic location of rainfall and tide monitoring stations are identified

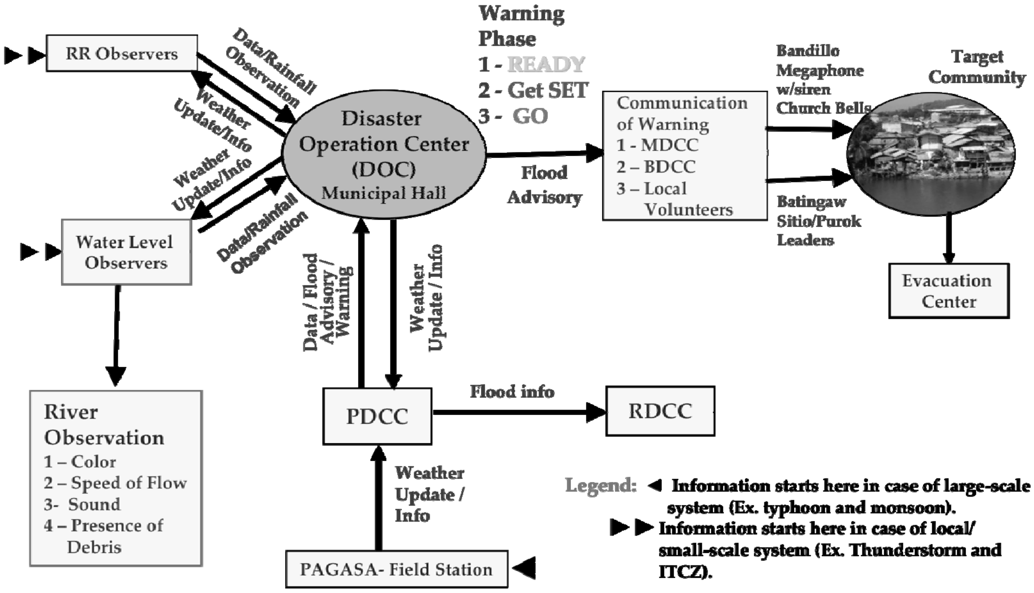
3. Installation of Monitoring and Warning Instrument



4. Hydrographic Survey is composed of leveling and cross-sectioning of rivers and river flow measurements.



5. Drawing-up of Information Dissemination Network



6. Dry Run on the Operation of the CBFEWS and Community Drill

7. Ceremonial MOA signing & Turnover of the CBFEWS to LGUs

The READY Project implements a community based EWS that:
- involves institutions, instrumentation & community
- people centered
- cheap flood mitigating measure

The success of an EWS is implicit in the operative capability and the response of the community which operates it.

B. Community-based Early Warning System for Tsunami

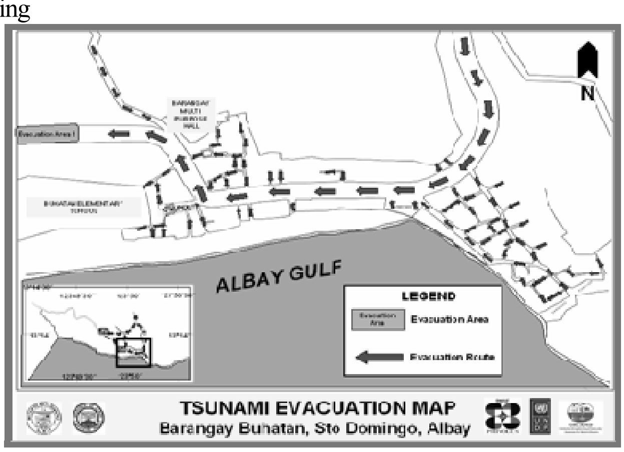
For tsunami CBEWS, hazards and risk assessment, evacuation planning, installation of tsunami signage, IEC campaign and tsunami drills are undertaken in pilot sites recommended by the experts in consultation with officials in concerned LGU. Preparatory activities involve site suitability assessment involving site investigation, gathering of community maps, identification and evaluation of evacuation sites and routes and determination of tsunami signage location. IEC campaigns are conducted a few days before the tsunami drill. Basic information about earthquake and how it generates tsunami and preparedness activities are taught during these IEC. The whole community is enjoined to be involved in the actual evacuation. Conduct of an on-site assessment of the results of the activity for purpose of improving the effectiveness of the exercise is done immediately.

A set of preparedness activities that teaches a barangay basic tsunami information and appropriate response to its hazard, includes:

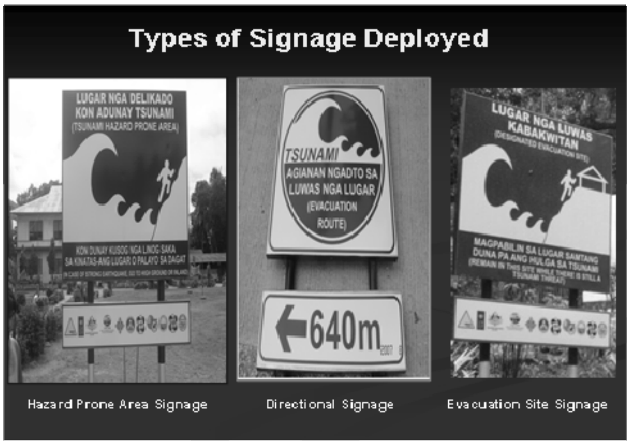
1. Table top analysis for tsunami modeling using the Rapid Earthquake Damage assessment software developed by local scientists at the PHIVOLCS
2. Coordination Meetings with the LGUs
3. Pilot Site Selection based on the following criteria:
    a. High tsunami hazard
    b. No other fluvial hazards (flooding from adjacent major river)
    c. Elevated, open area (possible evacuation site)
    d. Access routes (simple barangay layout; wide or uncluttered roads)
    e. Emplaced warning system
    f. Size of population (moderate-size or <1,000 -3,000)
    g. Largely residential areas (for maximum participation)
    h. Venue for IEC
    i. Security (of CBEWS implementers
    j. Willingness of LGU (Mayor of town//Barangay [village] captain)
    k. Local politics situation

Tsunami evacuation site survey in Brgy Barobaybay Lavezares, Northern Samar

4. Tsunami Evacuation Planning



5. Development & Installation of Signage (3 kinds) & Batingaw (bell)



6. Tsunami IEC

7. Tsunami Evacuation Drill

8. Tsunami Drill Assessment & Evaluation

C. IEC campaign conducted for 27 provinces

The READY Project Team are directly responsible for the design and publication of facts about the natural hazards in the country. Standard format and design for the posters and flyers were established. Mapping results and IEC materials are disseminated in a province-wide conduct of IEC campaigns.

D. IEC materials on disaster risk mitigation produced and disseminated to 27 provinces and

E. Hazard signed (i.e. floods, tsunami, landslide and rock fall) installed in 27 target provinces

Outcome 3:

1. **Develop LGU capacity to integrate risk reduction in development planning though the use of risk assessment tools like REDAS**

The REDAS (Rapid Earthquake Damage Assessment System) is a seismic hazard and risk assessment software developed by PHIVOLCS-DOST that can produce hazard and risk information which can guide disaster managers in assessing the potential impact and appropriate response immediately after the occurrence of a strong earthquake or in establishing earthquake scenarios. Although originally designed for earthquake hazards assessment, other hazard maps, such as those produced under the READY project are easily incorporated into the REDAS Software. The software also contains a database of earthquake occurrences in the Philippines and also of available data of elements at risk such as location of population centers, houses, roads, bridges, schools and other critical facilities. The database on exposure can be updated easily by local governments. Thus, the software is a tool that can be used not only by disaster managers in planning for preparedness, response or mitigation activities but also by development planners in integrating hazards and risk information in land use and development planning.

A five-day training course is conducted by PHIVOLCS for provincial and city or town development planners and disaster managers under the READY project. An introduction on the local hazards and how the software can be used in integrating hazards and risk information in planning through case studies are given prior to actual detailed lectures and hands on use of the software. The participants are also taught how to map exposed elements (at risk) in the field by GPS and how the update the exposure data base in the software.

17. Strength and limitations

Availability of national and local experts both in the scientific field and DRM.

Local politics oftentimes sets back the smooth implementation of the Project

The project can only become sustainable if it is supported by both local and national government thru mainstreaming in its programs and allocating appropriate financial requirement thereof.

18. Lessons learned through implementation if any

Multi-hazard approach and tapping expertise of multi-agencies are effective tools in hazard mapping and for conducting public education campaigns.

Development of sustainable community-based early warning systems especially for sudden-onset natural hazards is an effective way to empower communities in disaster risk mitigation. Nurturing of stakeholders at the local level, however, by concerned agencies during the course of Project implementation is needed.

Effective and sustainable DRM in the community level must always have LGU support to succeed;

Local technical expertise exists in the field of hazard mapping;

It is best to tap local experts for IEC campaigns as they are more familiar with local needs and can relate more with local people; and

It is important to tap non government organizations (NGO) in ensuring sustainable disaster risk mitigation efforts.

VI. Resources required

19. Facilities and equipments required

An institutionalized project management office and working offices of the experts are needed with the corresponding functional working stations for data processing and simulation. Mapping equipment such as micro-tremor instrument, global positioning system (GPS) usually hand-held, and various geodetic and rock/soil testing equipment are needed. Rain gauges (automatic and manual), IT equipment and software are also required.

20. Costs, organization, manpower, etc.

The Project total estimated cost is US$ 1.9 million. There are primarily five government organizations involved ie. OCD, PHIVOLCS, PAGASA, MGB and NAMRIA. These are the mandated and technical agencies involved in disaster risk management/disaster risk reduction. Mapping of one hazard in a province necessitates 60 man-days. Conduct of IEC days ranges from one week –two weeks depending on the number of villages the province has. Establishment of community based early warning systems for floods and tsunami are community coordination intensive. The establishment usually runs from 2-3 months.

VII. Message from the proposer if any

21. Message

Natural disasters know no bounds and limits, but, preparing our communities for its ill-effects is our responsibility regardless of culture and ethnicity. Thus, this project is in response to the need for a more rational and effective basis for contingency and long term development planning and most importantly, increasing the capacities of our communities to prepare for and respond to natural disasters and ultimately, getting out of harms way.

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

This project is most applicable to communities which are prone to natural disaster because of its geologic setting like the Philippines.
Most specifically, for developing countries where DRM and DRR has been starting to gain momentum side by side with Climate Risk Reduction.

IX. Application examples

No.1

E1-1. Project name if available
READY Project started its implementation in 2006 and its on-going and targeted to be finished by 2011

E1-2. Place
27 high risk provinces in the Philippines, finished and on-going provinces are the following: Surigao del Sur, Surigao del Norte, Leyte, Southern Leyte, Bohol, Aurora, Cavite, Pampanga, Laguna, Northern Samar, Eastern Samar, Zambales, Ilocos Sur

E1-3. Year
2006-2011

E1-4. Investor
United Nations Development Programmed (UNDP) Philippines
Australian Agency for International Development (AusAID)

E1-5. People involved
General Glenn J Rabonza (Project Manager), Officers and Staff of OCD
Director Renato U. Solidum, Jr, Officers and Staff of PHIVOLCS
Director Prisco D Nilo, Officers and Staff of PAGASA
Director Horacio Ramos, Officers and Staff of MGB
Undersecretary Diony Ventura, Officers and Staff of NAMRIA

E1-6. Monetary costs incurred
US$ 1.9 million for the estimated Project costs excluding work stations, salaries and emoluments of government employees involved as these are the counterpart of the Philippine Government

E1-7. Total workload required
Please refer to the details in items no. 19 and 20

E1-8. Evidence of positive result
Outputs of the project (attached as pictures) and awareness and preparedness of the people in the communities covered and the possible numbers of lives save and properties protected because of the knowledge and technology imparted by the Project are the intangible outputs and results/evidenced by the Project.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:

> 091011_READY_figure2-1.png (PNG - 408 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

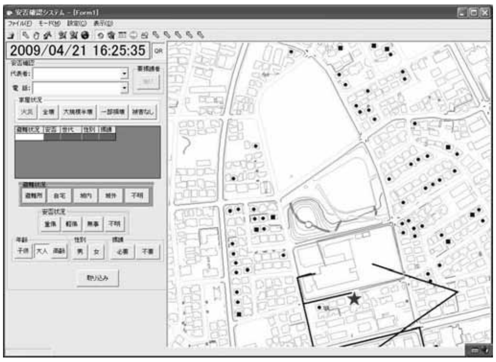
DRH-Asia Contents (DRH 50)

I. Heading

1. Title

Safety Confirmation System using GIS and QR code

ID:	DRH 50
Hazard:	Earthquake
Category:	Implementation Oriented Technology (IOT)
Proposer:	Koichi Shiwaku
Country:	JAPAN;
Date posted:	20 April 2009
Date published:	09 June 2009



System interface

Contact
Koichi Shiwaku (Research Fellow, EDM-NIED)
Mitsuaki Sasaki (Research Fellow, EDM-NIED)
Shigeru Kakumoto (Visiting Researcher, EDM-NIED)
Takashi Furuto (Research Fellow, EDM-NIED)

shiwaku@edm.bosai.go.jp

2. Major significance / Summary

When disaster occurs, community people need to help each other. The proposed system using spatial temporal GIS and QR code help community cooperation in disaster situation especially, response. The system help to collect safety information of each person and identify who need rescue or help promptly.

3. Keywords

Spatial Temporal GIS, QR code, safety confirmation, IT, community, response

II. Categories

4. Focus of this information

Implementation Oriented Technology (IOT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.)
5-2. Other users: Local residents

6. Hazards focused

Earthquake

7. Elements at risk

Human lives

III. Contact Information

8. Proposer(s) information (Writer of this template)

Koichi Shiwaku (Research Fellow, EDM-NIED)
Mitsuaki Sasaki (Research Fellow, EDM-NIED)
Shigeru Kakumoto (Visiting Researcher, EDM-NIED)
Takashi Furuto (Research Fellow, EDM-NIED)

shiwaku@edm.bosai.go.jp

9. Place where the technology/knowledge originated

JAPAN;

10. Names and institutions of technology/knowledge developers

Shigeru Kakumoto, Mitsuaki Sasaki, Takashi Furuto, and Koichi Shiwaku (EDM-NIED)

11. Title of relevant projects if any

12. References and publications

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

Kobe Earthquake occurred in 1995 at Kobe, Hyogo Prefecture, Japan. More than 6,000 people died. Many people out of 6,000 people died because of house collaptions. Meantime, most of people under collapsed houses were rescued by community people. This experience is one of the lessons of Kobe Earthquake. Community people play important roles for disaster reduction.

In disaster situation, police or self defense force have difficulties to provide sufficient rescue services because of too many injured persons or traffic problems (road problems). Community people have to survive by themselves especially soon after disasters occurs.

V. Description

15. Feature and attribute

DiMSIS (Disaster Management Spatial Information System) is a one of GIS. The characteristic of DiMSIS is that DiMSIS is spatial temporal GIS. It means that DiMSIS can cope with temporal data as well as spatial data.

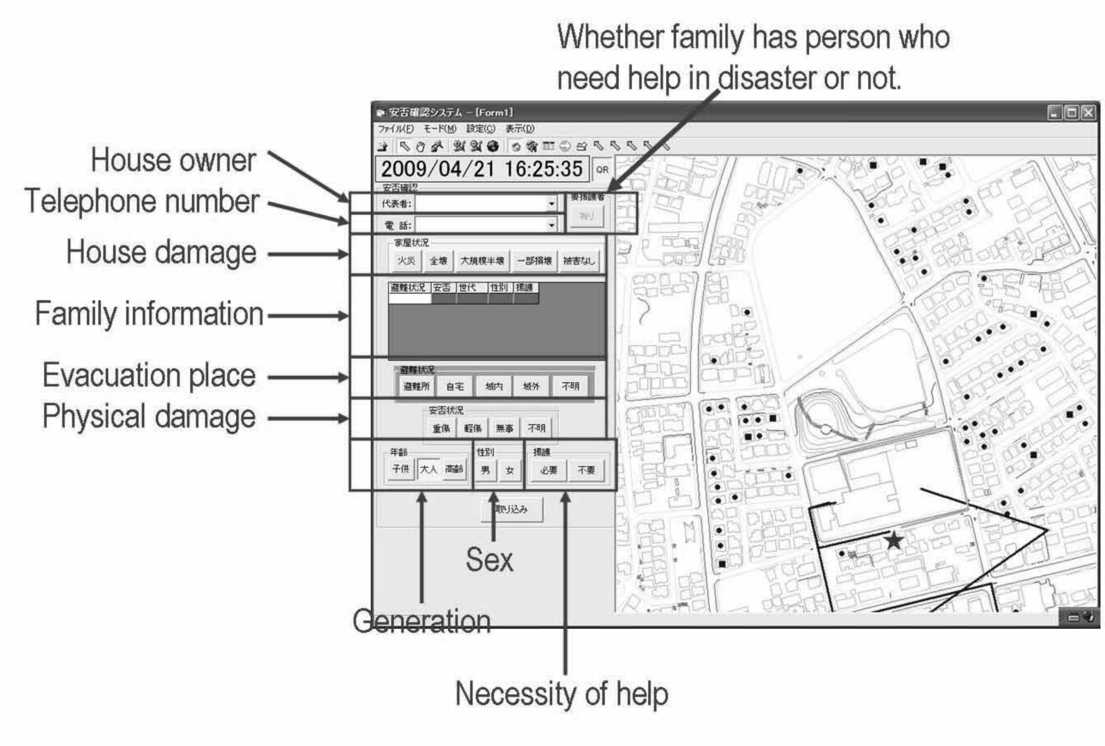
To provide prompt and effective rescue activities, it is necessary for community people to understand who need rescue or help where when. But it is difficult to find such people directly in disaster situation. In case of Japan, people are requested to visit evacuation center (e.g. schools) after disasters. If it is identified who come to evacuation center, it is identified who are not in evacuation center. People who are not in evacuation center are mainly divided into two types;

1) people who need rescue and can not come to evacuation center

2) people who are outside affected area and can not come to evacuation center.

It is the concept to develop safety confirmation system. The most important thing on system development is how system can collect information (who are in evacuation center) promptly and how system can show results effectively.

As mentioned above, DiMSIS is spatial temporal GIS. If results show on map properly, it is effective for people to rescue promptly.



Database has linking between house owner and location (coordinates) of his/her house. When people come to evacuation center, system user asks them about family information or any damages and enter information by clicking corresponding information (refer to the above figure). But it is difficult for system user to enter information promptly and accurately when many people come to evacuation center.

To collect information promptly, QR code is utilized. QR code is a kind of bar-code.

The above card with QR code is distributed to each house before disaster occurs. This QR code has coordinate of each house which can be available in the system. Reading the QR code by bar-code reader, location of each house and name of house owner can be identified in the system and shown on map and interface to enter other information.

To enter other information, QR code is also used in order to enter information fast, compared to clicking. Following figures are the sheets to enter damage information or family information.

These sheets are used after identification of family (house owner) through reading QR code of the card distributed to each family. Mouse is not used if QR code is utilized. QR code can reduce time to enter information.

In addition to the function of safety confirmation, the system has following functions;

- Rescue management (who visit where and when with what): This function is human resource management and rescue tools management.
- Identification of passable route: When system user asks people about damages, he/she also asks which route was used to come to school. This function records which route can be passable or not.
- Counting: Through reading QR code in evacuation center, it is identified who came to evacuation center. Counting function shows status of people (e.g. number of people in evacuation center, number of people who need help, and other)

16. Necessary process to implement

Development of user-friendly system

The user of the proposed system is local community in disaster situation. All of local people are not specialist of information technology. Therefore, complicated operation or handling should not used in system. System developers need to know which kind of interface is user-friendly or which operation is easier for user through discuss with persons who are not familiar with information technology or computer.

User training

The concept of system development is that anybody can use the system easily. But it does not mean that anybody does not need instruction. In disaster situation, system developer is not in affected area. Local community have to use system soon after disasters. Therefore, user training is necessary before disasters. But long time training is not necessary. If such training is necessary, system should be modified. Photo below shows training by EDM-NIED. Trainees are house wife and elderly person. They are not so familiar with using computer daily life.

Understand of QR code by local community

It is possible to enter information without QR code. But QR code is effective to enter information effectively. Local community needs to understand how QR code works in the system and are requested to keep QR code with them always. Evacuation training is one of opportunities for local community to understand the system and QR code.

17. Strength and limitations

Strength

- In emergency situation, infrastructure may be collapse down. In such situation, internet may not be available. Web GIS or Web system can not work in such situation. The system proposed is stand alone and not connecting to network. Even if network is stopped in disaster situation, the system works properly.
- The system is easy to use for local people although short training is necessary.
- It is easy and fast to enter information if QR code is used. Only bar-code reader and PC are necessary.

Limitation

- If people do not come to evacuation center or send information to system, the system can not work effectively. It means that people can not find people who need rescue or help.
- To utilize QR code in disaster situation, people are requested to keep QR code always in daily life although it is possible to enter information by clicking.
- QR code has coordinate of each house. The coordinate can work in only the system. But some people in Japan hesitate to have QR code because they think QR code is private information and the coordinate may be abused.

18. Lessons learned through implementation if any

The system was tested in a part of community disaster management training (refer to application examples). Through the training, awareness on disaster reduction was raised as well as enhancing understand of QR code and the system.

VI. Resources required

19. Facilities and equipments required

- PC which DiMSIS and the system are installed
- Bar-code reader
- Card with QR code which is distributed to each house owner

20. Costs, organization, manpower, etc.

- Bar-code reader: 600-700 US$
- The system: the system is output of the research. If necessary, the system can be installed by free. (Spatial Temporal GIS is developed by NIED. Software fee is free for non-commercial use.)

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has fair applicability demonstrated by implementation in one or more field sites.

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
This is not any project. Local community conducted community based disaster management training once a year. EDM-NIED helped the training and tested the system according to request of local leader.
Training is one day (2-3 hours).

E1-2. Place
Katsura Elementary School, Yokohama, Kanagawa, Japan

E1-3. Year
2007

E1-4. Investor

E1-5. People involved
- Community organization
- EDM-NIED
- Local community

E1-6. Monetary costs incurred

E1-7. Total workload required
When the training started, local community come to school. It is a situation that people come to evacuation center when disaster occurs. The system users (local trained persons) read QR code at the entrance of school and enter information of each house through asking to local people.

In the training, EDM-NIED provided lecture with local community. The system aims to help effective response activities. In other words, the system can work in response duration. In the lecture, EDM-NIED emphasized importance of mitigation and preparedness and the system can just help response. In addition, it was told to local people how and when the system work effectively and how local people act in disaster situation.

E1-8. Evidence of positive result
Before the training, most of local people did not know this kind of system and it was the first time for them to participate in training using the system. Through the training, many people were interested in the system and QR code. This is important result as the first step to introduce the system to community.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:
> map.jpg (JPG - 358 Kb)
> SANY1307.JPG (JPG - 658 Kb)
> Photo020.jpg (JPG - 2676 Kb)
> interfacetoenterinformation.jpg (JPG - 122 Kb)
> systeminterface002.jpg (JPG - 166 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 51)

I. Heading

1. Title

Effective International Communication Method with Video Conference Network System

ID:	DRH 51
Hazard:	Multi-hazard, Other
Category:	Process Technology (PT)
Proposer:	Tatsuo Narafu
Country:	INDONESIA; JAPAN; NEPAL; PAKISTAN; TURKEY;
Date posted:	20 May 2009
Date published:	09 June 2009

Video conference

Contact
Tatsuo Narafu
Senior Advisor, Japan International Cooperation Agency (JICA)
(formerly) Senior Coordinator for International Cooperation, Building Research Institute (BRI)
tatsuozzz@gmail.com

2. Major significance / Summary

International communication requires a lot of time and money if we employ conventional ways like meeting in person. Video conference network system offers a great possibility to save them. Building Research Institute (BRI) applied this tool for international collaborative research project on earthquake disaster mitigation from 2006 to 2008 with four countries and proposes an effective method based on our experiences.

3. Keywords

Video conference network system, international communication, international collaboration, save time, save money

II. Categories

4. Focus of this information

Process Technology (PT)

5. Anticipated Users

5-1. Practitioners: Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.), NGO/NPO project managers and staff, International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Commercial entrepreneurs, Experts, Architects and engineers, Sociologists and political economists, Information technology specialists, Urban planners, Rural planners, Environmental/Ecological specialists, Others
5-2. Other users: Policy makers, Motivated researchers

6. Hazards focused

Multi-hazard, Other
This method is a communication technology applicable for any kind of international communication

7. Elements at risk
Others
This method is a communication technology applicable for any kind of international communication

III. Contact Information

8. Proposer(s) information (Writer of this template)
Tatsuo Narafu
Senior Advisor, Japan International Cooperation Agency (JICA)
(formerly) Senior Coordinator for International Cooperation, Building Research Institute (BRI)
tatsuozzz@gmail.com

9. Place where the technology/knowledge originated
INDONESIA; JAPAN; NEPAL; PAKISTAN; TURKEY;
Conference rooms with video conference facilities

10. Names and institutions of technology/knowledge developers
Building Research Institute (BRI) applied the method with technical support service provided by World Bank (We rely on the network of World Bank because it has established international network all over the world and offers professional support services to support communication)

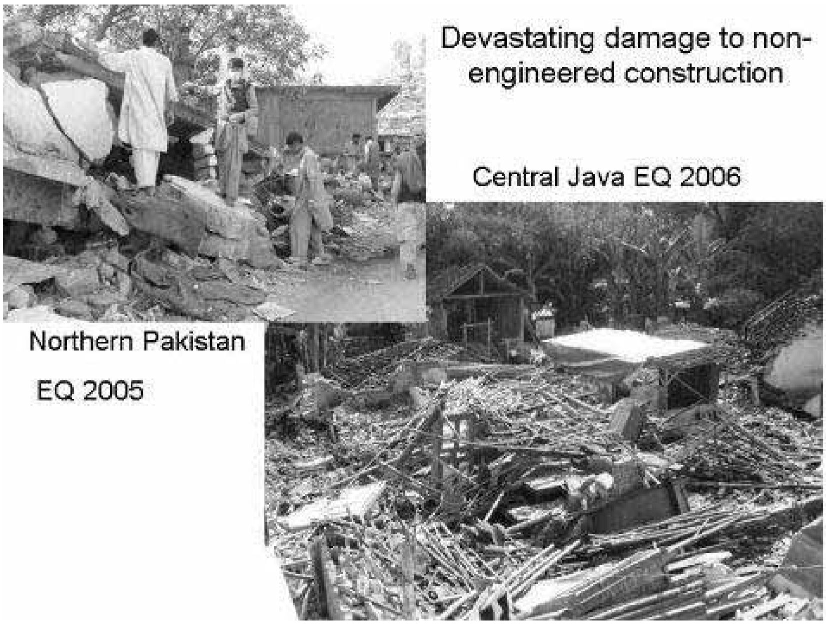
11. Title of relevant projects if any
Collaborative Research and Development Project for Earthquake Disaster Mitigation on Network of Research Institutes in Earthquake Prone Areas in Asia financed by Ministry of Education, Culture, Sports and Science (MEXT), Japanese Government

12. References and publications

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice
Sharing experiences and exchanging lessons are important in disaster reduction. Our collaborative research project with Asian countries focuses on non-engineered houses to which limited human and financial resources are devoted. We use video network system for an effective tool for communication for the collaboration works.



V. Description

15. Feature and attribute

The video conference network system allows us to communicate with less expense and time compared with meeting in person.

16. Necessary process to implement

Establishing basis for communication: It is recommendable to share basic knowledge and common target for communication basis. We invited partner researchers from abroad and conducted a series of lecture meetings and technical visits for basic knowledge and had intensive discussion for common target and understanding each other. Preparatory discussion: Discussion on topics and presentation materials for video conferences in advance is necessary to have fruitful conferences. Emails are convenient and useful tool. Preparation for the conferences: Preparation and exchange of presentation materials in advance is recommendable for well understanding. It also works in the case of unstable communication conditions such as interruption or unclear image. Confirmation of minutes: Necessary procedures for next steps

17. Strength and limitations

Cost and time effectiveness is the biggest point. With self-owned facilities and fixed charge for internet, cost is almost free. Deepness of communication is less than direct talking or discussion. Communication only through video conference system is not enough. Direct discussion in advance and occasional meeting in person makes the communication more successful.

18. Lessons learned through implementation if any

Periodical video conferences are recommendable for good command of the tool. Occasional meetings in person are preferable for better understanding. Professional technical support (confirmation and keeping of connection) is effective in the case of multilateral meeting or unstable communication conditions in developing countries.

VI. Resources required

19. Facilities and equipments required

Video conference facilities become quite usual recently and many research institutes including developing countries have their own. Facilities open for public is available at World Bank in almost all the countries.

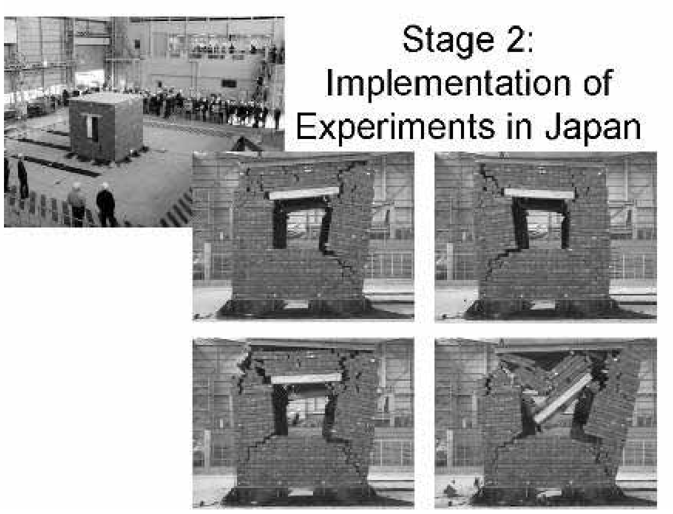
20. Costs, organization, manpower, etc.

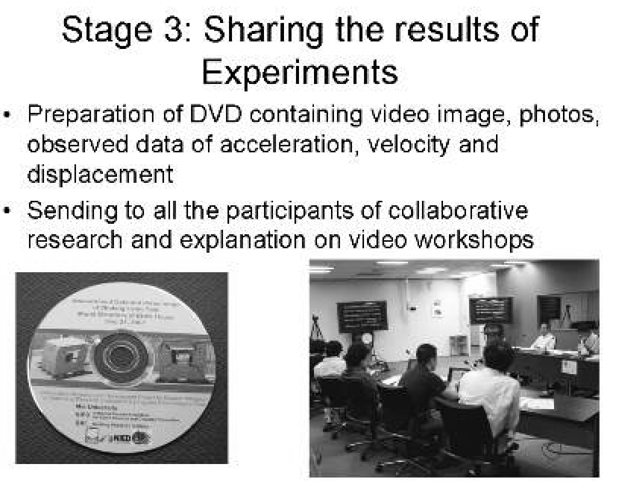
Charges for the video conference facilities and meeting room are necessary in the case you rent them. Additional communication charge if you do not contract your internet service on fixed charge.

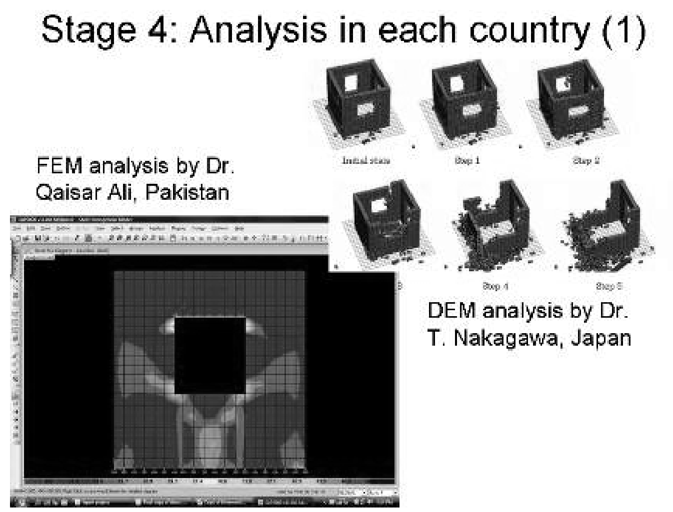
VII. Message from the proposer if any

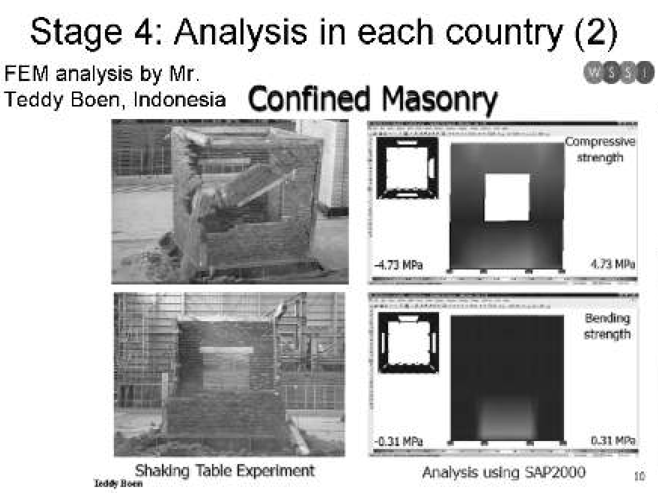
21. Message

An example of collaborative works: Research with shaking table experiments









VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has high application potential verified by implementation in various field sites.

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
Collaborative Research and Development Project for Earthquake Disaster Mitigation on Network of Research Institutes in Earthquake Prone Areas in Asia financed by Ministry of Education, Culture, Sports and Science (MEXT), Japanese Government

E1-2. Place
Collaboration with Indonesia, Nepal, Pakistan, Turkey and Japan

E1-3. Year
2006-2008

E1-4. Investor
Ministry of Education, Culture, Sports and Science (MEXT), Japanese Government

E1-5. People involved
13 workshops (five hours in each) in three years
usually connecting 8 to 10 venues in five countries with participants of 80 to 150

E1-6. Monetary costs incurred
One workshop for five hours connecting 10 venues Rental charge for meeting room of 100 seats in Tokyo: US$ 1,800
Professional technical support service: US$ 2,100

E1-7. Total workload required
Same as usual workshops such as preparation of agenda, arrangement of presenters, announcement, management of workshop, making proceedings etc. Additional works for VC facilities are managed by professional technical support

E1-8. Evidence of positive result
We have 80 to 150 participants every time with supportive response Outline of some of the workshops:
http://www.kenken.go.jp./english/information/information/event/tokyo-2008/index-e.htm
http://www.kenken.go.jp./english/information/information/event/ws2008/index-e.htm
http://www.kenken.go.jp./english/information/information/event/tokyo-2007/index.htm
http://www.kenken.go.jp./english/information/information/event/tokyo-2006/index.htm

---

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:

> DRH_Case_Disaster.pdf (PDF - 227 Kb)
> DRH_Case_WS.pdf (PDF - 261 Kb)
> 3-1WS-PB230196.jpg (JPG - 38 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

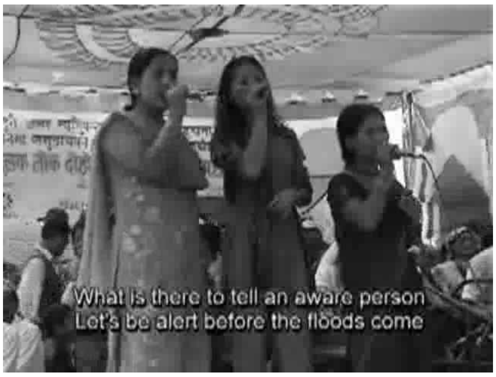
DRH-Asia Contents (DRH 53)

I. Heading

1. Title

Implementation of Folk-Song Program in Disaster Awareness Raising

ID:	DRH 53
Hazard:	Landslide, Flood, Flash flood, Climate change impact
Category:	Process Technology (PT)
Proposer:	Binaya Kumar Mishra
Country:	NEPAL;
Date posted:	22 October 2009
Date published:	29 December 2009



Participants of the Folk-Song Program performing at the stage

Contact
Binaya Kumar Mishra (Research fellow)
Kaoru Takara (Professor)
Disaster Prevention Research Institute, Uji Campus,
Kyoto University, Kyoto 611-0011, Japan. Tel.: +81-774384133,
Fax: +81-774384130; Email: mishra@flood.dpri.kyoto-u.ac.jp

2. Major significance / Summary

In country like Nepal, most of the disaster awareness raising education/training programs has been able to attract only educated and leading people of the community. The implementation of Folk-Songs like programs with disaster awareness theme can be useful in attracting the children, women, minorities and other marginalized groups who generally don't take part in other such activities.

3. Keywords

Folk-Song, disaster reduction, public event, effective, marginalized people

II. Categories

4. Focus of this information

Process Technology (PT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), NGO/NPO project managers and staff, International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Rural planners, Environmental/Ecological specialists
5-2. Other users: Policy makers, Motivated researchers, Local residents

6. Hazards focused

Landslide, Flood, Flash flood, Climate change impact

7. Elements at risk

Human lives, Business and livelihoods, Infrastructure, Buildings, Rural areas, River banks and fluvial basin, Mountain slopes, Agricultural lands

III. Contact Information

8. Proposer(s) information (Writer of this template)

Binaya Kumar Mishra (Research fellow)
Kaoru Takara (Professor)
Disaster Prevention Research Institute, Uji Campus,
Kyoto University, Kyoto 611-0011, Japan. Tel.: +81-774384133,
Fax: +81-774384130; Email: mishra@flood.dpri.kyoto-u.ac.jp

9. Place where the technology/knowledge originated

NEPAL
Various districts of Nepal (for example, Chitwan, Nawalparasi, Banke, Bardiya)

10. Names and institutions of technology/knowledge developers

Practical Action Nepal (a non-profit organization)

11. Title of relevant projects if any

(i) Flood security projects in Nepal
(ii) Disaster risk reduction and climate change projects in Nepal

12. References and publications

See the website of Practical Action Nepal below for more information.
http://practicalaction.org/nepal/region_nepal_ia1

13. Note on ownership if any

No restriction for the non-commercial use. Usage has been encouraged for disaster awareness raising, however credit should be given to the Practical Action Nepal.
See website: http://practicalaction.org/dipecho/dipecho_video
Contact email: info@practicalaction.org.np

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

Nepal is highly vulnerable to natural disaster. There is a high risk of floods in the plain (**Fig. 1**) and landslide in the hills. The frequency of such disaster is increasing year by year. Low awareness level in terms of disaster preparedness and management, lack of efficient mechanisms and capacity to deal with these natural disasters have severe impacts on the lives of the people, property and economy at large.

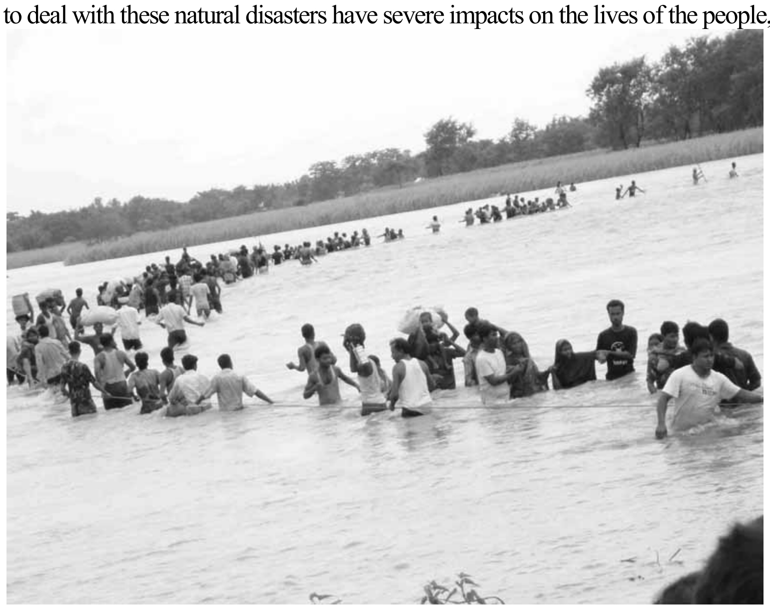


Fig. 1 Flood in Sunsari due to Sapta Koshi River Eastern Embankment Breach on 21-08-2008. (Source: UN-NIP)

Raising awareness of risks and an understanding of the factors which underlie them are critical to reducing vulnerability. Only by understanding fully the risks can people plan their response. Different kinds of programs/training are found to be conducted for the disaster awareness raising in the rural community. However, rural women, children and minors, who are the most affected group by any natural disaster, are unable to get attracted by the usual disaster awareness trainings/programs because of illiteracy, poverty, religious/cultural obligations etc.

In this regard, the implementation of Folk-Song like programs (**Fig. 2**) can be highly effective to rural people, particularly the marginalized people, for disaster awareness raising.

Fig. 2 Folk-Song program for the disaster awareness in Chitwan, Nepal

V. Description

15. Feature and attribute

If the mediums of communication are based on local language to raise awareness, the marginalized group of the community are found to be largely benefitted. Song or "Dohari" competitions are common events throughout the year, the traditional form of song being a dialogue between two individuals or groups, male and female. This form lends itself naturally to a "questions and answers" or dialogue structure within a song with competitions being hard fought and creative in their attempts to achieve the most innovative or amusing stories.

The proposed technology of implementation of Folk-Song program for disaster awareness raising is simple to implement in practice. In addition, the technology is inexpensive. Such technology can be useful to various types of natural disasters. Since the technology is based on local language and culture, it can effectively attract and make the rural uneducated, women, children, minors etc., who generally do not participate in other community awareness programs, understand the nature of disasters, their tangible/intangible impacts and the importance of existing protective measures.

16. Necessary process to implement

To implement the proposed technology of Folk-Song like cultural program, the training team needs to contact the local community leaders and governmental/non-governmental organization people as the first step. After discussion with the local leaders, decisions are made on the place for the Folk-Song competition event, probable participants, disaster theme explanation to the participants, event information to the expected people through loud speakers and others that required for successful completion of any such program.

Given basic information or messages competitors create their own songs. Based on their performance in term of their songs' strength and performance skill to communicate the message for disaster awareness raising, the winner is declared by the selected judges. These make the competitors as well as the participants, specially marginalized who do not possess other forms of entertainment, interested to take part in such disaster awareness raising.

17. Strength and limitations

The proposed technology will enable effectively to know about the nature of disasters, their impact and how to cope with the disasters. In particular, the rural women, children, uneducated men and other marginalized people who are not able to access the disaster raising programs delivered through TV, radio, school etc. will be largely benefitted (**Fig. 3**). Like the street drama events the Folk-Song or "Dohari" competitions have proved an alternative means of communicating risk messages to audiences which might not have been accessible through more formal approaches. However, the proposed technology may not be effective to urban people.

Fig. 3 Folk-Song program with the presence of large marginalized group of people.

18. Lessons learned through implementation if any

The technology was found to be largely effective after the implementation of the Folk-Song Program for flood disaster awareness raising in the various districts of Nepal. Villagers who were not attentive to the importance existing early warning system and other structural components were found to be largely careful to siren sound, safety of river bank, levee etc. after such program was implemented. Hence, the programs like this can be largely effective in the rural sector of the developing/under-developed nations.

VI. Resources required

19. Facilities and equipments required

Local community leaders/technicians and governmental/non-governmental organizations can play important roles in the implementation of such cultural-based Folk-Song competition program in disaster awareness raising. A venue for the event needs to be prepared for watching the program. The venue should be such that it can accommodate the expected people. Arrangement of loudspeakers, chair, carpets, drinking water, and sanitation facilities need to be made at program venue. Sometime, such program may be more effective in night. In this case, there should be good facility of lights.

20. Costs, organization, manpower, etc.

Budget is required for the manpower involved in training program, expenses in the preparatory works with local leaders, governmental organization, transportation, communication etc. Other costs will include labor cost involved in carrying the arrangement of the program, the rental hiring cost of loudspeaker, chair, carpet, lights etc for the event and the prize money for participants of Folk-Song Program.

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has fair applicability demonstrated by implementation in one or more field sites.

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
(i) Flood security projects in Nepal, and (ii) Disaster risk reduction and climate change projects in Nepal

E1-2. Place
Chitwan district, Nepal *(See video with file name* **flood1** *attached at the end)*

E1-3. Year

2002-2007

E1-4. Investor
Practical Action Nepal (a non-profit organization)

E1-5. People involved
Contact email: info@practicalaction.org.np

E1-6. Monetary costs incurred
Contact email: info@practicalaction.org.np

E1-7. Total workload required
Contact email: info@practicalaction.org.np

E1-8. Evidence of positive result
After the implementation of program, the vulnerable villagers are largely sensitive to evacuation, and hence enable to reduce the disaster damage losses (**Fig. 4**). It has also helped reduce loss of lives and assets - from landslide, floods and other forms of natural disaster - through the use of early warning systems, local preparedness planning and other initiatives.

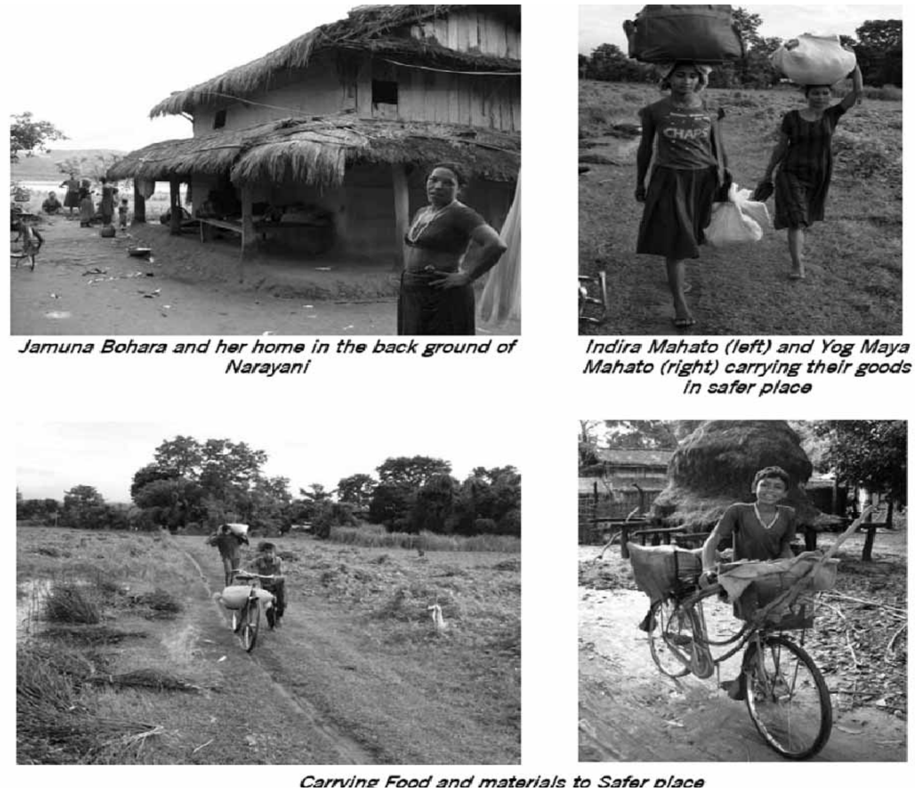


Fig. 4 People evacuating their belonging effectively to safe place after hearing the warning siren at Chitwan, Nepal.

Basanta Chaudhari, a resident of Bagaincha tole expressed his experience as "As soon as we heard the sound of the siren, we came out of our house, we took our cattle to a nearby highland area, called Thule Chour, and shifted our valuables from the ground floor to the upper floor of the house."

No.2

E2-1. Project name if available
(i) Flood security projects in Nepal, and (ii) Disaster risk reduction and climate change projects in Nepal

E2-2. Place
Banke district, Nepal

Fig. 5 Folk-Song program being implemented at Banke, Nepal

E2-3. Year
2002-2008

E2-4. Investor
Practical Action Nepal (a non-profit organization)

E2-5. People involved
Contact email: info@practicalaction.org.np

E2-6. Monetary costs incurred
Contact email: info@practicalaction.org.np

E2-7. Total workload required
Contact email: info@practicalaction.org.np

E2-8. Evidence of positive result
This was the first time that Biraha (Awadhi) and Kathaura (Tharu) song competitions had been used for public awareness purposes. This program was a part of the project intended for reducing vulnerability to the flood. For example, the implementation of Folk-Song program led the local marginalized people to know the importance of newly constructed flood warning siren.
Many farmers in Joraiya, Khalla Tepari, Gulaldeva, Bisambharpur and Sidhanawa villages, on hearing the warning, started taking their ploughs, oxen and agricultural tools to higher land. Traditionally farmers here leave their tools and oxen near their farm land, as it can be distant from their homes, but as in past years, when there was no warning, they had often been lost, they moved them in advance this time.
Fishermen, such as Balak Godia, Bahur Godia and their friends, were fishing on the Rapti on 28th June. On hearing the sound of the siren from the Joraiya area about 6:45 pm, they realized the threat and returned quickly to the river bank, stating if they had not heard the siren they might have remained fishing ‘till midnight, possibly camping on one of the many islands in the river. If they had it could have been disastrous.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:
> 6.jpg (JPG - 51 Kb)
> fisherman.JPG (JPG - 11 Kb)
> flood1.wmv (WMV - 23749 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

DRH-Asia Contents (DRH 56)

I. Heading

1. Title

Low-cost and Adaptive Technology to Support a Community-based Landslide Early Warning System in Developing Countries

ID:	DRH 56
Hazard:	Landslide, Climate change impact
Category:	Implementation Oriented Technology (IOT)
Proposer:	Teuku Faisal Fathani
Country:	INDONESIA;
Date posted:	02 March 2010
Date published:	15 March 2010

Contact
Name: Dr. Teuku Faisal Fathani
Position: Assoc. Professor in Geotechnical Engineering
Affiliation: Gadjah Mada University
Address: Department of Civil and Environmental Engineering, Gadjah Mada University, Jl. Grafika No. 2 Yogyakarta 55281, INDONESIA
E-mail: tfathani@yahoo.com / fathani@tsipil.ugm.ac.id
Tel: +62 274 545675 Fax : +62 274 545676

Co-writer (1): Prof. Dwikorita Karnawati
Position: Professor in Geological Engineering
Affiliation: Gadjah Mada University

Co-writer (2): Prof. Kyoji Sassa
Position: Prof. Emeritus of Kyoto University – Executive Director of ICL
Affiliation: International Consortium on Landslides (ICL)

Co-writer (3): Dr. Hiroshi Fukuoka
Position: Assoc. Professor of Kyoto University
Affiliation: Disaster Prevention Research Institute (DPRI) Kyoto University

2. Major significance / Summary

Simple and low-cost equipments for landslide monitoring and early warning have been developed and installed at five provinces in Indonesia. These monitoring equipments are connected to siren system in order to directly warn the local community for taking necessary actions in dealing with landslide disaster. In addition, the local community in remote areas can easily operate and maintain the equipment based on their own capability.

3. Keywords

Landslide early warning, simple technology, community development, disaster risk reduction

II. Categories

4. Focus of this information
Implementation Oriented Technology (IOT)

5. Anticipated Users
5-1. Practitioners: Community leaders (voluntary base), Administrative officers, NGO/NPO project managers and staff, International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Commercial entrepreneurs, Experts
5-2. Other users: Policy makers, Motivated researchers, Local residents

6. Hazards focused
Landslide, Climate change impact

7. Elements at risk
Human lives, Human networks in local communities, Business and livelihoods, Infrastructure, Buildings, Information and communication system, Urban areas, Rural areas, Mountain slopes, Agricultural lands, Cultural heritages

---

III. Contact Information

8. Proposer(s) information (Writer of this template)
Name: Dr. Teuku Faisal Fathani
Position: Assoc. Professor in Geotechnical Engineering
Affiliation: Gadjah Mada University
Address: Department of Civil and Environmental Engineering, Gadjah Mada University, Jl. Grafika No. 2 Yogyakarta 55281, INDONESIA
E-mail: tfathani@yahoo.com / fathani@tsipil.ugm.ac.id

Tel: +62 274 545675 Fax : +62 274 545676

Co-writer (1): Prof. Dwikorita Karnawati
Position: Professor in Geological Engineering
Affiliation: Gadjah Mada University

Co-writer (2): Prof. Kyoji Sassa
Position: Prof. Emeritus of Kyoto University – Executive Director of ICL
Affiliation: International Consortium on Landslides (ICL)

Co-writer (3): Dr. Hiroshi Fukuoka
Position: Assoc. Professor of Kyoto University
Affiliation: Disaster Prevention Research Institute (DPRI) Kyoto University

9. Place where the technology/knowledge originated
INDONESIA;
Central Java, West Java, East Java, South Kalimantan, South Sulawesi

10. Names and institutions of technology/knowledge developers
Dr. Teuku Faisal Fathani and Prof. Dwikorita Karnawati
Institution: Gadjah Mada University, INDONESIA

11. Title of relevant projects if any
1. Development of community-based landslide early warning system in Central Java and East Java, supported by Indonesian Ministry for Development of Disadvantages Region (2007-2008)
2. Installation and dissemination of appropriate technology for landslide disaster risk reduction in Central Java and West Java, supported by the Indonesian Agency for Disaster Management (2008)
3. Integration of low-cost and simple technology of landslide monitoring with a real-time landslide early warning technology in Central Java, supported by International Consortium on Landslides (ICL) and Disaster Prevention Research Institute (DPRI) Kyoto University (2007–now)
4. Seismic and Landslide Hazard Mapping for Community Empowerment (including landslide early warning dissemination), supported by British Council of DELPHE Project (2007-2010)

12. References and publications

1. Fathani T.F. and Karnawati D. (2009) Early warning of landslide for disaster risk reduction in Central Java Indonesia, Proceeding of International Workshop on Early Warning for Landslides Disaster Risk Reduction in the Eastern Asian Region, ICL – CGS, Kunming, China.
2. Karnawati, D. , Fathani T.F., Andayani B., Burton P.W. and Sudarno I. (2009) "Strategic program for landslide disaster risk reduction; a lesson learned from Central Java, Indonesia" , in Disaster Management and Human Health Risk; Reducing Risk, Improving Outcomes. Eds : K. Duncan and C.A. Brebbia. WIT Transactions on the Built Environment, WIT Press, Southompton, UK. p.115-126.
3. Karnawati, D., Fathani T.F., Andayani B., and Burton P.W. (2009) "Landslide Hazard and Community-based Risk Reduction Efforts in Karanganyar and the Surrounding Area, Central Java, Indonesia", published in the Proceeding of the 7th Regional Conference of IAEG (Int. Assoc. Of Engineering Geology), 9-11 September 2009, Chengdu, China. p.436-441.
4. Fathani, T.F., D. Karnawati, K. Sassa, H. Fukuoka, K. Honda (2008) Development of Landslide Monitoring and Early Warning System in Indonesia. Proceeding of the First World Landslide Forum, 18-21 Nov. 2008. United Nation University, Tokyo, Japan. Global Promotion Committee of The Int. Program on Landslide (IPL) – ISDR. p. 195 - 198.
5. Andayani B., Karnawati D., Pramumijoyo S. (2008) Institutional Frame Work for Community Empowerment towards Landslide Mitigation and Risk Reduction in Indonesia. Proceeding of the First World Landslide Forum, 18-21 Nov. 2008. United Nation University, Tokyo, Japan. Global Promotion Committee of The Int. Program on Landslide (IPL) – ISDR. P. 57-59.
6. Karnawati D., Pramumijoyo S., Andayani B., Burton P.W. (2008) Earthquake and Landslide Hazard Mapping For Community Empowerment. Proceeding of the 51st Annual Meeting Assoc. of Engineering and Environmental Geologist.Sept. 15 – 20, 2008. New Orleans, Lousiana, USA.
7. Karnawati D. and Fathani T.F. (2008) Mechanism of Earthquake Induced Landslides in Yogyakarta Province, Indonesia. Published in The Yogyakarta Earthquake of May 27, 2006. Eds. D. Karnawati, S. Pramumijoyo, R. Anderson and S. Hussein. STAR Publishing Company Inc., Belmont, CA. ISBN 978 – 0 – 89863 – 304 – 7. p 8-1 to 8-8.

13. Note on ownership if any

Gadjah Mada University, INDONESIA

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

As the dynamic volcanic-archipelagoes, more than 60 % of Indonesian region are covered by the mountainous and hilly areas of weathered volcanic rocks, which are intersected by faults and rock joints. These geological conditions give rise to the high landslide susceptibility of the region. Moreover, the high rain precipitation which can exceed 2,000 mm to 3,000 mm per year, frequent earthquake vibrations as well as the extensive landuse changing and deforestation cause the occurrence of landslides frequently increase recently. Since the last 8 years, more than 40 landslide disasters occurred and result in 1,326 people died or missing. Urgently, some efforts should be done to avoid or reduce the risk of landslides. Unfortunately, most landslide susceptible areas have very fertile soils and very good quality and quantity of water. This makes the susceptible areas are densely populated, and it create serious inducement to slope instability.

In order to improve the community resilience, a strategic program for landslide risk reduction should be carried out by establishing appropriate landslide risk management program with respect to social vulnerability. Despite an effort to establish slope protection zone, which is restricted for any development and settlement, the relocation program is not easy to be carried out due to socio-economical constrains. Therefore, landslide monitoring, prediction and early warning system are urgently required to guarantee the safety of community living in hazard prone area.

V. Description

15. Feature and attribute

Aim:

1. To propose a simple and low-cost technology for landslide monitoring and early warning, so that the local community in remote area could easily operate and maintain the proposed technology by their own capability.
2. To support landslide disaster risk disaster program in Indonesia, though the installation and dissemination of the most adaptive technology for landslide early warning to guarantee the safety of community living in hazard prone area

Mechanism:

The aims can be achieved by implementing a socio-technical strategic approach through community-based landslide early warning system. As the initiation of quantitative investigation, two types of simple extensometers and automatic raingauge were installed at several pilot areas in five provinces in Indonesia. The first type of extensometer is a handmade manual reading extensometer. Another type is the automatic extensometer, where the relative movement between two points is mechanically enlarged by 5 times and recorded on a paper continually (**Fig. 1**). Both types of extensometers are connected to the siren system in order to directly warn the local community for taking necessary actions in dealing with landslide disaster. Furthermore, a simple modified raingauge has also developed with hourly rainfall intensity recorded on a paper continually. This raingauge is also connected to the siren system to warn the community if the precipitation reaches a certain value. During the installment, five local operators have been trained on how to install and operate this simple equipment

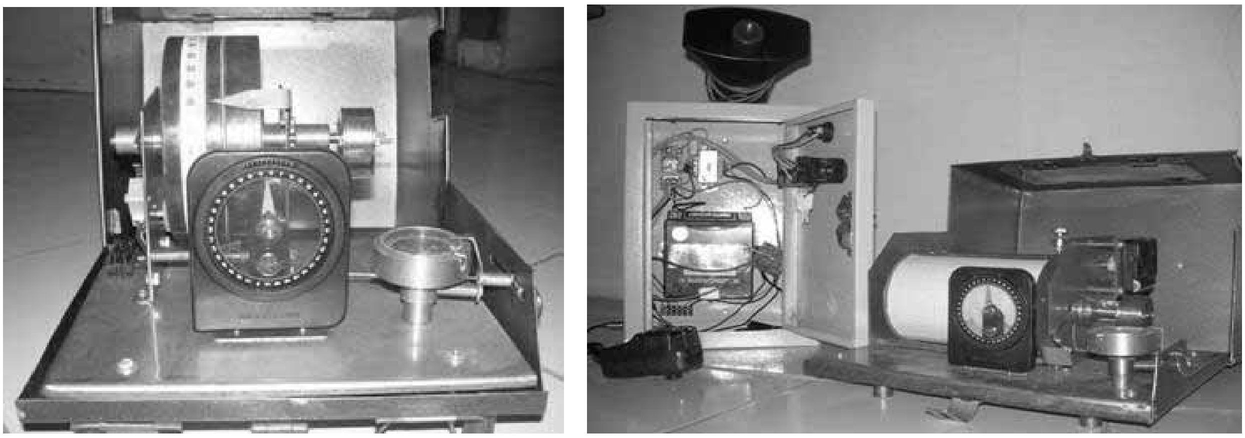


Fig. 1 Handmade manual reading extensometer and with recording to a paper manually.

Fig. 2 Simple modified raingage to monitor critical rainfall, which connected to siren system

In line with the development of simple equipment, a field survey to support the establishment of low-cost real-time landslide monitoring and warning system has been conducted. This system presents the results of real-time measurement by using automatic extensometer (**Fig.3**), tiltmeter, groundwater measurement and tipping bucket raingauge (**Fig. 4**). The monitoring equipment connected with a data logger and integrated in a fieldserver. This sensing device provides real-time online data display system, which gathers the data from multiple sensors and shows them in a webserver. This unit also implements early warning that can be adjusted depending on the site condition.

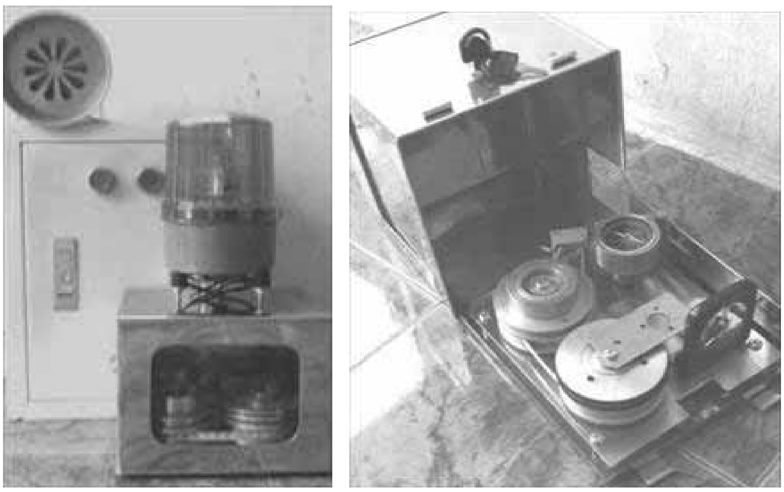


Fig. 3 Automatic upper-ground extensometer.

Fig. 4 Automatic tipping bucket raingage with siren and rotary light

16. Necessary process to implement

Procedure:

The equipment installation and operation need to be supported by local community through the establishment of Task Force for Disaster Mitigation and Management. This team is responsible for the installment, operation and maintenance of the technical system. To provide an early warning, an alarm is connected to each equipment in the system and the alarm is automatically set to be "on" when the critical rainfall which can induce landsliding and/ or the critical conditions of slope movement occurs. To set the alarm to be on at the appropriate time, all of those equipments are generated by the dry battery and/ or solar energy which can work effectively during the heavy rainfall when the electricity power does not work properly. Small group in charge from local community installed the equipment by themselves under the supervision of the students of Gadjah Mada University (**Fig. 5**). **Fig. 6** shows a student of Gadjah Mada University is checking a newly installed simple extensometer. **Fig. 7** shows the placement of handmade manual extensometer crossing to a crack at the upper part of a dense residential area.

Fig. 5 Equipment installation conducted by the local community

Fig. 6 A student of Gadjah Mada University is checking the performance of simple extensometer at Karanganyar, Central Java.

Fig. 7 Placement of simple extensometer at Banjarnegara, Central Java.

Village action plan (including the contingency plan) for disaster prevention and response program is accordingly developed by this Task Force Team. Obviously, one of the most important program to guarantee the effectiveness in implementing this early warning system in the village is public education and evacuation drill such as illustrated in **Fig. 8** and **Fig. 9**. These programs need to be conducted regularly to improve the awareness and readiness of local community for any possible landslide disaster. In fact, this simple early warning system has successfully saved 35 families from landslide which occurred in Kalitelaga village at Banjarnegera Regency on November 7, 2007.

Fig. 8 Training for operator as a part of public education program

Fig. 9 Evacuation drills involving primary school students

Major actors:

a. The university students, researchers and lectures.

b. The local government leader and officers as the stake holders.

c. The local key persons and local communities as the local task force for disaster mitigation and management.
d. The local NGO may also participate as the partners.
e. Private or Governmental Companies may also participate to provide financial sponsors as a part of their Corporate Social Responsibilities.

17. Strength and limitations

Strength:

This simple and low-cost technology of landslide monitoring and early warning is very effective and practical to be implemented in developing countries having a large landslide susceptibility area and limited budget.
An integrated approach of both technical and social system could establish an effective community-based early warning system, hence the community resilience in disaster-prone area at village level can be effectively improved.

Limitations:

The implementation of early warning technology needs a strong support from central and local government as well as related stakeholders. However, they willingness in working for disaster risk reduction is still very low compare to their sudden-reactive effort for disaster quick-response and reconstruction-rehabilitation activities.

18. Lessons learned through implementation if any

Some lesson learned can be derived from this program that landslide early warning system should be based on the appropriate and most adaptive technology with the involvement of community participation. Therefore, both technical skill and communication skill are the main requirements to achieve the success of early warning system program. The system should include some technical aspect such as the geological surveys and site selection, design of monitoring equipment which is simple (low cost) but effective, determination of early warning levels, installment and operation/maintenance at the field site, as well as include the social aspect such as social mapping and evaluation, public consultation and dissemination of program, community empowerment including the technical training and evacuation drill for landslide hazard preparedness. The role of scientist or researcher is more like to be the motivator and facilitator, instead of the instructor or manager of program.

VI. Resources required

19. Facilities and equipments required

a. Detail geological investigation to determine the necessity of early warning and type of technology to be installed.

b. Simple and low-cost technology for monitoring and early warning of landslide, such as: handmade simple extensometer, extensometer with data logger, automatic raingauge, groundwater level gage and tiltmeter.

c. Community empowerment through the establishment of Task Force for disaster mitigation and management, training, focus group discussion and evacuation drills.

d. Hazard, vulnerability and risk mapping, as well as evacuation map in village or sub-village level.

20. Costs, organization, manpower, etc.

Cost of this program is mainly supported by Gadjah Mada University, but some additional which may become the major supports can also be generated from the government institutions/local government resources/ private companies/ and international organizations (International Consortium on Landslides-ICL).
Estimated cost for detail field investigation, development of one set of early warning equipment, installation and dissemination of early warning system to the local community is about 20,000 USD for each landslide area (approximately 100 ha covered area). One set of equipment consist of 5 extensometer or tiltmeter, 1 raingauge and 1 groundwater measurement. The type of early warning equipment to be installed will be decided based on the results of detail field investigation.

The manpower mainly supported by the 10 students and 4 lecturers who are deployed in the field together with the local communities (10 persons in charge as local operators), in coordination with the local governments.

VII. Message from the proposer if any

21. Message

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has fair applicability demonstrated by implementation in one or more field sites.

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
Development of community-based landslide early warning system in Central Java and East Java Province

E1-2. Place
Banjarnegara Regency – Central Java Province and in Situbondo Regency – East Java Province, INDONESIA

E1-3. Year
2007-2008

E1-4. Investor
Gadjah Mada University-Ministry of National Education, Indonesian Ministry for Development of Disadvantages Region, Local Government of Banjarnegara Regency and Situbondo Regency for the financial and facility supports, as well as the International Consortium on Landslides (ICL) and Disaster Prevention Research Institute (DPRI) Kyoto University

E1-5. People involved
- Students, Researchers and Lecturers with multidisciplines background from Gadjah Mada Univresity
- Local community and Task Force for disaster mitigation and management.
- Local government of Banjarnegara and Situbondo Regency
- Indonesian Ministry for Development of Disadvantages Region

E1-6. Monetary costs incurred
USD 30,000 (provided by Gadjah Mada University – Ministry of National Education & Indonesian Ministry for Development of Disadvantages Region)

E1-7. Total workload required
Deployment of students and lecturers for field investigation was undertaken for 2 months.
Designing the simple and low-cost technology in the laboratory was undertaken for 3 months.
Installation and dissemination of early warning system were conducted for another 2 months.

E1-8. Evidence of positive result
Tangible evidence:
a. The establishment of new technology for landslide monitoring and early warning system.
b. The establishment of Community Task Force for Disaster Mitigation and Management.
Intangible evidence:
a. Improvement of community awareness and capacity for landslide mitigation.
b. Improvement of students'/young researchers' knowledge and skill for landslide disaster management.

No.2

E2-1. Project name if available
Installation and dissemination of appropriate technology for landslide disaster risk reduction in Central Java and West Java

E2-2. Place
Karanganyar Regency – Central Java Province and Cianjur Regency – West Java Province, INDONESIA

E2-3. Year
2008

E2-4. Investor
Gadjah Mada University-Ministry of National Education, Indonesian National Agency for Disaster Management, Local Government of Karanganyar Regency and Cianjur Regency for the financial and facility supports, as well as the International Consortium on Landslides (ICL) and Disaster Prevention Research Institute (DPRI) Kyoto University

E2-5. People involved
- Students, Researchers and Lecturers with multidisciplines background from Gadjah Mada University, ICL and DPRI-Kyoto University
- Local community and Task Force for disaster mitigation and management.
- Local government of Karanganyar and Cianjur Regency
- Indonesian National Agency for Disaster Management

E2-6. Monetary costs incurred
USD 35,000 (provided by Gadjah Mada University – Ministry of National Education & Indonesian National Agency for Disaster Management)

One set of landslide early warning system – provided by The International Consortium on Landslides (ICL).

E2-7. Total workload required
Deployment of students and lecturers for field investigation was undertaken for 2 months.
Designing the simple and low-cost technology in the laboratory was undertaken for 2 months.
Installation and dissemination of early warning system were conducted for another 2 months.

E2-8. Evidence of positive result
Tangible evidence:
a. The establishment of new technology for landslide monitoring and early warning system.
b. The establishment of Community Task Force for Disaster Mitigation and Management.
Intangible evidence:
a. Improvement of community awareness and capacity for landslide mitigation.
b. Improvement of students'/young researchers' knowledge and skill for landslide disaster management

No.3

E3-1. Project name if available
Integration of low-cost and simple technology of landslide monitoring with a real-time landslide early warning technology in Central Java

E3-2. Place
Banjarnegara Regency – Central Java Province

E3-3. Year
2007 - now

E3-4. Investor
Gadjah Mada University-Ministry of National Education, Local Government of Banjarnegara Regency, the International Consortium on Landslides (ICL) for the financial and facility supports and Disaster Prevention Research Institute (DPRI) Kyoto University

E3-5. People involved
- Students, Researchers and Lecturers with multidisciplines background from Gadjah Mada University, ICL and DPRI-Kyoto University
- Local community and Task Force for disaster mitigation and management.
- Local government of Banjarnegara Regency

E3-6. Monetary costs incurred
One set of real-time landslide early warning system -provided by The International Consortium on Landslides (ICL) and DPRI Kyoto University.
Once set of simple and low-cost landslide early warning system-provided by Gadjah Mada University.

E3-7. Total workload required
Deployment of students and lecturers for field investigation was undertaken for 6 months.
Designing the simple and low-cost technology in the laboratory was undertaken for 4 months.
Installation and dissemination of early warning system were conducted for another 4 months.

E3-8. Evidence of positive result
Tangible evidence:
a. The integration of low-cost and simple technology of landslide monitoring with a real-time landslide early warning technology.
b. Development of integrated online early warning system website of Gadjah Mada University : http://www.ews-ugm.com
Intangible evidence:
a. Improvement of community awareness and capacity for landslide mitigation.
b. Improvement of students'/young researchers' knowledge and skill for landslide disaster management.

X. Other related parallel initiatives if any

The development of the most adaptive (simple and low-cost) technology for community-based landslide early warning system has been promoted and recognized as one research excellence of International Programme on Landslides under UNESCO (No: IPL-158)

XI. Remarks for version upgrade

Attached files:
> 16_Fig6.jpg (JPG - 23 Kb)

DRH-Asia Contents (DRH 57)

I. Heading

1. Title

University-Community Collaborative Education Model for Developing Resilient Society in the Areas Vulnerable for Geological Disasters, in Indonesia.

ID:	DRH 57
Hazard:	Earthquake, Landslide, Mudflow, Flash flood, Multi-hazard
Category:	Process Technology (PT)
Proposer:	Dwikorita Karnawati
Country:	INDONESIA;
Date posted:	03 March 2010
Date published:	10 April 2010

Contact

Name : Dr. Dwikorita Karnawati
Position : Professor in Geological Engineering Department and also the Coordinator of the Main Facilitating Institution for the Interdisciplinary Research in Disaster Mitigation of ASEN University Network/ SEED Net.
Affiliation: Gadjah Mada University
Address: Geological Engineering Department, Jl. Grafika no 2. Yogyakarta 55281, INDONESIA.
Email: geologi@ugm.ac.id/ dwiko2007@yahoo.co.id
Tel & Fax: 62 274 513668 / 62 274 883 919 / 62 811 286 756

Co-writer 1: Dr. Teuku Faisal Fathani
Position: Researcher and Lecturer in Department of Civil and Environmental Engineering
Affiliation: Gadjah Mada University, Indonesia

Co-writer 2: Dr. Wahyu Wilopo
Researcher and Lecturer in Department of Geological Engineering Affiliation : Gadjah Mada University, Indonesia

Co-writer 3: Ms. Budi Andayani,
Position : Researcher and Lecturere in Faculty of Psychology
Affiliation : Gadjah Mada University

Co-writer 4: Prof. Kyoji Sassa
Position : Prof. Emeritus of Kyoto University – Executive Director of ICL
Affiliation : International Consortium on Landslides (ICL)

Co-writer 5: Dr. Hiroshi Fukuoka
Position : Assoc. Professor of Kyoto University
Affiliation : Disaster Prevention Research Institute (DPRI) Kyoto University

2. Major significance / Summary

The project addresses a university-community collaborative education model to support the geological disaster risk reduction (DRR) program at the local or village level. The specific objective is to provide a media for capacity development of students and young researchers to enable them to dedicate their knowledge and skill to support the development of society resilient in a particular village, which is vulnerable for any geological disaster.

3. Keywords

Research-based education, capacity development for students and young researcher, local community, society resilient

II. Categories

4. Focus of this information
Process Technology (PT)

5. Anticipated Users
5-1. Practitioners: Community leaders (voluntary base), Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.), NGO/NPO project managers and staff, International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Financing and insurance business personnel, Teachers and educators, Architects and engineers, Sociologists and political economists, Information technology specialists, Rural planners, Environmental/Ecological specialists, Others
5-2. Other users: Policy makers, Motivated researchers, Local residents

6. Hazards focused
Earthquake, Landslide, Mudflow, Flash flood, Multi-hazard

7. Elements at risk
Human lives, Human networks in local communities, Business and livelihoods, Infrastructure, Information and communication system, Rural areas, River banks and fluvial basin, Mountain slopes, Agricultural lands

III. Contact Information

8. Proposer(s) information (Writer of this template)
Name: Dr. Dwikorita Karnawati
Position: Professor in Geological Engineering Department and also the Coordinator of the Main Facilitating Institution for the Interdisciplinary Research in Disaster Mitigation of ASEN University Network/ SEED Net.
Affiliation: Gadjah Mada University
Address: Geological Engineering Department, Jl. Grafika no 2. Yogyakarta 55281, INDONESIA.
Email: geologi@ugm.ac.id/ dwiko2007@yahoo.co.id
Tel & Fax: 62 274 513668 / 62 274 883 919 / 62 811 286 756

Co-writer 1: Dr. Teuku Faisal Fathani
Position : Researcher and Lecturer in Department of Civil and Environmental Engineering
Affiliation: Gadjah Mada University, Indonesia

Co-writer 2: Dr. Wahyu Wilopo
Position: Researcher and Lecturer in Department of Geological Engineering Affiliation : Gadjah Mada University, Indonesia

Co-writer 3: Ms. Budi Andayani,
Position: Researcher and Lecturere in Faculty of Psychology
Affiliation: Gadjah Mada University

Co-writer 4: Prof. Kyoji Sassa
Position: Prof. Emeritus of Kyoto University – Executive Director of ICL
Affiliation: International Consortium on Landslides (ICL)

Co-writer 5: Dr. Hiroshi Fukuoka
Position: Assoc. Professor of Kyoto University
Affiliation: Disaster Prevention Research Institute (DPRI) Kyoto University

9. Place where the technology/knowledge originated
INDONESIA;
Central Java & West Sumatra

10. Names and institutions of technology/knowledge developers
Prof. Dr. Dwikorita Karnawati
Gadjah Mada University
INDONESIA

11. Title of relevant projects if any
a. Earthquake microzonation mapping at Bantul Regency of Yogyakarta Province, supported by JICA AUN/SEED Net (2006-2007).

b. Development of community-based landslide early warning system supported by Indonesian Ministry for Development of Disadvantages Region (2007), as well as by the Indonesian Agency for Disaster Management (2008), Gadjah Mada University (2008-2009) and the International Consortium on Landslide (2007-now).
c. Seismic and Landslide Hazard Mapping for Community Empowerment, supported by British Council under Development Partnership in Higher Education (DelPHE) Project (2007-2010)
d. Development of Landslide Early Warning System with respect to Community Empowerment and Appropriate Technology, Research Excellent for National Strategy, supported by Indonesian Ministry of Education (2009)
e. Development of Landslide Early Warning based on GPS "on-line" system, supported by Gadjah Mada University under Research Cluster Project (2009).
f. Student Community Service for Disaster Mitigation Program in Central Java supported by Gadjah Mada University and the Indonesian Ministry of National Education (2009) and in West Sumatra (2009-2010) supported by the Indonesian Ministry of National Education and the Oil and Gas Industries.

12. References and publications

1. Karnawati, D. , T.F. Fathani, Budi Andayani, P.W. Burton and I. Sudarno, "Strategic program for landslide disaster risk reduction; a lesson learned from Central Java, Indonesia" , in Disaster Management and Human Health Risk; Reducing Risk, Improving Outcomes. Eds : K. Duncan and C.A. Brebbia. WIT Transactions on the Built Environment, WIT Press, Southompton, UK. p.115-126.
2. Karnawati, D., T.F. Fathani, Budi Andayan and P.W. Burto "Landslide Hazard and Community-based Risk Reduction Efforts in Karanganyar and the Surrounding Area, Central Java, Indonesia", published in the Proceeding of the 7th Regional Conference of IAEG (Int. Assoc. Of Engineering Geology), 9-11 September 2009, Chengdu, China. p.436-441.
3. Karnawati, D., S. Pramumijoyo, S. Hussein, B. Andayani, P.W. Burton. 2009. A New Approach of Earthquake Hazard Mapping as A Tool to Facilitate Public and Non Technical Decision Maker; A Pilot Study in Bantul, Yogyakarta Province, Indonesia. Proceeding of Geohazard and Geo-Disaster Mitigation RC-GeoEnvi 2009. March 2 – 4, 2009, Kuala Lumpur, Malaysia. p. 32-38.
4. Karnawati, D. and S. Pramumijoyo. 2008. Strategy for Promoting Education for Natural Disaster Reduction in Indonesia and ASEAN Region. Proceeding of the First World Landslide Forum, 18-21 Nov. 2008. United Nation University, Tokyo, Japan. Global Promotion Committee of The Int. Program on Landslide (IPL) – ISDR. p. 301 – 305.
5. Karnawati, D., T.F. Fathani, Ign. Sudarno, B. Andayani. 2008. Development of Community-based Landslide Early Warning System in Indonesia. Proceeding of the First World Landslide Forum, 18-21 Nov. 2008. United Nation University, Tokyo, Japan. Global Promotion Committee of The International Program on Landslide (IPL) – ISDR. p. 305 – 308.
6. Fathani, T.F., D. Karnawati, K. Sassa, H. Fukuoka. 2008. Development of Landslide Monitoring and Early Warning System in Indonesia. Proceeding of the First World Landslide Forum, 18-21 Nov. 2008. United Nation University, Tokyo, Japan. Global Promotion Committee of The Int. Program on Landslide (IPL) – ISDR. p. 195 - 198.
7. Andayani, B. D. Karnawati, S. Pramumijoyo. 2008. Institutional Frame Work for Community Empowerment towards Landslide Mitigation and Risk Reduction in Indonesia. Proceeding of the First World Landslide Forum, 18-21 Nov. 2008. United Nation University, Tokyo, Japan. Global Promotion Committee of The Int. Program on Landslide (IPL) – ISDR. P. 57-59.
8. Karnawati, D., Pramumijoyo, S. Andayani, P.W. Burton. 2008. Earthquake & Landslide Hazard Mapping For Community Empowerment. Proceeding of the 51st Annual Meeting Assoc. of Engineering and Environmental Geologist.Sept. 15 – 20, 2008. New Orleans, Lousiana, USA.
9. Karnawati, D. and T. F. Fathani. 2008. Mechanism of Earthquake Induced Landslides in Yogyakarta Province, Indonesia. Published in The Yogyakarta Earthquake of May 27, 2006. Eds. D. Karnawati, S. Pramumijoyo, R. Anderson and S. Hussein. STAR Publishing Company Inc., Belmont, CA. ISBN 978 – 0 – 89863 – 304 – 7. p 8-1 to 8-8.
10. Karnawati, D. 2008. Earthquake Induced Landslide at Sengir , Prambanan District, Yogyakarta Province, Indonesia. Published in The Yogyakarta Earthquake of May 27, 2006. Eds. D. Karnawati, S. Pramumijoyo, R. Anderson and S. Hussein. STAR Publishing Company Inc., Belmont, CA. ISBN 978 – 0 – 89863 – 304 – 7. p 9-1 to 9-11.
11. Karnawati, D. S. Hussein, S. Pramumijoyo, A. Ratdomopurbo, K. Watanabe and R.. Anderson. 2008. Earthquake Microzonation and Hazard Maps of the Bantul Area, Yogyakarta, Indonesia. Published in The Yogyakarta Earthquake of May 27, 2006. Eds. D. Karnawati, S. Pramumijoyo, R. Anderson and S. Hussein. STAR Publishing Company Inc., Belmont, CA. ISBN 978 – 0 – 89863 – 304 – 7. p 7-1 to 7–15.
12. Karnawati, D, S. Pramumijoyo and H. Hendrayana, 2006. Geology of Yogyakarta, Java; the Dynamic Volcanic Arc City. Proc. of 10th International Assoc. of Engineering Geology (IAEG) International Congress, Nottingham United Kingdom, September 6-11, 2006
13. Karnawati, D, S. Pramumijoyo and K. Uchino, 2006. Strategy and Programs for Geological Education in Geohazard Vulnerable Areas in the South East Asia. Proc. of 10th International Assoc. of Engineering Geology (IAEG) International Congress, Nottingham United Kingdom, September 6-11, 2006

13. Note on ownership if any

Gadjah Mada University, Indonesia

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

Several disaster events and the factual finding that community resilient at the village level in Indonesia is still quite low are considered as the driving force for this development of Process Technology for capacity development. In fact, series of disaster events, such as Yogyakarta Earthquake in May 27, 2006; Bengkulu Earthquake in September 2007; Cianjur Earthquake in September 2009 and West Sumatran Earthquake in September 30, 2009, as well as various debris floods and landslide disasters which more frequently occur since the year of 2000, have been seriously resulted in thousands of death tolls and very bad socio-economical loss, due to low community resilient at the village level.

Another important driving force is the mission of Gadjah Mada University as the research university that should be dedicated for education and community service. In fact, this University has been developed the research-education model for sustainable development since more than five years a go, and this mission is strongly relevant to be implemented for the disaster risk reduction.

Various disasters as the driving force of this proposed capacity development activities are illustrated below:

Fig. 1 Yogyakarta Earthquake on May 27, 2006 (left) and rain-induced landslide in Karanganyar, Central Java on February, 2009.

Fig. 2 Debris slides (left) and rock falls (right) induced by the earthquake in West Sumatra occurred on September 30, 2009.

V. Description

15. Feature and attribute

Aim :

• To enhance the education process by exposing and providing more opportunity for the students to learn and implement their knowledge and skill gained in the class for solving the real disaster problem in the field and society.

• To support the disaster risk reduction program in Indonesia, through the capacity development of students/ young researchers, as well as through the community empowerment

Mechanism ;

This capacity development program is implemented as a summer school to facilitate the compulsory subject in undergraduate curricula at UGM, and this program is so called as a Student Community Service-Community Empowerment Learning (SCS-CEL) program (with 3 credits). Such program consists of pre-departure course (for one week) followed by the field works at the village and workshop for data compilation and analysis either at the village or in the Campus. This Program is implemented by deploying a team of students (consist of 20 - 30 students) from various disciplines in Engineering, Natural and Social Sciences, Agriculture, Health and may also from Economic and Business, in order to support the geological disaster risk reduction program at the village. Thus, the students should be capable to work together as a multidisciplinary team, and to integrate their knowledge and skill for disaster risk reduction. Joint participation of students, community and the local government should be developed through this program, to guarantee the effectivity and sustainability of geological disaster risk reduction program.

This summer school can be a supporting research for undergraduate students to conduct their final year project (with an additional 5 credit units), and for master student to carry out the thesis work (with 8 credit units). Those research projects may include hazard, vulnerability and risk mapping; natural and social resources mapping; slope stability analysis and prediction for landslide prevention, psychological assessment for community empowerment, formulation of community-based disaster management, etc.

Indeed, this education model provides various benefits not only for the students/ young researcher, but also for the local community. Capacity of students or young researchers in applying their discipline-based knowledge and skill for reducing the risk of geological disaster can be effectively developed by cross-discipline approach. Emotional management and various ethical values can also be significantly stimulated during their interaction with the local community.

Obviously, this mechanism of education model is important to support the improvement of community awareness and empowerment to reduce the risk of geological disaster, and it has been implemented in Bantul Region of Yogyakarta Province, financially supported by JICA/ AUN SEED Net (in 2006-2007) and by the British Council (2007-2010), in Karanganyar Regency of Central Java supported by International Landslide Consortium, the British Council, Gadjah Mada University, and Indonesian National Agency for Disaster Management (2008-2009), and also in West Sumatra in December 2009 up to 2010 for the community-based earthquake-induced landslide mitigation, in which the multi-national oil companies in Indonesia and the Indonesian Ministry of National Education provides the financial supports whilst the International Consortium on Landslide provide the technical and scientific supports.

More detailed information related to course is enclosed in the paper accepted as the keynote speech in the International Symposium on Disaster Management that will be held on February 25-26, 2010 in Bal

Expected Users:

Expected users of this method may be those shown in **Figs. 3**, **4**, and **5.**

Fig. 3 Member of Parlement as the user of this technology and knowledge for developing national strategy and policy in disaster risk reduction (DRR)

Fig. 4 Overseas students and motivated researchers from Asia, Africa, Europe & USA are interested to have joint learning actions in this education program.

Fig. 5 Local residents and local government are the most immediate users of the outputs of this joint capacity development

16. Necessary process to implement

Procedures:

Major actors:

a. Students of Undergraduate at Gadjah Mada University from various disciplines of Engineering, Natural, Social, Business, Law and Medical Sciences, should be the main actors through the implementation of University Curriculla with the compulsory course on student community service program (3 credits), and or through the final year project (5 credits).
b. Students of Master Coure at Gadjah Mada University from various disciplines, can be the main actors (not compulsory) to be involved by integrating this research-based education model for his/her master thesis work (8 credits).
c. The young and/ or senior lecturers/ researchers as the students' supervisors.
d. The Management Staff of University Research and Community Service Program.
e. The Senior Vice Rector for Education, Research and Community Service of Gadjah Mada University as the Responsible person in Charge.
f. The local Government Leader and Officers as the stake holders.
g. The local key persons and local communities as the participants for community empowerment.
h. The local NGO may also participate as the partners.
i. Private or Governmental Companies may also participate to provide financial sponsors as a part of their Corporate Social Responsibilities.

17. Strength and limitations

Strength:
This research-based education model is considered as an excellent media to provide holistic approach in capacity development program for disaster risk reduction actions. Not only academic or scientific and education approach are implemented, but this model also addresses the humanity and sustainable development concerns.

Limitations:
Effective communication process with the community and multi-stakeholders is the key driving force to assure the success of this capacity development program. To initiate, develop and maintain such effective communication quite a lot efforts and time are required. Indeed, this is the most tough challenge for the adviser and the students to work out.

18. Lessons learned through implementation if any

It is learned that this researched based education model is also very valuable not only to develop the knowledge and skill of students in handling the disaster risk reduction program, but also considered as a useful media to stimulate the development of ethical values with respect to the humanity and moral issues.
During the implementation of this education model, community empowerment at village level for disaster risk reduction can also be stimulated and developed.

VI. Resources required

19. Facilities and equipments required

Facilities required for:
a. hazard, vulnerability and risk mapping.
b. Socio-economical mapping.
c. Community empowerment program through training, focus group discussion, and other community participation program such as public education and evacuation drill.
d. Development of local and/ or indigenous technology and infrastructures for disaster risk reduction actions, such as the indigenous technology for early warning system, local communication system and network, revegetation and green technology for environmental protection, etc.

20. Costs, organization, manpower, etc.

Cost of this program is mainly supported by Gadjah Mada University, but some additional budget which may become the major supports can also be generated from the private companies/government institutions/ and local government resources.

The manpower mainly supported by the students and lecturers or young researchers who are deployed in the field together with the local communities, in coordination with the local governments.

VII. Message from the proposer if any

21. Message

This capacity development program provides a lot of opportunity for conducting public communication and education actions. Thus this proposed program can be implemented as an effective mechanism to solve conflict of perception about the risk of disasters, which usually to become one serious obstacle for disaster mitigation program.
The main challenges in conducting this program is to understand the community aspiration and then to motivate them to be actively in participating in the disaster risk reduction actions at the village. That is why social survey and mapping need to be carried out at the beginning of the such program. Then, the establishment of a community task force at the village should be the most important target, in order to assure the sustainability and effectivity of the implementation of this capacity development program.

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has fair applicability demonstrated by implementation in one or more field sites.

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
Research-based education for rain-induced landslide disaster risk reduction in Tawangmangu District, Karanganyar Regency, Central Java, Indonesia

E1-2. Place
in Tawangmangu District, Karanganyar Regency, Central Java, Indonesia

E1-3. Year
2009

E1-4. Investor
Gadjah Mada University-Ministry of National Education, Local Government of Karanganyar Regency for the financial and facility supports, as well as the International Consortium on Landslide and the British Council Delphe Project for the scientific and facility supports

E1-5. People involved
Students, Researchers and Lecturers with multidisciplines background from Gadjah Mada Univresity and from Andalas University
Local community and the key person at the project area.
Local government of Karanganyar Regency
Indonesian National Agency for Disaster Management.

E1-6. Monetary costs incurred
USD 8,000 (provided by Gadjah Mada University – Ministry of National Education & The British Council DELPHE Project)
One set of landslide early warning system – provided by The International Consortium on Landslide

E1-7. Total workload required
Deployment of students in the field was undertaken for 2 months.
Analysis results was conducted for another 2 months.

E1-8. Evidence of positive result
Tangible evidence:
a. The availability of landslide early warning system equipment as reported by Fathani.
b. The establishment of Community Task Force for Disaster Risk Reduction and early warning system (**Fig. 6** left)
c. Landslide hazard and risk map, supported by the map of evacuation route and shelter (**Fig. 6** right)
d. Standard Operational Procedure for Evacuation.
e. Materials of public education for improving community awareness (**Fig. 7**)

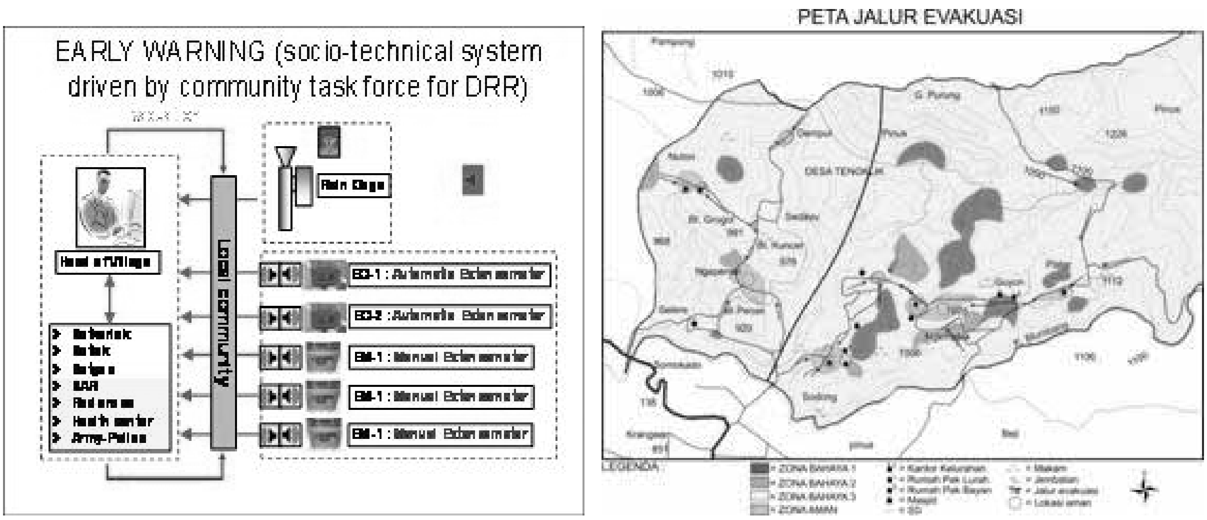


Fig. 6 Schematic framework of the community task force for DRR and landslide early warning system (left) and community hazard map (right)

Fig.7 Materials for public education: landslide calendar and early warning (most left), community hazard and risk map and the evacuation route (center), and procedure for evacuation (bottom right).

Intangible evidence:
a. Improvement of community awareness and capacity for disaster risk reduction.
b. Improvement of students'/young researchers' knowledge and skill for landslide disaster management.
c. Positive attitude of students with respect to ethical values for humanitarian and sustainable development spirits.
d. Better communication and coordination for disaster early warning and risk reduction with the regency and provincial disaster management institutions.

No.2

E2-1. Project name if available
Research-based education for earthquake induced landslide risk reduction

E2-2. Place
Tanjungsani Village at Agam Regency and Tandikek Village at Pariaman Regency, West Sumatra Province, Indonesia

E2-3. Year
2009 to 2010

E2-4. Investor
Gadjah Mada University – Ministry of National Education
Multi-national Oil Companies in Indonesia

E2-5. People involved
Students, Researchers and Lecturers with multidisciplines background from Gadjah Mada Univresity and from Andalas University
Local community and the key person at the project area.
Local government of Agam and Pariaman Regency, as well as of the West Sumatra Province.
Geological Survey of Indonesia.
Indonesian National Agency for Disaster Management.

E2-6. Monetary costs incurred
First Batch in December 2009 to January 2010:
30,000 USD supported by Oil Companies
10,000 USD supported by Gadjah Mada University-Ministry of National Education

E2-7. Total workload required
First Batch (Dec 2009 – January 2010): 21 students and 10 researchers/ lecturers, plus two volunteers.

E2-8. Evidence of positive result
Tangible evidence:
a. The establishment of Community Task Force for Disaster Risk Reduction (**Fig. 8**).
b. Landslide hazard and risk map, supported by the map of evacuation route and shelter (**Fig. 9**).
c. Modules/ materials for public education with respect to landslide disaster risk reduction.
d. Standard Operational Procedure for Evacuation.
e. Materials (modules, posters, booklet and calendar) for public education with respect to landslide disaster risk reduction.

Fig. 8 Community task force of Tanjungsani Nagari at Agam Regency (left) and Tandikek Nagari at Pariaman Regency (right) in West Sumatra Province

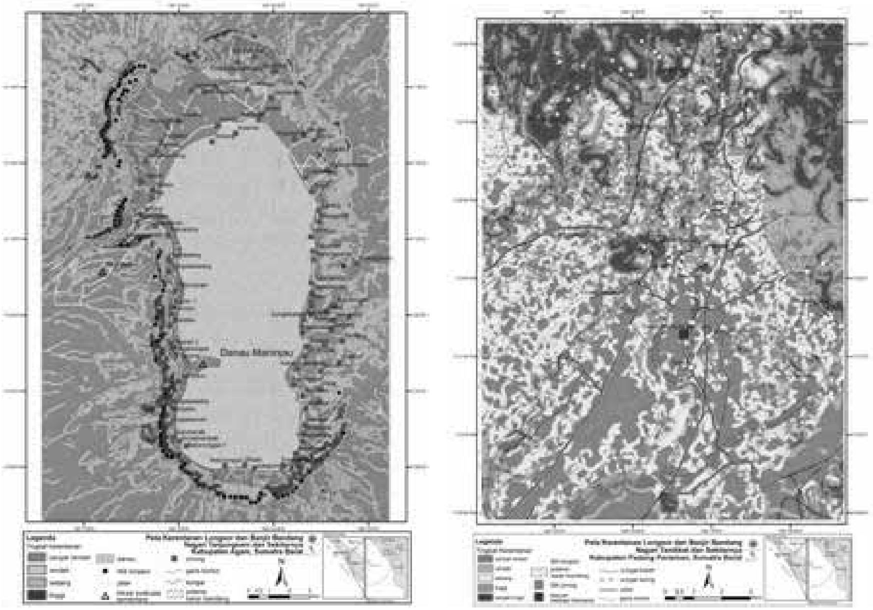


Fig. 9 Landslide hazard map of Maninjau Lake, Tanjungsani Nagari (left) and of Tandikek Nagari (right) at West Sumatra.

Intangible evidence:
a. Improvement of community awareness and capacity for disaster risk reduction.
b. Improvement of students'/young researchers' knowledge and skill for landslide disaster management.
c. Positive attitude of students with respect to ethical values for humanitarian and sustainable development spirits.
Additional outcomes to be proposed for the second batch:
The availability of landslide early warning system equipment.
Improvement of practical skill of the Community Task Force as the main driving force for Disaster Risk Reduction at the village level.
Better communication and coordination for disaster early warning and risk reduction with the regency and provincial disaster management institutions

X. Other related parallel initiatives if any

This education model has been promoted and recognized as one research excellence of International Program on Landslide under UNESCO (no IPL 159)

XI. Remarks for version upgrade

Attached files:

> DRH57_Cover_photo.png (PNG - 99 Kb)

Disaster Reduction Hyperbase - Asian Application (DRH-Asia) -

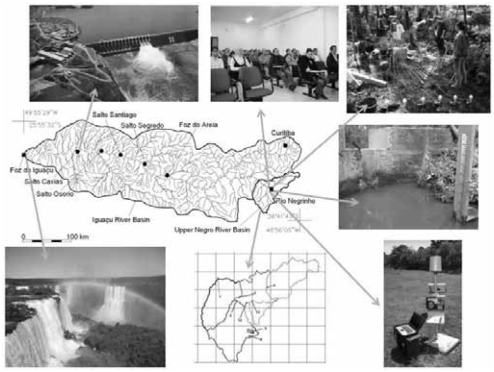
DRH-Asia Contents (DRH 58)

I. Heading

1. Title

School-Catchments Network for Water-related Disaster Prevention

ID:	DRH 58
Hazard:	Landslide, Mudflow, Flood, Flash flood, Drought, Desertification, Climate change impact, Land degradation, Multi-hazard
Category:	Process Technology (PT)
Proposer:	Masato Kobiyama
Country:	BRAZIL;
Date posted:	29 March 2010
Date published:	23 April 2010



School-Catchments Network in Upper Rio Negro watershed, Brazil

Contact
Dr. Masato KOBIYAMA
Associate Professor, Federal University of Santa Catarina (UFSC), Brazil
Coordinator, Laboratory of Hydrology (LabHidro), UFSC, Brazil
Contact: kobiyama@ens.ufsc.br / +55 (48)3721-7749

2. Major significance / Summary

Implementation of School Catchments Network is conducted by constructing various hydrological stations. This network is utilized for scientific research, environmental education and disaster prevention, by local inhabitants, scientists, water resources managers and the Civil Defense organization. Local communities can recognize the hydrological processes of their region and establish adequate manages of water resources and natural disasters.

3. Keywords

School catchment; monitoring; education; water resources management; disaster prevention.

II. Categories

4. Focus of this information

Process Technology (PT)

5. Anticipated Users

5-1. Practitioners: Community leaders (voluntary base), Administrative officers, Municipalities, National governments and other intermediate government bodies (state, prefecture, district, etc.), NGO/NPO project managers and staff, International organizations (UN organizations and programmes, WB, ADRC, EC, etc.), Commercial entrepreneurs, Experts, Teachers and educators, Architects and engineers, Information technology specialists, Urban planners, Rural planners, Environmental/Ecological specialists, Others
Civil Defense organization
5-2. Other users: Policy makers, Motivated researchers, Local residents

6. Hazards focused

Landslide, Mudflow, Flood, Flash flood, Drought, Desertification, Climate change impact, Land degradation, Multi-hazard

7. Elements at risk

Human lives, Human networks in local communities, Business and livelihoods, Infrastructure, Buildings, Urban areas, Rural areas, River banks and fluvial basin, Mountain slopes, Agricultural lands, Cultural heritages

III. Contact Information

8. Proposer(s) information (Writer of this template)

Dr. Masato KOBIYAMA
Associate Professor, Federal University of Santa Catarina (UFSC), Brazil
Coordinator, Laboratory of Hydrology (LabHidro), UFSC, Brazil
Contact: kobiyama@ens.ufsc.br / +55 (48)3721-7749

9. Place where the technology/knowledge originated

BRAZIL;
Upper Negro River basin, Santa Catarina state.

10. Names and institutions of technology/knowledge developers

Laboratory of Hydrology (LabHidro) of the Federal University of Santa Catarina (UFSC)

11. Title of relevant projects if any

"Analysis of the water and sediment production of the Rio Preto watershed through the use of school-catchments", funded by the National Council of Technological and Scientific Development (CNPq) of Brazil.

12. References and publications

Kobiyama M, Chaffe PLB, Rocha HL, Corseuil CW, Malutta S, Giglio JN, Mota AA, Santos I, Ribas Junior U, Langa R (2009). Implementation of school catchments network for water resources management of the Upper Negro River region, southern Brazil. In: Taniguchi M, Burnett WC, Fukushima Y, Haigh M, Umezawa Y (eds). From Headwaters to the Ocean: Hydrological Changes and Watershed Management, London: Tayor & Francis Group, 2009. p.151-157.

13. Note on ownership if any

IV. Background

14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice

The Upper Negro River (UNR) basin (3,552 km²) is one of the headwater basins of the Iguaçu River basin (68,410 km²) which is located along the border between the Paraná and Santa Catarina States, southern Brazil (**Fig. 1**).

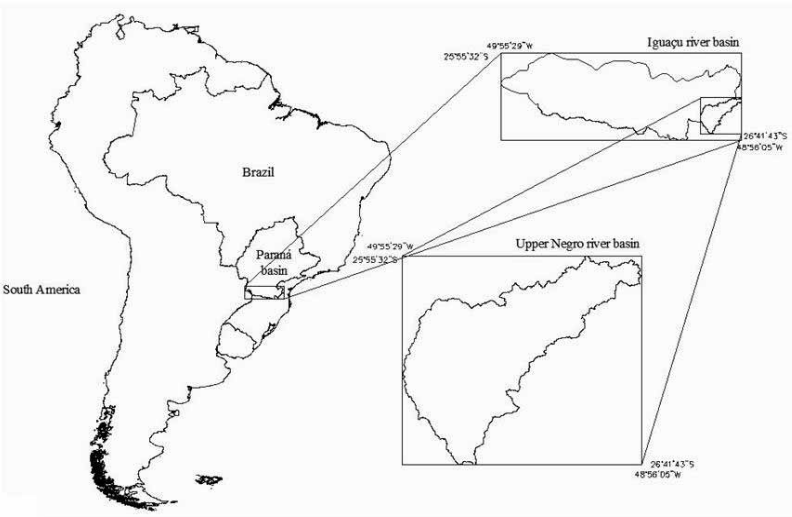


Figure 1 - Upper Negro River basin location

The Iguaçu River basin is characterized with a very high potential to generate the hydroelectric energy and there are 5 large hydroelectric-power-dams along the Iguaçu River. Some local communities have thought that the frequent floods are caused by the dam construction. Also, the Iguaçu River basin is characterized with the Subtropical Ombrophilous Forest (SOF). Since only 2 % of its original area remain, this ecosystem must be preserved. Recently the conversion of the pine reforestation areas to the SOF has been strongly requested without the consideration that the regional economy depends mainly on the reforestation activities. Therefore, the ecological and hydrological researches in the UNR basin are indispensable to reduce the damages caused by the water-related disasters. In these circumstances, seven small experimental catchments (0.1 to 10 km^2 scales) with hydrological monitoring were constructed in the UNR basin in order to answer the question about what kind of land-use is best for the water resources management (**Fig. 2**).

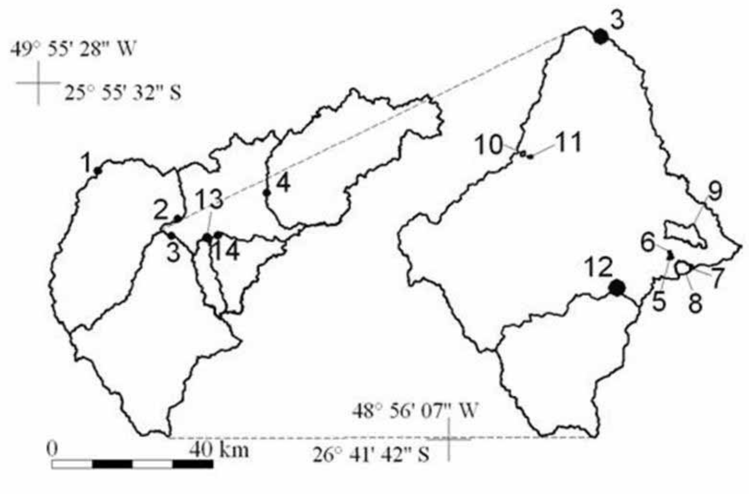


Figure 2 – School-catchments (1 to 12) in Upper Negro River basin

V. Description

15. Feature and attribute

School catchment network is a network of experimental catchments which serve for scientific research and educational purposes, such as environmental education activities of local communities and qualification lectures for technicians. The catchments should be equipped with meteorological, hydrological and/or sedimentological stations for scientific research and educational activities. Data provided by the stations can also be used for water and disaster management. Ideally, the school-catchments network should have catchments with different land-uses and also with different scales. This technology can be implemented through agreements between university, government and enterprises. In each municipality or region, the school-catchment network should be established and inhabitants, scientists, managers working together with the Civil Defense organization do the hydrological monitoring. The final goal of the school catchments network is disaster reduction. This technology would increase an individual's knowledge on hydrology, which would enhance his (or her) participation in the community in terms of water resources management and disaster prevention. Consequently, an enhanced participation of each member would elevate the quantity and quality of the community action, and would increase the efficiency of the water resources management and disaster prevention processes (**Fig. 3**).

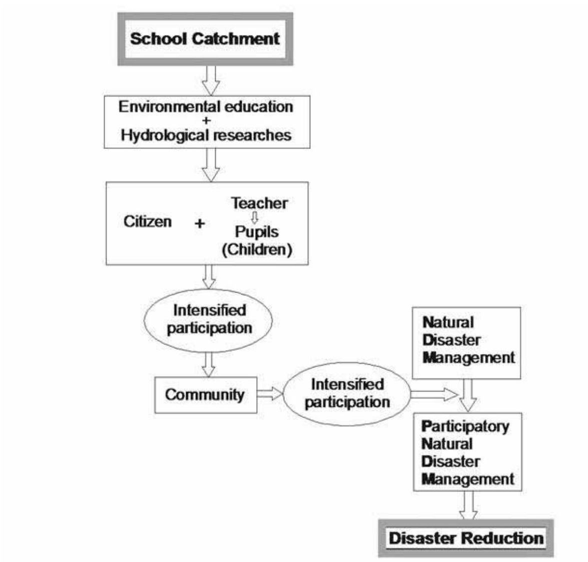


Figure 3 - Contribution of school-catchments network to disaster reduction

16. Necessary process to implement

This technology can be implemented through agreements between university, government and enterprises (**Fig. 4**).

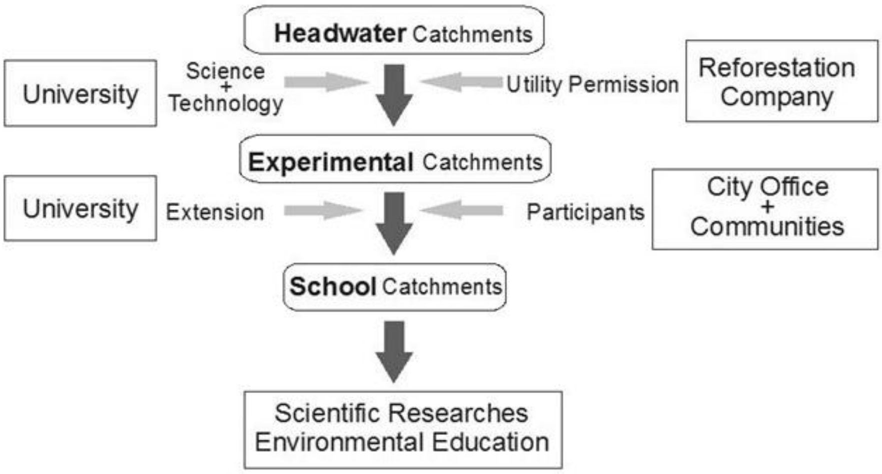


Figure 4 - Implementation of school catchments

Steps of the implementation: - Agreement between university and land owner (enterprises, government) for allowance of installation of monitoring stations in the strategic sites; - Installation and maintenance of meteorological, hydrological and/or sedimentological stations: by scientists; - Monitoring: by community, scientists, managers and Civil Defense organization; - Educational activities: by scientists and government; for children, students, teachers, technicians, managers and/or community; - Scientific research (monitoring and computational modeling): by scientists, university; - Data providing: database fed directly by automatic stations or by scientists; data freely available for scientists, government, enterprise, managers, Civil Defense organization, and community.

17. Strength and limitations

Strengths: - Contribution not only to the scientific researches but also to the environmental education activities; - Hydrological data provided for water resources management and disaster management; - Hydrological data available for enterprises, which can motivate them to participate in the project; - Hydrological data available for Civil Defense organization, which can improve its actions; - Hydrological data available for scientists, which can increase the understanding of natural processes; - Hydrological data available for community, which can increase its awareness about hydrological processes; - Hydrological data available for managers, which is essential for their water resources and disaster management; - Hydrological data available for government, which is useful for land and water management and urban planning; - Visiting school catchments allows a person to understand hydrology better; - People will recognize the hydrological processes of their region and can plan most adequate water resources and disaster management.

Limitations: - Site for the installation of stations is needed, for long-term period; - Financial resources for purchase and installation of stations is needed; - Maintenance of stations is needed.

18. Lessons learned through implementation if any

~ Agreement between the scientists (university) and land-owner (enterprise) and long-term commitment are essential; ~ Partnership with government (Municipality, Prefecture, District, or other) is important; ~ Frequent maintenance of stations is required; this task can be done by scientists and inhabitants.

VI. Resources required

19. Facilities and equipments required

~ Monitoring stations (automatic or not): rainfall gauge, river gauge station, meteorological station (optional), sediment sensor (optional), tensiometer (optional). ~ If stations are automatic: system for data transmission (e.g., radio, internet, satellite) and computer for data acquisition.

20. Costs, organization, manpower, etc.

~ Manpower is required for installation of the stations: inhabitants and scientist; ~ Human resource is required for collecting data periodically: about once a week or once a month, if the stations are automatic, or every day if station is not automatic; it can be done by inhabitants and/or scientists; ~ Human resource is required for maintenance of stations: by inhabitants and/or scientist; ~ Organizational support is required for educational activities: by government; ~ Capacitated human resource is required for lecturing in education activities: scientists; ~ Financial resources are required for installation of the stations: by government, university and/or enterprise.

VII. Message from the proposer if any

21. Message

Small, slow, simple and science are beautiful.

VIII. Self evaluation in relation to applicability

22. How do you evaluate the technology/knowledge that you have proposed?

It is a technology/knowledge that has fair applicability demonstrated by implementation in one or more field sites.

23. Notes on the applicability if any

IX. Application examples

No.1

E1-1. Project name if available
"Analysis of the water and sediment production of the Rio Preto watershed through the use of school-catchments"

E1-2. Place
Upper Negro River watershed (Bacia Hidrografica do Alto Rio Negro), Rio Negrinho city and vicinities, Santa Catarina state, South of Brazil.

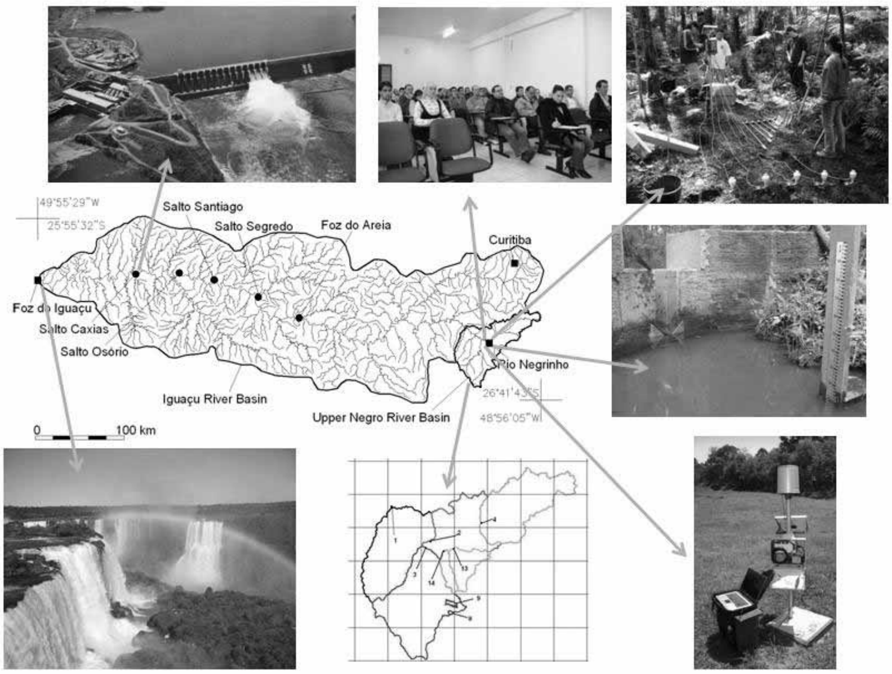


Fig. E-1 School-Catchments Network in Upper Rio Negro watershed, Brazil

E1-3. Year
2006

E1-4. Investor
National Council of Technological and Scientific Development (CNPq) of Brazil
Modo Battistella Reflorestamento S.A. - MOBASA (currently Battistella Florestas)

E1-5. People involved
Laboratory of Hydrology - Federal University of Santa Catarina (LabHidro/UFSC)
Rio Negrinho City Hall
Modo Battistella Reflorestamento S.A. - MOBASA (currently Battistella Florestas)
Laboratory of Hydrogeomorphology - Federal University of Parana
[Masato Kobiyama (Dr.), Pedro Luiz Borges Chaffe (Msc.), Henrique Lucini Rocha (Eng.), Fernando Grison (Msc.), Claudia Weber

Corseuil (Dr.), Simone Malutta, Joana Nery Giglio, Aline de Almeida Mota, Pedro Guilherme de Lara, Irani dos Santos (Dr.), Ulisses Ribas Junior (Eng.), Reinaldo Langa (Eng.), Elaine Cristina Schoeffel]

E1-6. Monetary costs incurred
Not every equipment are required. In the case of financial limitation, simpler gauges (not automatic) can be used. ~ Meteorological station US$ 2,500.00 ~ Parshall flume US$ 800.00 ~ Current meter US$ 6,000.00 ~ Pressure sensor (for water level) US$ 2,000.00 ~ Integrating Sediment sampler US$ 2,000.00 ~ Turbidity/Sediment station US$ 6,000.00 ~ Tensiometer US$ 200.00 ~ Microcomputer US$ 1,000.00 ~ Laptop US$ 1,000.00 ~ GPS US$ 700.00

E1-7. Total workload required
About 200 hours per week, by 20 people (mean + B208 of 10 hours per week per person).

E1-8. Evidence of positive result
~ Participants of the educational activities carried out so far were keen to attend more complementary hydrology courses that relate forest, water resources and natural disasters; ~ It is easily perceived that visiting school catchments allows a person to understand hydrology better.

X. Other related parallel initiatives if any

XI. Remarks for version upgrade

Attached files:

Appendix: DRH Template (ver.7.3)

Template for DRH Database (ver.7.3)

Disaster Reduction Technology and Knowledge under Implementation Strategies

<table>
<tr><th colspan="3">I. Heading</th></tr>
<tr><td colspan="2">1. Title</td><td></td></tr>
<tr><td colspan="2">2.Major significance
(summary less than 60 words)</td><td></td></tr>
<tr><td colspan="2">3. Keywords</td><td></td></tr>
<tr><th colspan="3">II. Categories (Multiple answers allowed)</th></tr>
<tr><td colspan="2">4. Focus of this information
Instruction for writers:
- For definitions, see the DRH website. http://drh.edm.bosai.go.jp/</td><td>☐ Implementation Oriented Technology
☐ Process Technology
☐ Transferable indigenous knowledge</td></tr>
<tr><td>5. Anticipated users</td><td>5-1. Practitioners

- Mark main and sub categories freely. There are no hierarchical rules.
- Items of “experts” may overlap with other categories. In that case, mark both categories.</td><td>☐ Community leaders (voluntary base)
☐ Administrative officers
  ☐ Municipalities
  ☐ National governments and other intermediate government bodies (state, prefecture, district, etc.)
☐ NGO/NPO project managers and staff
☐ International organizations (UN organizations and programmers, WB, ADRC, EC, etc.)
☐ Commercial entrepreneurs
☐ Financing and insurance business personnel
☐ Experts</td></tr>
</table>

		☐ Teachers and educators ☐ Architects and engineers ☐ Sociologists and political economists ☐ Information technology specialists ☐ Urban planners ☐ Rural planners ☐ Environmental/Ecological specialists ☐ Others (Explain using the blank space below.)
	5-2. Other users	☐ Policy makers ☐ Motivated researchers ☐ Local residents
6. Hazards focused - Secondary hazard should be included in the categories of the original hazards. - Multi-hazard approach: Initiatives that focus on the combined risks of all hazards likely to occur in a given region.		☐ Earthquake ☐ Tsunami ☐ Volcanic eruption ☐ Landslide ☐ Mudflow ☐ Dust storm ☐ Cold wave ☐ Heat wave ☐ Zud ☐ Cyclone/ Typhoon ☐ Storm surge ☐ Flood ☐ Flash flood ☐ Glacial Lake Outburst Flood (GLOF) ☐ Snow avalanches ☐ Epidemic ☐ Wildfire ☐ Drought ☐ Desertification ☐ Climate change impact ☐ Land degradation ☐ Multi-hazard (Multi-hazard approach) ☐ Others (Explain using the blank space below. Other hazards, disaster chains, etc.)

7. Elements at risk		☐ Human lives ☐ Human networks in local communities ☐ Business and livelihoods ☐ Infrastructure ☐ Buildings ☐ Information and communication system ☐ Urban areas ☐ Rural areas ☐ Coastal areas ☐ River banks and fluvial basin ☐ Mountain slopes ☐ Agricultural lands ☐ Cultural heritages ☐ Others (Explain using the blank space below.)
III. Contact Information		
8. Proposer(s) information (Writer(s) of this template) - Name(s), position and affiliation, and other information (at least one of mailing address, e-mail address, tel. & fax.) are required.		
9. Place where the technology/ knowledge originated	9-1. Country(ies)	
	9-2. Location(s)	
10. Names and institutions of technology/knowledge developers		
11. Title of relevant projects if any		
12. References and publications		
13. Note on ownership if any		

IV. Background	
14. Disaster events and/or societal circumstances, which became the driving force either for developing the technology/knowledge or enhancing its practice	
V. Descriptions	
15. Feature and attribute (Aim and key mechanism to achieve the aim)	
16. Necessary process to implement (Procedure and major actors)	
17. Strength and limitations (Positive and negative sides)	
18. Lessons learned through implementation if any	

VI. Resources required	
19. Facilities and equipments required	
20. Costs, organization, manpower, etc.	
VII. Message from the proposer (if any)	
Instruction for writers: Any message from you to readers regarding intention, interpretation, utilization, etc. of this technology/knowledge.	
21. Your message	
VIII. Self evaluation in relation to applicability	
22. How do you evaluate the technology/knowledge that you have proposed? Instruction for writers: - Only a single answer allowed	*“It is a technology/knowledge that…”* ☐ a. has high application potential verified by implementation in various field sites. ☐ b. has fair applicability demonstrated by implementation in one or more field sites. ☐ c. is shown to be effective based on case studies/experiments in field sites. ☐ d. is shown to be effective based so far only on scientific experiments in laboratory. ☐ e. Others (Explain using the blank space below.)
23. Notes on the applicability if any	

IX. Application examples

Instruction for writers:

- Fill in this section with the examples that the technology/knowledge was applied to any fields. You may also write about ongoing projects.
- Writers who marked "a" and "b" in Section VIII are expected to provide as many examples as possible. Those who marked "c" to "e" are also strongly recommended to fill in here, but not compulsory.

No.1 (E1)

E1-1. Project name if available			
E1-2. Place - Specify as much as possible.			
E1-3. Year		**E1-4. Investor**	
E1-5. People involved - Indicate all contributors with their titles when available.			
E1-6. Monetary costs incurred - Show the breakdown with approximate cost for each facility or equipment, if possible.			
E1-7. Total workload required (Time frame and human resources)			
E1-8. Evidence of positive results (Tangible / intangible)			

No.2 (E2)

E2-1. Project name if available			
E2-2. Place - Specify as much as possible.			
E2-3. Year		**E2-4. Investor**	
E2-5. People involved - Indicate all contributors with their titles when available.			
E2-6. Monetary costs incurred - Show the breakdown with approximate cost for each facility or equipment, if possible.			
E2-7. Total workload required (Time frame and human resources)			
E2-8. Evidence of positive results			

(Tangible / intangible)			
No.3 (E3)			
E3-1. Project name if available			
E3-2. Place - Specify as much as possible.			
E3-3. Year		E3-4. Investor	
E3-5. People involved - Indicate all contributors with their titles when available.			
E3-6. Monetary costs incurred - Show the breakdown with approximate cost for each facility or equipment, if possible.			
E3-7. Total workload required (Time frame and human resources)			
E3-8. Evidence of positive results (Tangible / intangible)			
No.4 (E4)			
E4-1. Project name if available			
E4-2. Place - Specify as much as possible.			
E4-3. Year		E4-4. Investor	
E4-5. People involved - Indicate all contributors with their titles when available.			
E4-6. Monetary costs incurred - Show the breakdown with approximate cost for each facility or equipment, if possible.			
E4-7. Total workload required (Time frame and human resources)			
E4-8. Evidence of positive results (Tangible / intangible)			
No.5 (E5)			
E5-1. Project name if available			

E5-2. Place - Specify as much as possible.			
E5-3. Year		**E5-4. Investor**	
E5-5. People involved - Indicate all contributors with their titles when available.			
E5-6. Monetary costs incurred - Show the breakdown with approximate cost for each facility or equipment, if possible.			
E5-7. Total workload required (Time frame and human resources)			
E5-8. Evidence of positive results (Tangible / intangible)			

X. Other related parallel initiatives (if any)

XI. Remarks for version upgrade

Index A : Category Index

Implementation Oriented Technology (IOT)

DRH 1, DRH 3, DRH 6, DRH 10, DRH 12, DRH 18, DRH 22, DRH 23, DRH 26, DRH 33, DRH 39, DRH 40, DRH 41, DRH 50, DRH 56

Process Technology (PT)

DRH 2, DRH 13, DRH 19, DRH 22, DRH 23, DRH 24, DRH 25, DRH 28, DRH 29, DRH 38, DRH 48, DRH 49, DRH 51, DRH 53, DRH 57, DRH 58

Transferable Indigeous Knowledge (TIK)

DRH 4, DRH 8, DRH 11, DRH 15, DRH 16, DRH 17, DRH 25, DRH 29, DRH 36, DRH 44, DRH 45

Index B : Hazard Index

Earthquake
DRH 1, DRH 2, DRH 3, DRH 4, DRH 6, DRH 11, DRH 13, DRH 18, DRH 22, DRH 23, DRH 24, DRH 25, DRH 26, DRH 38, DRH 39, DRH 40, DRH 41, DRH 48, DRH 50, DRH 57

Tsunami
DRH 1, DRH 10, DRH 12, DRH 13, DRH 18, DRH 24, DRH 26, DRH 33, DRH 48

Volcanic eruption
DRH 2, DRH 13, DRH 18, DRH 24, DRH 26, DRH 48

Landslide
DRH 13, DRH 18, DRH 24, DRH 26, DRH 48, DRH 53, DRH 56, DRH 57, DRH 58

Mudflow
DRH 13, DRH 18, DRH 24, DRH 26, DRH 48, DRH 57, DRH 58

Dust storm
DRH 18, DRH 24, DRH 48

Cold wave
DRH 24, DRH 48

Heat wave
DRH 24, DRH 29, DRH 48

Zud
DRH 24, DRH 48

Cyclone/ Typhoon
DRH 4, DRH 13, DRH 18, DRH 19, DRH 24, DRH 26, DRH 48

Storm surge
DRH 10, DRH 12, DRH 13, DRH 16, DRH 18, DRH 19, DRH 24, DRH 26, DRH 48

Flood
DRH 6, DRH 8, DRH 12, DRH 13, DRH 16, DRH 17, DRH 18, DRH 24, DRH 26, DRH 36, DRH 44, DRH 48, DRH 53, DRH 58

Flash flood
DRH 13, DRH 15, DRH 16, DRH 18, DRH 24, DRH 26, DRH 48, DRH 53, DRH 57, DRH 58

Glacial Lake Outburst Flood (GLOF)
DRH 24, DRH 26, DRH 48

Snow avalanches
DRH 13, DRH 24, DRH 26, DRH 48

Epidemic
DRH 24, DRH 48

Wildfire
DRH 26, DRH 48

Drought
DRH 13, DRH 15, DRH 18, DRH 24, DRH 26, DRH 29, DRH 44, DRH 45, DRH 48, DRH 58

Desertification
DRH 24, DRH 29, DRH 45, DRH 48, DRH 58

Climate change impact
DRH 45, DRH 48, DRH 53, DRH 56, DRH 58

Land degradation
DRH 15, DRH 24, DRH 45, DRH 48, DRH 58

Multi-hazard (Multi-hazard approach)
DRH 3, DRH 6, DRH 13, DRH 24, DRH 28, DRH 48, DRH 49, DRH 51, DRH 57, DRH 58

Others
DRH 2, DRH 48, DRH 49, DRH 51

Index C : Country/Region Index

Afganistan
DRH 22

Algeria
DRH 11

Bangladesh
DRH 17, DRH 19, DRH 22

Brazil
DRH 58

Cambodia
DRH 28

China
DRH 16, DRH 44, DRH 45

India
DRH 22, DRH 28, DRH 29

Indonesia
DRH 10, DRH 12, DRH 18, DRH 22, DRH 23, DRH 28, DRH 51, DRH 56, DRH 57

Iran
DRH 22, DRH 25

Japan
DRH 1, DRH 2, DRH 3, DRH 4, DRH 6, DRH 8, DRH 10, DRH 12, DRH 22, DRH 24, DRH 26, DRH 33, DRH 36, DRH 38, DRH 40, DRH 41, DRH 50, DRH 51

Nepal
DRH 22, DRH 28, DRH 51, DRH 53

Pakistan
DRH 22, DRH 48, DRH 51

Papua New Guinea
DRH 12

Peru
DRH 13

Philippines
DRH 28, DRH 49

Sri Lanka
DRH 15

Tajikistan
DRH 22

Turkey
DRH 51

Other
UN/ IDNDR (International Decade for Natural Disaster Reduction): DRH 39

Technical Note of the National Research Institute for Earth Science and Disaster Prevention, No. 350 ; December, 2010

アジア防災科学技術情報基盤（**DRH-Asia**）コンテンツ集

亀田弘行[*]・根岸弘明[*]・塩飽孝一[*]・池田菜穂[*]・徳武美穂[*] 編集

[*]防災科学技術研究所　地震防災フロンティア研究センター

要　旨

アジア防災科学技術情報基盤（DRH アジア）は，災害軽減のための技術および知識を広く普及させる事を目的として構築されたデータベースである．文字通り，主にアジアを対象とした防災技術を取り扱うものであるが，実際には世界の様々な地域で考案され，検証された技術がアジア地域へ適用される可能性を持っており，その結果として広く世界中からの技術を対象とする．本データベースはウェブ上のインタラクティブなシステムにより運用され，コンテンツの投稿受付から議論を基にした改善作業（facilitation），そして公開までが一元的に行われる．2006 年から実際のコンテンツ収集を開始しており，2010 年 10 月現在，約 60 のコンテンツが投稿されており，そのうち 38 がデータベース上に登録され，公開されている．本巻は，DRH アジアのウェブデータベースで公開されている防災技術コンテンツを，DRH テンプレートの形式でまとめたものである．巻末には防災技術のカテゴリ，対象とする自然災害，およびその技術の検証された国による簡単な索引も付してある．オリジナルであるウェブ上の DRH アジアデータベースは，ここに掲載されているコンテンツ本体の他に様々な付加データ（動画ファイルやアプリケーション等）を含んでおり，本巻と同時に DRH アジアウェブサイト（http://drh.edm.bosai.go.jp）にもアクセスしてコンテンツを参照願いたい．

キーワード：防災技術，DRH アジア，現場適用戦略，データベース

（原稿受理：2010 年 10 月 26 日）