クロアチア
土砂・洪水災害軽減プロジェクト
中間レビュー調査
報告書

平成25年2月
（2013年）

独立行政法人国際協力機構
地球環境部

環境
JR
13-021

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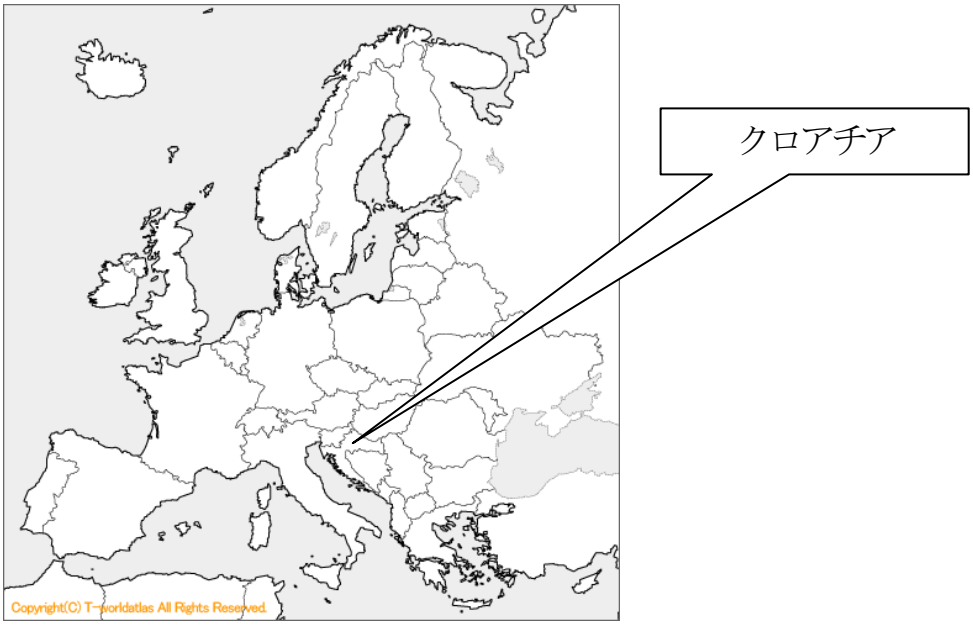
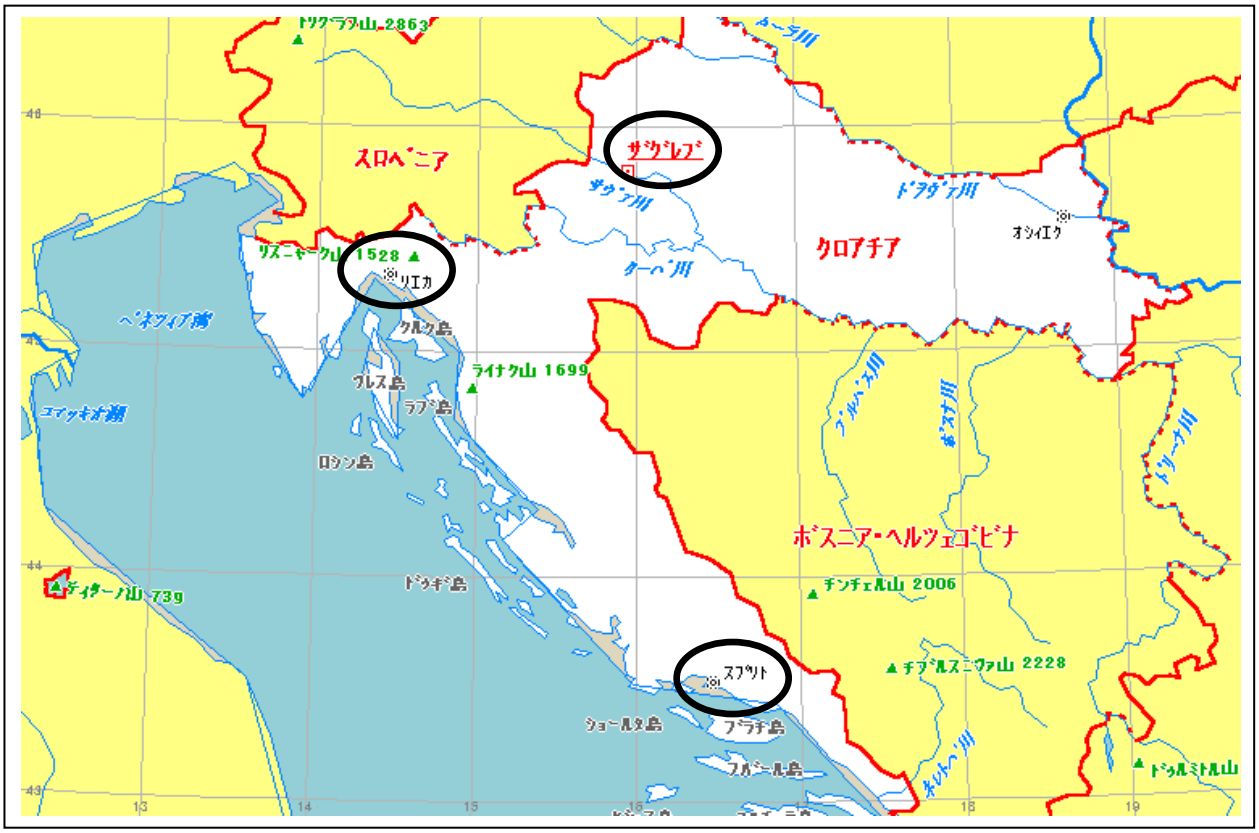
調査対象地域位置図



出典：http://www.sekaichizu.jp/atlas/europe/index.html



現地調査写真

コスタンジェック地すべり地
（ザグレブ）

地盤の変動により歪んでしまった家
（コスタンジェック地すべり地）

プロジェクトで設置した伸縮計
（コスタンジェック地すべり地）

プロジェクトで孔内に設置した傾斜計
（コスタンジェック地すべり地）

グロホボ地すべり地（リエカ）の
機材設置個所

ミニッツへの署名

略　語　表

AHP	Analytical Hierarchy Process　階層構造分析法
CGS	Croatian Geological Survey　クロアチア地質調査所
CW	Croatian Water　クロアチア水公社
DEM	Digital Elevation Model　数値標高モデル
DPRI	Disaster Prevention Research Institute, Kyoto University　京都大学防災研究所
DUZS	*Državna uprava za zaštitu i spašavanje*　(National Protection and Rescue Directorate) 国家保安・救援局
EMO	Emergency Management Office, City of Zagreb　ザグレブ市危機管理室
GIS	Geographic Information System　地理情報システム
HRK	Croatian Kuna (international abbreviation)　クロアチアクーナ
ICL	International Consortium on Landslides 国際斜面災害研究機構
JCC	Joint Coordination Committee　合同調整委員会
JPY	Japanese Yen　日本円
JICA	Japan International Cooperation Agency　独立行政法人国際協力機構
JST	Japan Science and Technology Agency　独立行政法人科学技術振興機構
LIDAR	Laser Imaging Detection and Ranging　レーザー画像検出と測距
M/M	Minutes of Meetings　会議議事録
MZOS	*Ministarstvo obrazovanja, znanosti i sporta*　(Ministry of Science, Education and Sport) 科学教育スポーツ省
PO	Plan of Operation　活動計画
R/D	Record of Discussion　討議議事録
SATREPS	Science and Technology Research Partnership for Sustainable Development 地球規模課題対応国際科学技術協力
UR	University of Rijeka, Faculty of Civil Engineering　リエカ大学土木工学部
US	University of Split, Faculty of Civil Engineering, Architecture and Geodesy スプリット大学土木工学・建築・測地学部
UZM	University of Zagreb, Faculty of Mining, Geology and Petroleum Engineering ザグレブ大学鉱業・地質・石油工学部
UZA	University of Zagreb, Faculty of Agriculture　ザグレブ大学農学部
VAT	Value Added Tax　付加価値税
WG	Working Group　ワーキンググループ

目　　次

付属資料

1　Mid-term Review Report（英文）
2　協議議事録（Minutes of Meeting）（英文）

中間レビュー調査結果要約表

1. 案件の概要	
国名：クロアチア	**案件名：**土砂・洪水災害軽減プロジェクト
分野：防災	**協力形態：**地球規模課題対応国際科学技術協力(SATREPS)
所轄部署：地球環境部水資源・防災グループ	**協力金額：**3.5 億円（JICA 予算ベース）
協力期間：(R/D) 2009 年 3 月～2014 年 3 月	**先方実施機関：** MZOS（科学教育スポーツ省）、ザグレブ大学、リエカ大学、スプリット大学、クロアチア水公社、クロアチア地質調査所
日本側協力機関：新潟大学、京都大学、国際斜面災害研究機構、東北学院大学、山形大学	

1-1 協力の背景と概要

クロアチアの国土は、断層・褶曲の影響を受けた複雑で脆弱な地形・地質構造を有し、地震が頻繁に発生する。また、アドリア海沿岸部を中心として全般的に降水量が多く、年平均降水量が 3500mm を超えている地域もある。こうした地震や降雨が引き金となり、風化しやすい砂岩[1]・頁岩[2]（けつがん）互層[3]や、摩擦角の低い粘土を多量に含んだ泥灰岩層のある斜面・渓流においては、地すべり、斜面崩壊、土石流等の土砂災害が多発し、また地層中に水みちが形成されやすい石灰岩地域においては局所的洪水（フラッシュ・フラッド）が発生する。

このような災害リスクの高い地域は、都市周辺部に多く見られるが、無秩序な開発により人口増加や資産の蓄積が進んでおり、土砂災害やフラッシュ・フラッドによる被害の増加が懸念されている。また、今後、気候変動による降雨パターンの変化で、地域によっては災害リスクがさらに高まる恐れもある。

しかしながら、クロアチアにおいては土砂災害やフラッシュ・フラッドのリスクを的確に評価し、それに基づく対策を講じるために必要な手法と仕組みが整備されていないことから、開発規制や災害予警報・避難体制の構築はほとんど行われていないのが実情であり、これを可能にするためには、これらの現象の科学的理解に基づく信頼しうる危険度評価手法やハザードマップ作成手法の開発、及び災害リスクを考慮した土地利用の改善に資する研究の実施が求められている。

このような背景において、2008 年に創設された「地球規模課題対応国際科学技術協力」の制度の下で、本案件がクロアチア政府から要請され、2009 年 1 月に詳細計画策定調査が実施された。また、2009 年 3 月に実施協議調査団が派遣され、2009 年 3 月 27 日に R/D（討議議事録）が署名された。プロジェクト終了予定は 2014 年 3 月 31 日であり、プロジェクトの中間地点である 2012 年 7 月には、R/D の第 V 項に従って中間レビューが実施された。

1-2 協力内容

(1) プロジェクト目標

クロアチア国内で適用可能な土砂・洪水災害統合ハザードマップ作成手法、及びハザードマップ

[1] 主に砂が堆積作用により固結してできた岩石
[2] 泥が水中で水平に堆積したものが脱水・固結してできた岩石のうち、堆積面に沿って薄く層状に割れやすい性質があるもの
[3] 岩質の違う単層が交互に繰り返し重なり合っている層

に基づく土砂・洪水災害軽減のための土地利用ガイドライン作成手法が開発される。

(2) 成果

1) クロアチア国の水文、地質条件に適応した地すべりの危険度評価手法、地すべり運動予測手法及び早期警戒システムが開発される。
2) クロアチア国の水文、地質条件に適応した局所的洪水（フラッシュ・フラッド）、土石流のシミュレーションモデル、及び早期警戒システムが開発される。
3) 土砂・洪水災害統合ハザードマップ、及びこれに基づく被害軽減のための土地利用ガイドラインが、調査対象地域で作成される。

(3) 投入（中間レビュー時点）

（日本側）短期専門家（研究者）：17 名（計 82 回、997 日間）、長期専門家（業務調整）：1 名
本邦研修：2010 年 4 名、2011 年 7 名
供与機材費：1 億 2842 万円（2010 年、2011 年の合計）
プロジェクト活動費：2 億 3710 万円（2010 年、2011 年の合計。供与機材費のほか、専門家派遣費用、本邦研修費用、現地活動費など）

（クロアチア側）カウンターパート：MZOS（科学教育スポーツ省）、ザグレブ大学、リエカ大学、スプリット大学、クロアチア水公社、クロアチア地質調査所
事務所スペース・備品の提供

(4) プロジェクトサイト

調査対象地域：ザグレブ、リエカ、スプリット

2. レビュー調査団の概要

調査団構成	1. 宮本秀夫（団長／総括）JICA 地球環境部　参事役 2. 村上　淳（協力企画）JICA 地球環境部防災第ニ課 3. 奥田浩之（評価分析）合同会社適材適所	
（以下オブザーバー）	4. 本藏義守（科学技術評価）JST 地球規模課題対応国際科学技術協力事業研究主幹 5. 佐藤雅之（科学技術評価）JST 地球規模課題国際協力室参事役 6. 月岡康一（科学技術評価）JST 地球規模課題国際協力室上席主任調査員 7. 酒井紀久子（科学技術評価）JST パリ事務所シニア・プログラム・コーディネーター	
調査期間	2012 年 6 月 25 日～2012 年 7 月 15 日	**調査種類：**中間レビュー

3. 進捗の確認

3-1 成果レベルの実績

1) 成果 1

- コスタニエク（ザグレブ）、グロホボ（リエカ）、ドゥチェ及びオミッシュ（スプリット）の計 4 ヶ所のモデルサイトが選択されている。
- 地すべり再現試験が可能な非排水リングせん断試験機の開発が終了し、またクロアチア若手研究者 2 人×2 ヶ月×2 回の、当該試験機を用いて試験方法に関する習熟訓練が実施された。
- コスタニエク、グロホボから採取した地すべり土試料が日本に配送され、当該試験機による土質試験が実施された。また当該試験機については、現在、日本からリエカ大学に向け発送中である。
- グロホボでは、総合モニタリングシステムの設置がほぼ完了している。早期警戒システムの根幹となる伸縮計が設置されて観測が進行しており、早期警戒に必要な基準値の設定のためのデータ

を収集中である。

2) 成果 2

- レジナ川流域、ドブラチナ川流域、モセニツカ・ドラガ（リエカ）、イモツキ、スティナ・カラカティカ（スプリット）の 5 ヶ所のモデルサイトが選択されている。また、リエカ大学がドゥルブルで実施している研究は、フラッシュ・フラッド、土石流のシミュレーションモデルのための要因解析に貢献することから、これを加えて計 6 ヶ所となる。
- リエカのモデルサイトでは降雨計測装置が設置され、降雨データを収集中である。
- 土石流の物理試験が、クロアチア研究者も参加して京都大学で実施されている。フラッシュ・フラッド、土石流のシミュレーションモデル（Hydro-Debris 3D）の開発が終了している。

3) 成果 3

- メドヴェニカ丘陵地帯（ザグレブ）、レジナ川流域、ドブラチナ川流域（リエカ）、ドゥチェ、オミシュ（スプリット）の計 5 ヶ所のモデルサイトが選択されている。
- ザグレブとリエカにおいては、主として空中写真を用いてモデルサイトおよびその周辺地域の地形判読が終了した。また、必要箇所については数値地形図を作成し、一部抽出空域については航空レーザー測量による地形判読が実施されている。さらにスプリットでは、地上からのレーザー測量によるサイトの観測を 2011 年 9 月から継続している。
- ザグレブとリエカでは、斜面災害地マップ及び AHP（階層構造分析法）による斜面災害危険度評価マップを作成中である。
- 統合ハザードマップ及び土地利用ガイドラインの作成に向けて、各大学の研究者は地方自治体の担当者との連絡・連携を進めている。

3-2 プロジェクト目標の達成度

プロジェクト目標の指標は、署名された R/D 中のマスタープランの中では設定されていなかったが、中間レビュー調査時点で、プロジェクトは各成果レベルで着実に研究活動が進展している。プロジェクトの総合的な進捗から、活動開始の遅れや資機材設置の遅れはあったものの、プロジェクトは 2014 年 3 月までの終了期間までに目標を達成する可能性は十分あると見込まれる。

4. ５項目評価の概要

4-1 妥当性

プロジェクトの妥当性は高い。

- クロアチアには、保安・救援に関する計画（官報 96/10）、自然災害からの保護に関する法律（官報 73/97）など、災害被害軽減に関するいくつかの政策・法律があり、本プロジェクトはこれら政策・法律に整合しているたけでなく、その実現に貢献している。
- モデルサイトは、クロアチア側の研究者の提案に基づき決定されている。ザグレブ市コスタニエクは、クロアチアで最大の地すべり地帯であり、ザグレブ市危機管理室の主要懸案事項となっている。リエカ市がその河口に位置するレジナ川は、洪水が起きた場合には市に大きな被害が及び、グロホボで同時に地すべりが起これば土石流により更に被害が拡大することも予想される。スプリットのオミシュ及びドゥチェは、頻繁に起こる落石により多くの家屋と人々が被害を受ける恐れがある。本プロジェクトは、こうした地方自治体や住民の災害軽減のニーズにも応えるものである。

4-2 有効性

プロジェクトの有効性は中程度である。

- プロジェクトの 3 つの成果はプロジェクト目標を達成するために必要なコンポーネントであり、これら成果とプロジェクト目標との関係は明確である。
- 一方、現在の PO（活動計画）では、今後の 2 年間でどのように各活動が実施され完了していくのか、特にプロジェクト目標の達成に向けて成果 3 において成果 1 と成果 2 がどのように利用・統合されていくのか、その過程と時期が示されていない。よってプロジェクト後半のための PO を準備し、そこで活動のプロセスとタイムラインを明確化し、日本とクロアチア双方で合意しておくことが求められる。
- 本プロジェクトのマスタープランでは、終了時評価時に各成果及びプロジェクト目標の達成度を検証することになる指標が定められていなかった。中間レビュー調査により、これまでのプロジェクトの進捗をレビューし、2 年後の目標を見据えて指標を関係者間で議論し合意した。

4-3 効率性

プロジェクトの効率性は中程度である。

- R/D 署名は 2009 年 3 月 27 日であったが、クロアチア側で内部調整に時間がかかったため口上書交換が終了したのは 2010 年 3 月 9 日であり、プロジェクトの開始が 1 年遅れた。
- またプロジェクト機材の調達については、VAT（付加価値税）免税が R/D に記載されていたものの、VAT 免税の手続きについて、日本側・クロアチア側双方の関係機関でこれまで実際に行った経験がなかった。その結果、研究に必要な機材の調達・設置が遅れ、さらにプロジェクト活動の進捗に影響を与えることとなった。
- プロジェクトの実施・運営体制を議題にしてプロジェクト関係者が一堂に会した会議は、2012 年 2 月に開催された第 1 回 JCC（プロジェクト合同調整委員会）が最初であり、今回の中間レビューを契機に第 2 回目の JCC が開催された。
- MZOS が一定のカウンターバジェットを確保して大学に配分するとともに、プロジェクトへの参画を通して博士号を取得する予定の 9 人の若手研究者の給与、供与資機材の配送・設置費等を支払っている。また、プロジェクトを実施している各大学も、会議費や旅費といった費用を負担している。
- プロジェクト開始当初より、日本側研究者・クロアチア側研究者は WG（ワーキンググループ）1、2、3 に属し、それぞれ成果 1、2、3 を担当してきた。しかしスプリット大学は、ザグレブ大学およびリエカ大学から距離的に離れているため、これら WG の一部として速やかな打ち合わせや調整が困難であった。このため、第 1 回 JCC 後にスプリット大学に新たに WG4 が設置され、今後はプロジェクト・マネジャーと直接連絡を取ること等によるプロジェクト調整の効率化が期待される。
- プロジェクトは、研究の進展と知見を共有するための国際会議を毎年開催している。日本側研究者とクロアチア側研究者の間での連絡調整は、WG 内では必要に応じて適切に実施されてきたが、WG 間の研究者のやり取りは少なく、こうした国際会議や JCC での場に限られてきた。

4-4 インパクト

プロジェクトのインパクトは、現時点ではまだ評価する段階には至っていない。

- プロジェクトが目的を達成し、社会実装が開始されれば、自然災害のリスク軽減、それに向けた具体的対策といった正のインパクトが期待されるが、中間レビュー時点では、これら期待される

インパクトはまた現れていない。

- プロジェクトにより、地方自治体と大学との関係が開始され、強化されている。地方自治体はR/D にはカウンターパートとして記載されていないが、今では研究者によりプロジェクト目標の達成に向け欠かせないパートナーであると認識されている。
- プロジェクトが実施した国際会議では、セルビア、ボスニア・ヘルツェゴビナ、コソボ、マケドニア、スロベニアといった隣国からの研究者も参加し、地すべりと局所的洪水・土石流に関する研究成果と知見が共有されている。
- プロジェクト・マネジャー（リエカ大学研究開発副学長、WG2 リーダー）が、MZOS の代表として、2012 年より国家保安・救援局の構成員となっている。

4-5 自立発展性

プロジェクトの自立発展性の見込みは中程度である。

- 人材的、技術的な観点からみたプロジェクトの持続可能性の見込みは、中程度以上である。現在、9 人の若手研究者が MZOS の予算によりプロジェクトに従事し博士号を取得する予定である。また、モデルサイトに設置された機材は、MZOS が費用を負担して良好に維持されている。
- 制度的な観点からは、研究成果がどのように土地利用ガイドラインといった行政政策に反映されるのか、その道筋が現時点では明確ではない。地方自治体と大学との関係については災害リスク管理に向けた連携の仕組み作り、また、研究成果がクロアチア国内の災害管理政策に貢献していくためには、国家保安・救援局の巻き込みも今後必要である。
- MZOS は現在、プロジェクト活動費の一部を負担しているものの、将来的な予算確保の見込みは現時点では不確かである。

4-6 プロジェクトの効果発現を促進・阻害した主な要因

(1) 促進要因

クロアチア側の人材的・技術的な高いキャパシティに加え、両国の研究者がプロジェクト当初の遅れを取り戻すべく鋭意活動を実施してきていること、また日本の研究者が頻繁にクロアチアに赴き、研究及び関係者間の調整活動を行ってきたことが、主な促進要因として挙げられる。

(2) 阻害要因

クロアチアでの技術協力プロジェクトの実施例は少なく、また現地事務所や兼轄する周辺事務所もないという状況での事業実施となったことが、国際約束の締結や供与機材の免税といったプロジェクト業務手続きの遅れの主要因として認められた。

5. 評価結果の要約

5-1 結論

プロジェクトは、災害軽減に関するクロアチアの法律・政策と整合しているだけでなく、対象地域の地方自治体・人々のニーズにも合致しており、その妥当性は高い。プロジェクトは適切にデザインされているが、プロジェクト目標の達成に向けては、これから終了時までの 2 年間の各活動の過程・時期がさらに明確化され、関係者間で共有されることが求められる。プロジェクトの効率性は中程度と判断されたが、これはプロジェクト開始の遅れ、続く機材設置の遅れがあったためである。中間レビュー時点では、まだプロジェクトのインパクトを検討する段階には至っていない。プロジェクトの持続可能性については、人材的・技術的な観点からは活動の十分な維持が見込まれるが、制度的・財政的な観点からは現時点ではまだ不確かである。

5-2 提言

ア．プロジェクト目標の達成を確実にするための提言

1) マスタープランを改訂し指標を設定の上、改訂マスタープランに沿ってプロジェクトを実施する。

2) 活動を細分化し、各活動の実施時期を明確にした上で、改訂 PO（活動計画）に基づきプロジェクトを実施する。プロジェクトの残り期間中、必要に応じて改訂 PO の再改訂を行う。

3) 土砂・洪水災害統合ハザードマップの作成のため、WG2（フラッシュ・フラッド・土石流研究）及び WG1・WG3（地すべり研究）間で、プロジェクト残り期間におけるそれぞれの WG の活動成果や成果品の内容及び完成時期等を共有・調整する。

4) WG1～4 の間の意思疎通及び連携を高めるため、活動成果を共有する年次会議の合間にも、ワーキンググループのリーダーだけでなくプロジェクトに関わる全研究者が集まれる会議の開催を検討する。

イ．プロジェクトの成果の活用に関する提言

1) プロジェクト期間中に得られるデータには限りがあるため、機材の維持管理体制も含め、プロジェクト終了後も見据えた継続的なデータ収集体制の構築を検討する。

2) プロジェクト成果の活用のため、地方自治体と各大学との関係強化・協力体制の仕組み（データ収集・共有の手続きの標準化、仕組みの文書化、了解覚書の交換等を想定）を検討する。

3) プロジェクト成果のクロアチア国内での活用のため、プロジェクト期間中に国レベルの防災担当機関との連携を検討する。

ウ．終了時評価に関する提言

1) 終了時評価を日本・クロアチア双方の評価者による合同評価として行う。

以上

Mid-term Review Summary Sheet

1 Outline of the Project	
Country: Republic of Croatia	**Project Title**：Project on Risk Identification and Land-use Planning for Disaster Mitigation of Landslides and Floods in Croatia
Thematic Area：Disaster Management	
Division in Charge：Disaster Management Division II, Water Resources and Disaster Management Group, Global Environment Department	**Cooperation Scheme**：SATREPS (Science and Technology Research Partnership for Sustainable Development)
Project Period：Mar 2009～Mar 2014	**Total Cost**：350 million JPY (JICA budget)
Supporting Organization in Japan：Niigata University, Kyoto University, ICL(International Consortium on Landslides), Tohoku Gakuin University, Yamagata University	**Counterpart Agency**：MZOS (Ministry of Science, Education and Sport), UZ (University of Zagreb), UR (University of Rijeka), US (University of Split), Croatian Water, Croatian Geological Survey

1.1 Background of the Project

Croatia has frequent earthquakes and, along the Adriatic coast, has a large amount of precipitation. At some places, average annual rainfall is 3,500mm and more. Triggered by such earthquakes and rainfall, sediment disasters occur quite often such as landslides, slope failure, and debris flow. The land of Croatia has a complex, fragile terrain and geological structure affected by earth faults and folds. Sediment disaster are common at the alternation of sandstone-shale strata that is prone to weathering, as well as at slopes with marl layer containing large amounts of clay with low friction angle. Local flood (flash flood) occurs at limestone regions where water roads are easily formed in the strata.

Sprawling of cities is causing the accumulation of assets and population growth in sub-urban areas, but many of these areas are at high risk of such disasters in Croatia, thus raising concerns about increasing damages by flash floods and landslides. In some areas, disaster risk is likely to become even higher with a change in rainfall patterns due to climate change.

In Croatia, however, techniques to assess flash-flood/landslide risk and mechanisms to take measures on the risk assessment are not yet developed. Sprawling control as well as disaster warning systems and evacuation rules are not in place yet, either. Towards such disaster risk management, researches are required to develop methodologies for hazard mapping and risk assessment based on scientific data of these phenomena, and to improve the land use taking into consideration such disaster risks.

In this context, this Project was requested by the Government of Croatia. Based on a detailed planning survey in January 2009 and a following consultation mission in March 2009, the R/D (Record of Discussion) of the Project was signed on 27 March 2009 under the scheme of SATREPS. In July 2012, about the halfway point of the Project period, a mid-term review is to be conducted as dictated by the Article V of the signed R/D.

1.2 Project Overview

1) Project Purpose

Integrated landslide/flood hazard mapping technology and land-use guidelines formulation methodologies are developed for nation-wide application in Croatia.

2) Outputs

1. Methodologies for landslide risk assessment, prediction of affecting areas, and early warning systems are developed adapting to hydrological and geological conditions in Croatia.
2. Flash-flood/debris-flow simulation models and early warning systems are developed adapting to hydrological and geological conditions in Croatia.
3. Integrated landslide/flood hazard maps and land-use guidelines for landslide/flood risk mitigation are developed for study areas.

3) Inputs

(Japanese Side)

Experts: 17 researchers (82 times, total 997 days) in May 2010 through Jul 2012, and 1 project coordinator.

Counterpart Training in Japan: 4 researchers (2010) and 7 researchers (2011)

Provision of Equipment: 128 million JPY (2010 - 2011)

Project Cost: 237 million JPY (2010 – 2011 for Dispatch of Experts, Trainings, Equipment, Local Costs, and others)

(Croatian Side)

Counterpart: Project Director (MZOS), Project Manager (UR), Deputy Project Manager (UZ), Project Coordinator (UZ), and 31 researchers.

Local Operational Cost: lump sum of 360,000 Kuna/year, salaries of 9 young researchers working for the Project, shipment and installation costs of equipment provided, and meeting and travel costs.

4) Target Area

Study Areas: Zagreb, Rijeka, and Split

2 Review Team

Member of the Review Team	1. Mr. Hideo Miyamoto (Leader) Senior Advisor to the Director General, Water Resources and Disaster Management Group, Global Environment Department, JICA 2. Mr. Jun Murakami (Survey Planning) Water Resources and Disaster Management Group, Global Environmental Department, JICA 3. Mr. Hiroyuki Okuda (evaluation and Analysis) Tekizaitekisho, LLC	
(Observer)	4. Dr. Yoshimori Honkura (SATREPS Evaluation) Program officer of Natural Disaster Prevention, Research Partnership for Sustainable Development Division, JST 5. Mr. Masayuki Sato (SATREPS Evaluation) Principal Researcher, Research Partnership for Sustainable Development Division, JST 6. Dr. Koichi Tsukioka (SATREPS Evaluation) Senior Staff, Research Partnership for Sustainable Development Division, JST 7. Ms. Kikuko Sakai (SATREPS Evaluation) Senior Program Coordinator, JST Paris Office	
Review Period	25 June 2012～15 July 2012	**Type of Evaluation：**Mid-term Review

3 Project Performance

3.1 Achievements of Outputs

(Output 1)

- There are four model sites selected: Kostanjek Landslide (a part of Medvednica Hilly Area, City of Zagreb), Grohovo Landslide (a part of Rječina River Basin, Primorsko-Goranska County, Rijeka), Duće and Omiš (Split-Dalmatian County).
- A low-cost undrained shear test apparatus was developed in Japan, and two Croatian researchers were trained for the operation of and the testing with the apparatus.
- Soil samples from model sites (Kostanjek and Grohovo) were sent to Japan and tested with the apparatus. At the time of mid-term review, 2 July 2012, the apparatus was at the Croatian custom still on its way for shipping to the University of Rijeka.
- Researchers indicated that the installation of monitoring equipment has completed more than 90% at Grohovo site and the monitoring has been in progress. At Kostanjek, extensometers were installed, largely depending on which an early warning system is to be established.

(Output 2)

- There are five model sites selected: Rječina River Basin, Dubračina River Basin, and Mošćenička Draga (Primorsko-Goranska County, Rijeka), Imotski and Sutina-Karakašica (Split-Dalmatian County). Besides, at Daruvar, the UR is conducting a research to clarify essential factors on flash-flood/debris-flow simulation model, considering sustainable land management to mitigate water erosion on different tillage treatments.
- Rainfall measurement equipment was installed at model sites in Rijeka and the data are being collected. The analysis of rainfall-discharge characteristics continues with new hydro-meteorological data.
- Physical experiments of debris-flow have been carried out in Kyoto University where the Croatian trainees jointed the experiments. The development of flashflood and debris flow simulation model (Hydro-Debris 3D) for Dubračina River is completed.

(Output 3)

- There are five model sites selected: Hilly area of the Medvednica Mountain (Zagreb), Rječina River and Dubračina River basin (Primorsko-Goranska County, Rijeka) and Duće and Omiš areas (Split-Dalmatian County).
- In Zagreb and Rijeka, topography interpretation of model sites and surrounding areas, mainly based on aerial photos, were completed. In addition, digital topography maps are being created based on LiDAR scanning with airplane. In Split, WG (Working Group) 4 is conducting ground-based LiDAR scanning once a month since September 2011.
- In Zagreb and Rijeka, WG3 is preparing landslide inventory maps and conducting landslide susceptibility analysis using AHP methodology.
- Researchers of the implementing universities meet local authorities more often than not, raising their awareness towards the development of integrated landslide/flood hazard map and land-use guidelines.

3.2 Achievements of Project Purpose

Although indicators for the Project Purpose were not set in the Master Plan included in the signed R/D, as of the Mid-term review, the project is making a steady progress of research activities at each output level as summarized in the above section. Considering the overall progress towards attaining the Project Purpose, in spite of the delay of launching the Project and setting up the monitoring equipment at model sites, the Project has

a good potential to achieve its goal by the end of project period, March 2014.

4 Review Based on the 5 Criteria

4.1 Relevance

The relevance of the Project is high.

- There are several laws and policies speaking to the importance of disaster mitigation in Croatia such as Protection and Rescue Plan for Croatia (Official Gazette 96/10) and Law on Protection from Natural Disasters (Official Gazette 73/97). The project is aligned with these Croatian laws/policies, and contributes to their realization.
- The model sites of the Project were proposed by Croatian researchers. The Kostanjek in Zagreb is the largest landslide in Croatia, and one of primal concerns of the Emergency Management Office in the City of Zagreb. At the downstream of Rječina River located the city of Rijeka, and the flood waters can cause significant damage to the city; it could be an even higher hazard in case of concurrent rock avalanche at Grohovo landslide. The model sites in Split are Omiš and Duće where a rock fall is quite frequent, causing damages and posing threats to many houses and population in the towns. The project can also meet the needs and expectation of these local authorities and population.

4.2 Effectiveness

The effectiveness of the Project is medium.

- The basic design of the Project is clear as per summarized in the Master Plan, and the three outputs are essential components for the Project to achieve its purpose.
- The current PO doesn't describe the process and schedule of how Output 1 and Output 2 can be integrated or utilized in Output 3 to attain the Project Purpose. Specific PO for the 2nd half of the project period is necessary; it is to provide further breakdown of each activity to show how each activity can be conducted and completed for the next two years. The breakdown of each activity with timeline is helpful for better understanding and communication among researchers of different working group and also between Croatian and Japanese researchers.
- Indicators were not set in the Master Plan included in the signed R/D. The indicators by foreseeing the goal to be reached two years ahead was set by discussing in the Mid-term review.

4.3 Efficiency

The efficiency of the Project is medium.

- The R/D of the project was signed on 27 March 2009, but it was 9 March 2010 when the Note Verbal was exchanged for launching the Project as it took long time for Croatian side to conduct necessary inter-organizational coordination.
- Concerning the procurement of project equipment, the exemption of VAT (25%) was agreed on the R/D but administrative procedures for this VAT's exemption to become effective was not clear among concerned agencies both in Japanese and Croatian side. As a result, the procurement of equipment took longer than planned, affecting the research plan and project progress significantly.
- The project held the 1st JCC (Joint Coordination Committee) on 23rd February 2012 at the Faculty of Agriculture, UZ, where counter personnel from the three universities and Croatian Geological Survey attended, including representatives of local community (City of Zagreb's Emergency Management Office).

This JCC was the first meeting where administrative instructions for the project such as equipment and procurement were shared among all those who were involved in the Project.

- For project implementation, MZOS has prepared a counter-budget, which includes the lump-sum 360,000 Kuna/year, salary payments of nine young researchers who are expected to obtain doctor's degree through researches in the Project, payment for equipment installation and maintenance, and travel allowance & accommodation for researchers. Each faculty of the three universities implementing project activities also has borne a part of operational costs such as conference and travel.
- The formation of WG4 based in US is a response to administrative issues of project coordination such as the distance between US and UR/UZ and resulting difficulty for US to have meetings and smooth communication as a part of WG1, WG2 and WG3. Research subject and activities remain unchanged, though, in US with the formation of WG4, and the leader of WG4 as US is now able to directly contact with Project Manager in UR.
- The Project organizes annual international conferences to share the research progress and findings. Meetings and communication for research coordination between Japanese researchers and their Croatian counterparts have been properly held as and when necessary. On the other hand, communication of researchers among different working groups is much less and confined to such opportunities as the annual international conferences and JCC.

4.4 Impact

It is still premature to evaluate the impact of the Project.

- Positive impacts such as measures against natural hazard and disaster risk mitigation can be expected once the Project achieves its purpose and the application of research results to local/national government policies starts realized. At the time of mid-term review, such expected impacts have not been observed yet.
- It is widely indicated that the relationship between the universities and the local governments has been forged and strengthened due to the presence of the Project. Representative of local governments are not listed as counterpart in the R/D, but they are now recognized as essential partners of the Project by researchers towards achieving the Project goal.
- Through international conference organized by the Project, research results and findings on landslides and flash-floods/debris-flow are shared among researchers from neighboring countries such as Serbia, Bosnia and Herzegovina, Kosovo, Macedonia, and Slovenia, where studies on disaster risk management are important and required for societies.
- The Project Manger, on behalf of MZOS, has become a member of National Protection and Rescue Diretorate since 2012 due to her function in the Project.

4.5 Sustainability

The prospect of sustainability of the Project is medium.

- Prospect of sustainability from the viewpoints of human resource and technical capacity is indicated more than medium. Currently, nine young researchers, doctoral students, are sponsored by MZOS to work for the Project. Equipment installed in model sites is currently well maintained and MZOS bears the costs of these protective and maintenance measures.
- From an institutional viewpoint, it still needs to be further clarified how the research results will be

incorporated into the local government policy such as the preparation of land-use guideline. The relationship between the local authorities and the universities should be institutionalized as a system for disaster risk management between the two entities. Moreover, for research results to feed into national disaster management policies, an involvement of disaster management agency, namely National Protection and Rescue Directorate, will become more important in future.

- At present, MZOS has prepared a counter-budget, financing a part of project operation. From a financial viewpoint, however, budgetary commitment for the Project in future is still uncertain.

4.6 Factors that have promoted or hindered the implementation of project

(1) Promoting factors

Efforts of both Japanese and Croatian researchers to make up for the initial delay of project progress, and frequent visits of Japanese researchers to Croatian for research coordination and cooperation are recognized as promoting factors for the Project.

(2) Hindering factors

Little experience in Croatian side to conduct JICA technical cooperation before and the absence of JICA branch office in Croatia are mainly attributed to the initial delays of Project implementation such as the exchange of Note Verbal and the procurement of equipment.

5 Results of the Mid-term Review

5.1 Conclusion

The relevance of the Project is high - the Project is not only aligned with national laws and policies associated with disaster mitigation, but also meets the needs of local authorities and population. The effectiveness of the Project is medium as the Project is properly constructed, but the process and timeline for the remaining 2 years need to be further clarified and agreed toward achieving the Project Purpose. The efficiency of the project to date is rated medium mainly due to the initial delay of project launching and further delay of equipment installation. It is still premature to evaluate the impact of the Project at the time of Mid-term review. The prospect of sustainability of the Project is medium as technical and human resource capacity are indicated enough to sustain Project activities, but it is still uncertain from institutional and financial viewpoints.

5.2 Recommendations

1. The project has a good potential to achieve its goal by the end of project period, March 2014, in spite of the delay of launching the project and setting up monitoring equipment at model sites. The followings are recommended to ensure the goal to be attained: clarification of activities and plan, cooperation among working groups, and implementation monitoring.

1-1. A revised Master Plan has been drafted with indicators. The Project will be carried out based on the revised Master Plan.

1-2. A revised PO has been drafted with activity breakdown and timeline for the next two years. The implementation will be undertaken according to the revised PO, which is subject to change and updated as and when necessary.

1-3. WG2 (flash-floods/debris-flow research) and WG1 & WG3 (landslide research) are to promote coordination and cooperation on the image of research outputs and its time of completion so that the results of both researches can be synthesized to produce integrated landslide/flood hazard maps.

1-4. Communication and cooperation among WG1, WG2, WG3 and WG4 is to be further promoted towards the intended Project Purpose; meetings in between the annual conference can be considered, not only among WG leaders but also of all researchers involved. .

2. In order for the application of research results, the followings are recommended: coordination with local authorities and continuous data collection.

2-1. The data that can be collected within Project period is limited, and hence the arrangement for continuous data collection after the project should be established for better research outputs, including the maintenance of installed equipment.

2-2. A system to strengthen the relationship between the local authorities and the universities in the study areas need to be explored - such as standardized procedures, documentation of protocol, memorandum of understanding – towards the application of research results.

2-3. For nation-wide application in Croatia of the Project outputs in future, the involvement of national authority for disaster risk management need to be explored while the Project is being undertaken.

3. The terminal evaluation can be conducted as a joint evaluation by both Japanese and Croatian evaluators.

第1章　レビュー調査の概要

1-1　背景

クロアチアの国土は、断層・褶曲の影響を受けた複雑で脆弱な地形・地質構造を有し、地震が頻繁に発生する。また、アドリア海沿岸部を中心として全般的に降水量が多く、年平均降水量が 3,500mm を超えている地域もある。こうした地震や降雨が引き金となり、風化しやすい砂岩[4]・頁岩[5]（けつがん）互層[6]や摩擦角の低い粘土を多量に含んだ泥灰岩層のある斜面・渓流においては、地すべり、斜面崩壊、土石流等の土砂災害が多発し、また地層中に水みちが形成されやすい石灰岩地域においては局所的洪水（フラッシュ・フラッド）が発生する。

このような災害リスクの高い地域は、都市周辺部に多く見られるが、無秩序な開発により人口増加や資産の蓄積が進んでおり、土砂災害やフラッシュ・フラッドによる被害の増加が懸念されている。また、今後、気候変動による降雨パターンの変化で、地域によっては災害リスクがさらに高まる恐れもある。

しかしながら、クロアチアにおいては土砂災害やフラッシュ・フラッドのリスクを的確に評価し、それに基づく対策を講じるために必要な手法と仕組みが整備されていないことから、開発規制や災害予警報・避難体制の構築はほとんど行われていないのが実情であり、これを可能にするためには、これらの現象の科学的理解に基づく信頼しうる危険度評価手法やハザードマップ作成手法の開発、及び災害リスクを考慮した土地利用の改善に資する研究の実施が求められている。

このような背景において、2008 年に創設された「地球規模課題対応国際科学技術協力」の制度の下で、本案件がクロアチア政府から要請され、2009 年 1 月に詳細計画策定調査が実施された。また、2009 年 3 月に実施協議調査団が派遣され、2009 年 3 月 27 日に討議議事録（R/D）が署名された。プロジェクト終了予定は 2014 年 3 月 31 日であり、プロジェクトの中間地点である 2012 年 7 月は、R/D の第 V 項に従って中間レビュー調査を実施した。

1-2　レビュー調査の目的

中間レビュー調査の目的は次の通りである。

1) 「新 JICA 事業評価ガイドライン（2010 年 6 月）」に基づき、マスタープランの達成度について、評価 5 項目（妥当性、有効性、効率性、インパクト、自立発展性）の観点から、中間段階にあるプロジェクトのレビューを行う。

2) プロジェクトの残り期間における対応について提言をまとめる。

3) プロジェクトの指標について、関係者間での共通認識を得る。

4) 中間レビューの結果、提言及び指標等の内容をレビューレポートに取りまとめ、クロアチア側関係者と協議を行い、合意形成した上で、ミニッツ署名により確認する。

[4] 主に砂が堆積作用により固結してできた岩石
[5] 泥が水中で水平に堆積したものが脱水・固結してできた岩石のうち、堆積面に沿って薄く層状に割れやすい性質があるもの
[6] 岩質の違う単層が交互に繰り返し重なり合っている層

1-3　レビュー調査団の構成

中間レビューは、以下の団員から構成された調査団により実施された。

名前	役割	所属
宮本　秀夫	団長／総括	JICA 地球環境部　参事役
村上　淳	協力計画	JICA 地球環境部防災第二課
奥田　浩之	評価分析	合同会社適材適所
【以下、オブザーバー】		
本藏　義守	科学技術評価	JST 地球規模課題対応国際科学技術協力事業　研究主幹
佐藤　雅之	科学技術評価	JST 地球規模課題国際協力室　参事役
月岡　康一	科学技術評価	JST 地球規模課題国際協力室　上席主任調査員
酒井　紀久子	科学技術評価	JST パリ事務所　シニア・プログラム・コーディネーター

1-4　調査日程

日程は付属資料 1 Annex3 の通りである。

1-5　レビュー調査の手法

中間レビュー調査は、OECD が発行した「開発援助の評価のための諸原則（1991）」を踏まえて準備された「新 JICA プロジェクト評価ガイドライン第 1 版（2010 年 6 月）」に基づいて実施された。プロジェクトに対するレビュー調査の基準としたのは、プロジェクト目標、成果、活動が記載された当該プロジェクトのマスタープランである。（付属資料 1 Annex 1 は、本調査により指標を記載した改訂版マスタープラン（案）である。）

まず、プロジェクトに関する報告書や関連資料を参照しながら、JICA ガイドラインに提示された評価判断のための情報を整理するためのフレームワークとして、活動状況・進捗表と評価グリッドを用意した。そして、活動状況・進捗表については日本側研究者に記入を依頼するとともに、評価グリッドについては情報収集のためクロアチア側研究者・日本側研究者向けの質問票を作成・配布した。現地調査中は、質問票に基づいてクロアチア側関係者にインタビューし、関連文献および資料を収集し、モデルサイトがある対象市を訪問した。（付属資料 1 Annex 3/Annex 4）

こうして報告書、活動状況・進捗表、インタビュー、質問票、サイト訪問などから情報・データを集め、これらの整理と分析に基づいて、プロジェクトの実績を確認するとともに 5 項目に基づくレビューを実施し、提言を抽出した。

5 項目（妥当性、有効性、効率性、インパクト、持続可能性）については次の通りである。

妥当性	プロジェクト目標が、クロアチアの開発政策や課題ニーズ、日本の援助方針に対して、どの程度関連性があるかを評価した。
有効性	プロジェクトが目的を達成するために効果的に組み立てられ、その結果として、活動の進捗によるプロジェクト目標の達成の見込みを分析した。.
効率性	成果の産出に向けた投入の内容・量・質・タイミング等を整理して、これらが活動を通していかに効率的に成果に転換されたかを評価した。.

インパクト	プロジェクトの実施によって生じた、プロジェクトの枠組み外における正・負の影響を調べた。
持続可能性	達成される成果や便益がプロジェクト終了後も維持されるかどうかについて、制度、技術、人材、財政の各観点から現時点での見通しを示した。

第2章　プロジェクトの概要

2-1　プロジェクト目標

クロアチア国内で適用可能な土砂・洪水災害統合ハザードマップ作成手法、及びハザードマップに基づく土砂・洪水災害軽減のための土地利用ガイドライン作成手法が開発される。

2-2　成果

1. クロアチア国の水文、地質条件に適応した地すべりの危険度評価手法、地すべり運動予測手法及び早期警戒システムが開発される。

2. クロアチア国の水文、地質条件に適応した局所的洪水（フラッシュ・フラッド)、土石流のシミュレーションモデル、及び早期警戒システムが開発される。

3. 土砂・洪水災害統合ハザードマップ、及びこれに基づく被害軽減のための土地利用ガイドラインが、調査対象地域で作成される。

第3章　プロジェクトの進捗

3-1　投入実績

プロジェクトの R/D は 2009 年 3 月 27 日に署名されたが、プロジェクト開始の前提条件となる国際約束の締結に際して、クロアチア側が内部調整に多大な時間を要し、ようやく 2010 年 3 月 9 日に口上書交換が完了した。当初開始予定から 1 年遅れ、プロジェクトへの投入は 2010 年 5 月の日本人専門家の派遣により開始された。

(日本側)

1)　専門家（日本側研究者）の派遣

2010 年 5 月から 2012 年 7 月までの間、17 人の研究者が、合計 82 回、日数にして 997 日間クロアチアに派遣された。それぞれの研究者は WG1、2 または 3 のいずれかに属している。加えて、2010 年 5 月から業務調整専門家 1 名が JICA より派遣されている。（付属資料 1 Annex 5）

2)　カウンターパート（クロアチア側研究者）本邦研修

ザグレブ大学、リエカ大学、スプリット大学、およびクロアチア地質調査所から、2010 年に計 4 人、2011 年には計 7 人の研究者が、 東北学院大学、山形大学、新潟大学、ICL（国際斜面災害研究機構）および京都大学で実施された本邦研修に参加した。（付属資料 1 Annex 6）

3)　供与機材

プロジェクト活動は、R/D 署名から 1 年遅れて 2010 年 5 月より開始された。加えて、クロアチア側実施機関に VAT 免税手続きの経験がなかったことから、求められる手続き解明に時間がかかっていた。このため、当初クロアチアで現地調達する予定であった機材を急きょ本邦調達に変更してクロアチアに輸送することとなり、この変更で機材の納入がさらに遅れることとなった。土砂災害、フラッシュ・フラッドの研究のため供与された資機材の金額は、2010 年、2011 年の合計で 1 億 2842 万円となっている。（付属資料 1 Annex 7）

4)　プロジェクト活動費

日本側はプロジェクトを実施するための活動費の一部を負担した。先に記述した供与機材費 1 億 2842 万円のほか、日本人研究者・業務調整専門家の派遣、クロアチア側研究者の本邦研修、現地活動費（クロアチア国内の旅費、ローカルコンサルタント傭上費、会議費など）を含む全額は、2010 年及び 2011 年の 2 年間で、2 億 3710 万円となっている。（付属資料 1 Annex 8）

(クロアチア側)

1)　カウンターパートの選任

プロジェクト・ディレクター（プルガー氏）は MZOS から、プロジェクト・マネジャー（オザニッチ教授）は UR から、それぞれ選任されている。副プロジェクト・マネジャー（ミハリッジ准教授）は UZM から、プロジェクト・コーディネーター（キシッチ教授）は UZA から、それぞれ選任されている。MZOS による 2012 年 3 月 28 日付けのレターにより、プロジェクト・マネジャーのボナッチ教授からオザニッチ教授への変更、副プロジェクト・マネジャーのオザニッチ教授からミハリッジ准教授への変更がプロジェクト関係者に伝えられた。その他のカウンターパー

トについては、これまでレターなどによって選任が通知されてきたわけではないが、中間レビューの時点では 35 名の研究者がカウンターパートと認められている。（付属資料 1 Annex 9）

2) 現地活動費

MZOS は、プロジェクトに対しては年間 36 万クーナ(約 600 万円、2,013 年 2 月時点のレート)の定額金、プロジェクトで働く 9 人の若手研究者の給与、供与機材の郵送・設置費用、研究者の旅費などの費用を負担している。プロジェクトを実施しているザグレブ大学鉱業・地質・石油工学部、リエカ大学土木工学部、スプリット大学土木工学・建築・測地学部もまた、会議費など活動費の一部を負担している。ただし、その総額については、中間レビュー調査中には確定できなかった。（付属資料 1 Annex 8）

3-2 活動実績と進捗

1) 成果レベルでの実績

(成果 1)

- コスタニエク（ザグレブ市メドヴェニカ丘陵地帯の一部）、グロホボ（リエカのプリモスコ・ゴランスカ郡レジナ川流域の一部）、ドゥチェ、オミッシュ（スプリット・ダルマシアン郡）の計 4 ヶ所のモデルサイトが選択されている。

- 地すべり再現試験が可能な非排水リングせん断試験機の開発が終了し、またクロアチア若手研究者 2 人×2 ヶ月×2 回の、当該試験機を用いて試験方法に関する習熟訓練が実施された。活動 1-1 については終了した。（活動 1-1）

- モデル・サイト（コスタニエク、グロホボ）から採取した地すべり土試料が日本に配送され、当該試験機による土質試験が実施された。当該試験機については日本からリエカ大学に向け発送されて、中間レビュー実施中である 2012 年 7 月 2 日には、クロアチアの税関まで到着している。（活動 1-2）

- グロホボでは、モニタリング機材（GPS、伸縮計、トータルステーション、プリズム、間隙水圧計など）は 2011 年の 8 月から 9 月にかけて大部分が設置された。現時点では 90%の設置が終了しており、この総合モニタリングシステムにより観測が進行している。また、コスタニエクでは、モニタリング機材はこの 2012 年 7 月に設置される予定である。（活動 1-3）

- 地すべり動力学に基づく地すべり危険度評価手法（活動 1-4）、および地すべり運動予測手法 （活動 1-5）は、お互い連動して実施されていくことになる。

- グロホボでは、早期警戒システムの根幹となる伸縮計が設置され、観測が進行している。早期警戒に必要な基準値の設定のためのデータが収集されている。（活動 1-6）

- 日本側・クロアチア側研究者の判断によるおおよその進捗度としては、活動 1-1 は 100%、活動 1-2 は 70%、活動 1-3 は 60%、活動 1-4 および 1-5 は 40%、活動 6 は 40%となっている。

(成果 2)

- レジナ川流域、ドブラチナ川流域、モセニツカ・ドラガ（いずれもプリモスコ・ゴランスカ郡）、及びイモツキ、スティナ・カラカティカ（いずれもスプリット・ダルマシアン郡）の

5 ヶ所のモデルサイトが選択されている。また、ドゥルブルでは、持続的土地利用に向けて耕種法の違いによる土壌流出軽減に関する研究をリエカ大学が行っており、フラッシュ・フラッド、土石流のシミュレーションモデルのための要因解析に貢献することから、これを加えて計 6 ヶ所となる。

・ リエカのモデルサイトにおいては降雨計測装置が設置され、降雨データが収集されている。ここで得られる新たな気象・水文データにより降雨・流出特性の解析を進めることとなっているが、2011 年から大雨が少ないことから、データの収集は予定したほどには進んでいない。また、気象観測装置がモセニツカ・ドラガの市役所建物に設置され、観測データは市にも利用されている。（活動 2-1, 2-2）

・ 土石流の物理試験が、クロアチア研究者も参加して京都大学で実施されている。その結果に関する 2 本の論文が査読に受理された。また、フラッシュ・フラッド、土石流のシミュレーション・モデル（Hydro-Debris 3D）の開発が終了している。（活動 2-3）

・ リエカにおける 3 ヶ所のモデルサイトをカバーする降雨計測用レーダー（Furuno）の調達が進行中であり、リエカ大学土木工学部に設置されて早期警戒システムの一部として用いられる予定である。（活動 2-4）

・ 日本側・クロアチア側研究者の判断によるおおよその進捗度としては、活動 2-1 は 50%、活動 2-2 は 40%、活動 2-3 は 50%、活動 2-4 については 40%となっている。

(成果 3)

・ メドヴェニカ丘陵地帯（ザグレブ市）、レジナ川流域、ドゥブラチナ川流域（いずれもプリモスコ・ゴランスカ郡）、ドゥチェ、オミシュ（いずれもスプリット・ダルマシアン郡）の計 5 ヶ所のモデルサイトが選択されている。

・ ザグレブとリエカにおいては、主として空中写真を用いてモデルサイトおよびその周辺地域の地形判読が終了した。また、必要箇所については数値地形図を作成し、一部抽出空域については航空レーザー測量（LiDAR）による地形判読が実施されている。さらにスプリットでは、WG4 では、地上からのレーザー測量（LiDAR）によるサイトの観測を 2011 年 9 月から継続している。（活動 3-1, 3-2）

・ ザグレブとリエカでは、ワーキング・グループ 3 が、斜面災害地マップ及び AHP（階層構造分析法）による斜面災害危険度評価マップを作成中である。ザグレブ市は保留ダムの設置によりフラッシュ・フラッドの危険性がないことから、WG2 はリエカのみで研究を実施している。よって、ザグレブでの土砂・洪水災害統合ハザードマップは地すべりの側面だけを扱うことになる。また、スプリットでは、ドゥチェ／オミシュの落石とイモツキ／スティナ・カレカティカの洪水はお互い関連しない現象である。従って WG4 が作成する統合ハザードマップについては、落石および洪水の個々のハザードマップとなる予定である。（活動 3-3）

・ 土地利用ガイドラインの作成（活動 3-4）、統合ハザードマップおよび土地利用ガイドライン作成のマニュアル化（活動 3-5）については、実質の活動はこれからである。しかし研究の社会実装にむけて、大学の研究者は地方自治体の災害担当者と打ち合わせを重ねており、

自治体関係者の意識の向上が図られている。

・ 日本側・クロアチア側研究者の判断によるおおよその進捗度としては、活動 3-1 および 3-2 は 50%、活動 3-3 は 20%、活動 3-4 および 3-5 については 10%となっている。

2) プロジェクト目標に向けた進捗

プロジェクト目標は、「クロアチア国内で適用可能な土砂・洪水災害統合ハザードマップ作成手法、及びハザードマップに基づく土砂・洪水災害軽減のための土地利用ガイドライン作成手法が開発される。」である。プロジェクト目標のための指標は署名された R/D 中のマスタープランの中では設定されていない。上のセクションで整理したとおり、現在のところプロジェクトは、各成果レベルで着実に研究活動が進展している。プロジェクトの総合的な進捗から、活動開始の遅れや資機材設置の遅れはあったものの、プロジェクトは 2014 年 3 月までの終了期間までに目標を達成する可能性は十分あると見込まれる。

3-3 実施プロセス

プロジェクト開始当初より、日本側研究者・クロアチア側研究者はワーキンググループ 1、2、3 に属し、それぞれ成果 1、2、3 を担当してきた。WG1 は詳細な地すべり研究、WG2 はフラッシュ・フラッド／土石流の研究、WG3 は広域の地すべり研究である。2012 年 2 月 23 日の JCC ののち、スプリット大学との連絡調整の促進のために新たに WG4 が形成されることとなった。

第4章　5項目による評価

4-1　妥当性

プロジェクトの妥当性は高い。

・　クロアチアでは、災害被害軽減に関する幾つかの法律・政策がある。例えば、クロアチア保安・救援に関する計画（官報 96/10）、クロアチア自然災害危険性評価、クロアチア災害被害軽減、保安、救援のための基本法（官報 127/10）、自然災害からの保護に関する法律（官報 73/97）、自然災害時における保安と救援に関するいくつかの国際約束である。プロジェクトは統合ハザードマップ作成手法と、土地利用ガイドラン作成手法のクロアチア国内での適用を目指すものであり、これらクロアチアの法律・政策に整合しているたけでなく、その実施に貢献するものである。

・　モデルサイトは、クロアチア側の研究者の提案に基づき決定されている。ザグレブ市のコスタニエクは、クロアチアで最大の地すべり地帯であり、ザグレブ市危機管理室の主要懸案事項ともなっている。現在ザグレブ市には土地利用計画はあるが、地すべり災害評価を含んだものとはなっていない。レジナ川の河口にはリエカ市が位置し、洪水が起きた場合には市に大きな被害が及び、さらにグロホボにおいて同時に地すべりが起これば土石流により更に大きな災害になることも予想されている。リエカ市は建設目的のための土地利用ガイドラインはあるが、これはハザードマップを含んだものとはなっていない。スプリットのモデルサイトであるオミシュおよびドゥチェは、落石が頻繁におこり、多くの家屋と人々に被害が及ぶ恐れが大きい。プロジェクトは、危険サイトをモニタリングし、早期警戒システムを設置し、ハザードマップや土地利用ガイドランを作成することから、こうした地方自治体や住民の災害軽減のニーズにも応えるものである。

・　「防災」は、我が国の ODA の重点課題「地球規模の問題の取り組み」の一つに挙げられ、2005 年 1 月に神戸で発表された「防災協力イニシアティブ」は我が国の「分野別開発政策」の一つとなっている。JICA の防災分野課題別指針においては、「災害に強いコミュニティ・社会づくり」を最も重要な戦略目標に位置づけ、具体的取組みとしてハザードマップによる災害リスクの把握や早期警戒体制の整備などを掲げている。本プロジェクトでは、土砂災害やフラッシュ・フラッドなどに対する先進的なハザードマップ作成手法及び早期警戒システムを開発し、その成果を土地利用ガイドラインの作成を通じて反映させていくこととしており、このような手法や技術は、JICA が他の開発途上国で実施する防災分野協力にも有効活用できる。

4-2　有効性

プロジェクトの有効性は中程度である。

・　プロジェクトの 3 つの成果はプロジェクト目標を達成するために必要なコンポーネントであり、これら成果とプロジェクト目標との関係は明確である。前章でも見たように、プロジェクトは観測機材を設置し、観測データの収集・解析を進めている。現時点までで、プロジェクトは各成果レベルで確実に進展しており、活動開始の遅れや機材設置の遅れにも関わらず、2014 年 3 月のプロジェクト予定終了時期までに、目標を達成する可能性は十分にあると考えられる。また、プロジェクト前半で機材の設置が終了してしまえば、プロジェクト後半の研究計画もより立てやす

くなり、研究活動はさらに順調に進むものと予想される。

- 成果1と成果2が統合される成果3については、現時点までの進捗はやや限定的である。加えて、現在のPOは、プロジェクト目標を達成するために成果3においてどのように成果1・成果2が統合され、利用されていくのか、そのプロセスと時期が明確に示されていない。よってプロジェクト後半に向けてはPOの改訂が必要であり、そこでプロジェクト目標の達成に向けたプロセスと時期を明確にすることで、より達成見込みが明らかになるものと考えられる。

- また、プロジェクト後半のPOについては、成果3だけでなくその他の成果についても、今後の2年間でどのように活動が実施され完成されるのか、各活動のさらなるブレイクダウンが求められる。各活動のブレイクダウンは、異なるグループ間の研究者や、日本側・クロアチア側双方の研究者の活動の理解とコミュニケーションに役立つ。また、詳細なPOは活動の効果的なモニタリングにも有益であり、こうしたPOを用意することで、プロジェクトの有効性はさらに上がるものと期待される。

- 土砂・洪水災害統合ハザードマップの作成と、統合ハザードマップに基づく土地利用ガイドラインがWG3の成果品となっている。しかしザグレブ市においては洪水災害の可能性は少ないことから、WG2はザグレブ市では洪水・土砂災害の研究を行っていない。したがってザグレブ市におけるWG3の成果は、洪水の要素を含まないハザードマップおよび土地利用ガイドラインになる見込みである。また、WG4に関しては、成果3では、（地すべりの特殊なケースとしての）落石に関する評価のためのハザードマップとガイドラインを作成する予定である。

- 終了時評価時に各成果およびプロジェクト目標の達成度を検証することになる指標については、署名されたR/Dにあるマスタープランの中には含まれていない。中間レビューを、これまでのプロジェクトの進捗をレビューし、2年後の目標を見据えて指標について関係者間で議論し、合意を得る機会とすることが必要である。

- プロジェクトは地すべり危険度評価や、地すべり予測、局所的洪水・土石流シミュレーションモデル、ハザードマップ作成手法を開発することになっている。実際の災害は頻繁には発生しないことから、こうした手法やモデルの検証は物理実験で得られた計測とデータに基づき実施されている。プロジェクト期間内に実際の災害に基づくモデルの検証が可能かどうかは気象条件に拠る。

4-3 効率性

プロジェクトの有効性は中程度である。

- R/D署名は2009年3月27日であったが、クロアチア側で内部調整に時間がかかったため、口上書交換が終了したのは2010年3月9日であり、プロジェクトの開始が1年遅れることとなった。本プロジェクトは2009年3月開始、2014年3月終了として予定された5年間のプロジェクトであり、開始が1年間遅れたことから、現在すべての活動を4年間で終了させる必要が出ている。

- プロジェクト機材の調達については、VAT（25%）免税がR/Dに明記されているが、VAT免税の実際の手続きについて日本側・クロアチア側双方で、これまで実際に行った経験がなかった。その結果、手続きの判明に時間がかかっていたことから、クロアチア国内で調達の予定であった機材を急きょ本邦調達してクロアチアに輸送することとなった。こうした手続き変更による遅れの

結果、グロホボに機材が設置されたのは、2010 年 5 月のプロジェクト開始から更に 1 年後の 2011 年 8 月となった。このモデルサイトへの機材設置の遅れは、さらにプロジェクト活動の進捗に影響を与えることとなった。

- プロジェクトの実施に際し、MZOS は予算を手当てし、年間 360,000 Kuna の一括金、このプロジェクトを通して博士号をとる予定の 9 人の若手研究者の給与、資機材の配送と設置、研究者の旅費・宿泊費を支払っている。プロジェクトを実施している各大学の学部も、会議費や旅費といった費用を負担している。

- プロジェクトは研究の進展と知見を共有するための国際会議を毎年開催している。第 1 回目は、2010 年 11 月にドブロクニクで開催、第 2 回目は、2011 年 12 月にリエカ大学で開催された。2013 年 2 月にザグレブで予定されている第 3 回目の会議は、さらに地方自治体の参加や広報に力を入れて開催される予定である。また、2012 年 12 月には、この第 3 回目の会議の準備のため、CW（クロアチア水公社）の予算によりザグレブで国内会議が予定されている。日本人研究者とクロアチア研究者の間での研究調整のための打ち合わせややり取りは、必要に応じて適切に実施されてきている。一方、WG 間の研究者間のやりとりはずっと少なく、こうした国際会議や JCC での場に限られている。

- プロジェクトの最初の JCC は、2012 年 2 月 23 日に、各大学および CGS からのカウンターパート、地方自治体（ザグレブ市 EMO）代表の参加を得て、ザグレブ大農学部にて開催された。この JCC が、資機材や調達などプロジェクト実施に関する説明が、プロジェクト参画者全員と共有された最初の会議であった。こうしたアドミニストレーション目的のための会議は、プロジェクトの開始直後に開催され、プロジェクト実施に関する規則やルールが共有されていれば、非常に有益であったと思われる。

- カウンターパートについては、例えば所属組織からの任命状あるいは JCC での承認など、何らかの手続きにより固定されてきているわけではない。カウンターパートについては、研究の進捗やその時の状況に応じて柔軟な選定がなされている。

- US と US/UZM は距離的に離れていることから、US の研究者が WG1、2、3 の一部としてほかの研究者と打ち合わせ、すみやかなやり取りを行うのが難しかった。こうしたプロジェクト調整への対応として、US に WG4 が設置された。WG4 の設置により、US の研究内容や活動内容が変わったわけではないが、今後は、WG4 のリーダーは UR のプロジェクト・マネジャーと直接連絡できるようになり、プロジェクト調整の効率化が期待される。日本側研究者は WG4 には割り当てられていないが、必要に応じて共同で研究を行っている。

4-4　インパクト

プロジェクトのインパクトは、現時点ではまだ評価する段階には至っていない。

- プロジェクトが目的を達成し、社会実装が開始されれば、自然災害リスクの軽減、それに向けた具体的対策といったプロジェクトから期待される正のインパクトが生まれることが期待できる。中間レビュー時点では、これらに関するインパクトはまだ表れていない。

- プロジェクトにより、地方自治体と大学間の関係が開始され、強化されている。地方自治体の代

表者は、R/D にはカウンターパートとして記載されていないが、今では研究者によりプロジェクト目的の達成に向け欠かせないパートナーと認識されている。例えば、ザグレブ市の EMO は 2009 年に新たに設置され、地震を中心とするザグレブ市のすべての自然災害に対応することを職務としている。プロジェクト開始前は、EMO は地すべりの問題に対処する重要性をあまり感じていなかったが、今は重要課題と認識しており、プロジェクトに対しては市有地における観測機材設置に対する許可を発行するなど、プロジェクトへの支援も行っている。

・ 設置された資機材のメインテナンスも、EMO と UZM の間では検討が始まっている。1 つのアイデアとしては、プロジェクト終了時に UZM がザグレブ市に資機材を供与し、ザグレブ市が機材のメインテナンスにかかる費用を負担する代わりに、UZM が機材を定期的に検査し、そこで得られるモニタリングデータを市に提供していく、というものである。このように、プロジェクト終了後の体制に向けた検討もすでに進んでいる。

・ オミシュ町は、町で頻発する落石を防止するためのプロジェクト・ドキュメントを作成した。WG4 のリーダーは、このプロジェクト・ドキュメントの審査者の一人となっており、本プロジェクトで現在実施しているモデルサイトの LiDAR 解析結果が、落石の可能性が高い箇所を特定する手助けになり、プロジェクト・ドキュメント実施に貢献することを期待している。プロジェクト・ドキュメントが署名に至った場合は、クロアチア政府財務省の予算により実施される予定である。

・ プロジェクトが実施した国際会議では、セルビア、ボスニア・ヘルツェゴビナ、コソボ、マケドニア、スロベニアといった隣国からの研究者も参加し、地すべりと局所的洪水・土石流に関する研究成果と知見が共有されている。

・ こうした隣国との国際協力については、ICL 地域ネットワーク（アドリア海・バルカン地域）および課題ネットワーク（地すべりモニタリング）の枠組みにおいて、公式化されつつある。これらネットワークは、2010 年 11 年のドブロブニクでの第 1 回国際会議で提案されたものである。UZ と UR の学部が ICL のメンバーとなり、本プロジェクトに参画していることをもってネットワークコーディネーターとして選任されている。

・ 現在 UR は、地方政府省およびリエカ市上層部とともに、グロホボの地すべりモニタリングを、レジナ川流域のさらに広範な地域に拡大していくためのプログラムを準備中である。

・ このプロジェクトのプロジェクト・マネジャー（リエカ大学研究開発副学長、WG2 のリーダー）は、プロジェクトにおける役割のため、MZOS を代表して、2012 年より、国家保安・救援局の構成員となっている。

・ スプリット大学土木工学・建築学部は、クロアチア 112 番（緊急通報用電話番号）システムの開発を通して国家保安・救援局と、また、緊急・災害に関する活動を通してスプリット近くのディブルジェにおける国家保安・救援局支部と、組織的な連携が図られるようになった。

4-5 持続可能性

プロジェクトの持続可能性の見込みは中程度である。

- 人材的、技術的な観点からみたプロジェクトの持続可能性は、中程度以上である。現在、9 人の若手研究者が MZOS の予算によりプロジェクトに従事し博士号を取得する予定である。これは人材的な面では大きな能力開発になることが期待される。モデルサイトに設置された機材は、傾斜計や間隙水圧計の収納箱、太陽光パネルの周りのフェンス、プリズム柱を支えるコンクリート土台、機材に対する保険の適用に見られるように、現時点では良好に維持されている。MZOS が、これら機材の保護・維持のための対策費用を負担している。さらに、プロジェクト終了後の機材維持にむけた支援の仕組みについても、各大学により検討が開始されている。

- 現在 MZOS は、独自予算によりプロジェクト活動費の一部を負担している。しかし財政的な観点からは、持続性の見込みは比較的低いと認識されている。その理由としては、現在クロアチアの経済はマイナス成長しており、将来的な予算確保の見込みが現時点では不確かなためである。

- 制度的な観点からは、研究成果がどのように土地利用ガイドラインの作成といった行政政策に反映されるのか、その道筋が現時点では明確ではない。地方自治体と大学との関係については、現時点では個人的なつながりに留まっている。これら 2 者の関係は、災害リスク管理に向けた連携の仕組みとして、今後制度化されることが望まれる。さらに、研究成果がクロアチア国内の災害管理政策に貢献していくためには、国家保安・救援局の巻き込みも今後重要である。

第5章　科学技術視点からの評価

総合評価　（A：所期の計画と同等の取組みが行われている）

本プロジェクトでは、国際共同研究の開始に必要な、両国間の口上書の交換までに長期間を要し、さらに現地購入機材の VAT（付加価値税）免税交渉でも時間を費やした。そのため、本格的な研究活動開始は大幅に遅れたが、関係者の多大な努力の結果、現時点では、当初計画の水準までキャッチアップできたと判断される。

地すべり・洪水挙動の解明を目指した主な現地観測機器の設置や、動的載荷非排水リングせん断試験機（地すべり再現試験機）の開発が順調に進んでいる。また、リエカ地域等を対象に、我が国が開発した AHP（階層分析）法による地すべり危険度評価や、洪水シミュレーションが進められている。

本プロジェクトは、計画段階から詳細な学術研究がターゲットになっていたこともあり、ワークショップ開催、プロシーディング発行、論文執筆などが重点的に行われ、多くの研究業績が得られている。

また人材育成に関しては、博士前期課程の学生の参加も見られ、研究者のシーズづくりとして評価できる。クロアチア側では、日本で開発された技術の習得等を通して、若手研究者が育成されており、相手国への貢献度は大きい。ただし、全体としては若手研究者の参加が少ないように思われ、今後は日本人人材の組織的な育成が期待される。

政策への反映という視点においては、クロアチアの開発地域・社会的価値の高い地域を対象として、土砂・洪水災害を軽減するための土地利用基本計画ガイドラインの策定、現地の地盤構造・水文特性の科学的解明に立脚した信頼し得る危険度評価法の確立、といった目標はクロアチア国の政策と合致する。現時点では本プロジェクトの成果が政策に広く反映される状況にはないが、今後の社会実装に向けた取り組みの強化により、研究成果の利活用を通して政策に反映される見込みは十分にあるものと判断される。

一方、本プロジェクトでは、我が国の最先端の防災科学技術とリーダーシップのもとで、クロアチアと同様、地すべり多発に悩む周辺西バルカン諸国（スロベニア、セルビア、モンテネグロ、ボスニア・ヘルツェゴビナ、アルバニア）を結ぶネットワーク構築を目指している。具体的には、2000 年 12 月に外務省の主催で開催された国際ワークショップにこれら周辺諸国関係者を招聘し、グループリーダー（主たる共同研究者）が座長をつとめるなどして、プロジェクト成果の波及と、南東欧地域の協力促進に向けたアウトリーチ活動を行っている。

これらの進捗状況を鑑み、研究計画は適切であり、その計画が着実に実施されていると評価する。

なお、今後は、引き続き真摯に研究に取り組むとともに、「グローバル」の名に見合った大きさと迫力が備わり、研究全体としての太い筋を打ち出せるよう、各研究グループの活動結果をまとめて、土砂・洪水統合ハザードマップを整備していくことが必要である。

まずはプロジェクト目標に掲げる「ガイドラインの作成」に、全メンバーが連携して優先的に取り

組むべきである。そこで真に活用されるガイドラインを纏め上げた後に、その公表・普及をめざしてシンポジウム等の開催に取り組むことが望まれる。

5-1　国際共同研究の進捗状況について

口上書および VAT 免税の問題を解決したのちは、全体として順調に進捗していると判断できる。

リエカ市郊外のグロホボの地すべりサイトでは、伸縮計 11 台からなる連続長スパン伸縮計測システム、連続計測 GPS と自動計測トータルステーションの組み合わせ、さらに無線を利用したデータ伝送による地すべり監視などの高度なシステムが構築されており、予想される成果とあいまって高い科学的・技術的インパクトが期待される。ポータブル地すべり再現試験機の開発では、基本的性能を削ぐことなく、小型化、低価格化に成功しており、我が国及び開発途上国の地すべり研究にとっても重要なツールとなることが期待される。本プロジェクトにおいては、モデルサイトで採取されたサンプルを用いた本試験機による分析結果と実際の地震波形データを組み合わせることで、新しい知見につながる可能性もある。

現段階でのシミュレーションモデルの開発に関しては、学術的、技術的成果は認められるものの、地震という特殊な原因の想定を除けば、流出解析と地すべりモデルという個別要素の結合に過ぎず、クロアチアの地域特性等を考慮する中で、社会実装の観点からの成果に新規性を出すことが期待される。

5-2　国際共同研究の実施体制について

研究代表者が、外交上の手続き等の遅れなどに対しても適切な対応を行っている点はリーダーとして優れていると判断できる。また、日本側及びクロアチア側研究者を適切にまとめるなどのリーダーシップも見られる。今後の土砂・洪水統合ハザードマップの作成に向け、一層のリーダーシップが求められる。研究チームについては、現状、大学の研究者だけで構成されていることから、社会実装に向けた活動を視野に入れて、クロアチア側に政府関係者を入れるなど、体制の見直しが必要と思われる。また、SATREPS の趣旨に鑑み、本プロジェクトがクロアチア側の若手研究者の単なる論文業績の機会にとどまらないよう、クロアチア側の社会実装意識を高めると共に、日本側にも若手研究者を増やすなどの取り組みが望まれる。研究費の執行状況は概ね問題なく、適材適所に順調に執行されている。伸縮計・GPS・トータルステーションを組み合わせた地すべり監視用モニタリングシステムは適切に現地観測地域に配置されており、有効に活用されている。地すべり再現試験機についても同様の対応が望まれる。

5-3　科学技術の発展と今後の研究について

基本的には研究志向のプロジェクトであり、豊富な実績を有する研究者がプロジェクトを主導していることからも研究の進め方としては妥当であるといえる。我が国の地すべり観測技術およびすべり面のせん断試験技術は世界トップレベルにある。とくに、本プロジェクトで開発した比較的安価な地震地すべり再現試験機は、国内における地すべり研究に貢献するだけでなく、諸外国における有効活用が期待できる。この意味で、地すべり再現試験機に所要の改良を加え、クロアチアへ供与するための試験機を製作した上で、クロアチアの若手研究者を対象とした本格的研修を実施し、地震による地すべりに関する研究の向上を図っている点は高く評価できる。

科学技術の発展への貢献という観点からは、クロアチアのような地域の洪水・地すべりへの理解を

高めることが必須と思われる。現在は、基本的には従来のモデルの利用にとどまっているが、クロアチアの地域特性をより明確にすることによって、日本の科学技術の発展に寄与することが期待される。

5-4　持続的研究活動等への貢献の見込みについて

クロアチアの科学技術という点で言えば、基本的に日本で開発された技術を用いることでクロアチアの若手研究者が育ってきていることを考慮すれば、現段階でも十分貢献している。具体的には、クロアチア研究者が本プロジェクトで得られたデータを用いて筆頭論文（プロシーディング）を公表し始めている。また、クロアチアの若手研究者を定期的に招聘して各種研修を実施しており、ボスニア・ヘルツェゴビナ、ブルガリア、マケドニア、セルビア、スロベニア、コソボ等の国々からの研究者に対しても有効な技術伝達が行われていることから、クロアチア及び周辺諸国の研究者の自立性・自主性の向上が期待できる。

クロアチアの開発地域・社会的価値の高い地域を対象として、土砂・洪水災害を軽減するための土地利用基本計画ガイドラインの策定、現地の地盤構造・水文特性の科学的解明に立脚した信頼し得る危険度評価法の確立、といった目標を維持する限りにおいて、研究成果の利活用を通した持続的発展はある程度は見込める。地すべり滑動は長期にわたる現象である。観測設備は適切に設置されていることから、プロジェクト終了後もクロアチア側による継続的な観測が見込まれ、持続的研究活動につながると思われる。

一方、社会実装あるいは政策等への成果の反映という点では、現地研究グループやJCC（合同調整委員会）への政府機関の関与を高めるとともに、今後作成する「ガイドライン」を有効なものとする必要がある。

5-5　今後の研究に向けての要改善点および要望事項

本プロジェクトの大目標として、「クロアチアの開発地域・社会的価値の高い地域を対象として、土砂・洪水災害を軽減するための土地利用基本計画ガイドラインを策定し、同国の発展の鍵となる持続可能な国土開発に貢献する」を掲げているが、個々の成果がどのように相手国側の行政施策に反映されていくのかという点については見通しを明確にする必要がある。特に、JCC への行政機関の積極的な参加を促すなどの対応が求められる。ポータブル地すべり再現試験機の利点が地震波特性の入力にあるのだとすると、現地ターゲット地域における想定地震波特性の把握が当然必要となる。現地での観測を計画しているようであるが、必ずしも研究期間内に想定地震が発生するとは限らないため、過去事例の調査からターゲット地域における地震波特性を把握することなども検討されたい。

本プロジェクトにおける「地すべりダイナミクス」の位置付けをさらに明確化するべきである。降雨による地すべりの予測にはシンプルな伸縮計が有効とするのならば、本プロジェクトにおける地震時の地すべり数値計算の比重を軽くするなどの見直しが必要であるように思われる。また、クロアチア側の地震学者、地震工学エンジニアなどの人的資源を有効に活かす努力にさらに傾注するとともに、JCC を研究者間の打合せ以上のものにするなどの工夫を望みたい。

リエカ地域における地すべりの観測データは、リエカ大学に伝送されているが、社会実装や行政の防災意識向上を目指し、行政の防災担当事務所等にも伝送されることを期待する。

第6章　中間レビューの結果

6-1　結論

プロジェクトは、災害軽減に関するクロアチアの法律・政策と整合しているだけでなく、対象地域の地方自治体・人々のニーズにも合致しており、その妥当性は高い。プロジェクトは適切にデザインされているが、プロジェクト目標の達成に向けては、これから終了時までの 2 年間の各活動の過程・時期がさらに明確化され、関係者間で共有されることが求められる。プロジェクトの効率性は中程度と判断されたが、これはプロジェクト開始の遅れ、続く機材設置の遅れがあったためである。中間レビュー時点では、まだプロジェクトのインパクトを検討する段階には至っていない。プロジェクトの持続可能性については、人材的・技術的な観点からは活動の十分な維持が見込まれるが、制度的・財政的な観点からは現時点ではまだ不確かである。

6-2　提言

１．プロジェクトは開始の遅れや資機材調達の遅れはあったものの、2014 年 3 月のプロジェクト終了時までに、目的を達成する可能性は十分にある。プロジェクト目標達成を確実なものにするため、活動・計画の一層の明確化、WG 間の協働に関し次のとおり提言する。

1-1. マスタープランを改訂し指標を設定の上、改訂マスタープランに沿ってプロジェクトを実施する。

1-2. 活動を細分化し、各活動の実施時期を明確にした上で、改訂版 PO（活動計画）に基づきプロジェクトを実施する。プロジェクトの残り期間中、必要に応じて改訂 PO の再改訂を行う。

1-3. 土砂・洪水災害統合ハザードマップの作成のため、WG2（フラッシュ・フラッド・土石流研究）と WG1・3（地すべり研究）の間で、成果品のイメージの共有と成果品の完成時期などについて今後さらに調整と協働を進める。

1-4. WG1～4 の間の意思疎通及び連携を高めるため、活動成果を共有する年次会議の合間にも、WG のリーダーだけでなくプロジェクトに関わる全研究者が集まれる会議の開催を検討する。

２．研究成果の活用のために、データの継続的収集、地方自治体との連携について、次のとおり提言する。

2-1. プロジェクト期間内に得られるデータは限りがあるため、機材の維持管理体制も含め、プロジェクト終了後も見据えた継続的なデータ収集体制の構築を検討する。

2-2. プロジェクト成果の活用のため、地方自治体と各大学との関係強化・協力体制の仕組み（データ収集・共有の手続きの標準化、仕組みの文書化、了解覚書の交換等を想定）を検討する。

2-3. プロジェクト成果のクロアチア国内での活用のため、プロジェクト期間中に国レベルの防災担当機関との連携を検討する。

３．終了時評価を、日本・クロアチア双方の評価者による合同評価として行う。

6-3 その他

１．クロアチア類似国での事業実施上の留意点

クロアチアでの JICA 事業の実施例は極めて少ない上、現地事務所や兼轄する周辺国事務所もないという状況でプロジェクトが実施されている。クロアチアは DAC の援助対象国から外れたため、同様の事業を行うことはないが、今後、条件の類似する国での事業の実施に対し、本件から次のような教訓が引き出される。

1-1. 先方にとって我が国の ODA を受ける経験が少ないことから、ODA 事業を実施する上で他の途上国では当たり前になっていることが通用しないということを前提にプロジェクトの準備を行う必要がある。本プロジェクトでは事業実施のための国際約束の締結及び機材供与にかかる VAT の免税について、事業準備段階で通常以上にきめの細かい説明や現地事情の調査を行うことによって、プロジェクト立ち上げの遅れは回避または相当程度軽減することができたと考えられる。

1-2. プロジェクトの実施に関して、現地での JICA によるサポートができないことから、在外事務所のある国での事業以上の本部からのサポートを行う必要がある。短期間の業務出張により先方関係者と直接協議する機会を増やすべきである。

1-3. 先方との関係をより緊密にするためには、シャトル型の専門家派遣では対応が困難であり、現地で機動的に動ける長期滞在の専門家の増員配置を検討する必要がある。

1-4. 先方との情報共有の機会をできるだけ増やす仕組みを設ける必要がある一方で、被援助国卒業に近い国を対象にしていることを認識し、途上国での事業以上に先方のオーナーシップを活用した事業のあり方を検討する必要がある。

Mid-term Review Report

for

the Project on Risk Identification and Land-use Planning for Disaster Mitigation of Landslides and Floods in Croatia

July 2012

Mid-term Review Team

付属資料1

Abbreviations

AHP	Analytical Hierarchy Process
CGS	Croatian Geological Survey
CW	Croatian Water
DEM	Digital Elevation Model
DPRI	Disaster Prevention Research Institute, Kyoto University
DUZS	*Državna uprava za zaštitu i spašavanje* (National Protection and Rescue Directorate)
EMO	Emergency Management Office, City of Zagreb
GIS	Geographic Information System
HRK	Croatian Kuna (international abbreviation)
ICL	International Consortium on Landslides
JCC	Joint Coordination Committee
JPY	Japanese Yen
JICA	Japan International Cooperation Agency
JST	Japan Science and Technology Agency
LIDAR	Laser Imaging Detection and Ranging
M/M	Minutes of Meetings
MZOS	*Ministarstvo obrazovanja, znanosti i sporta* (Ministry of Science, Education and Sport)
PO	Plan of Operation
R/D	Record of Discussion
SATREPS	Science and Technology Research Partnership for Sustainable Development
UR	University of Rijeka, Faculty of Civil Engineering
US	University of Split, Faculty of Civil Engineering, Architecture and Geodesy
UZM	University of Zagreb, Faculty of Mining, Geology and Petroleum Engineering
UZA	University of Zagreb, Faculty of Agriculture
VAT	Value Added Tax

Contents

Chapter 1: Outline of the Review Study

1.1 Background

Croatia has frequent earthquakes and, along the Adriatic coast, has a large amount of precipitation. At some places, average annual rainfall is 3,500mm and more. Triggered by such earthquakes and rainfall, sediment disasters occur quite often such as landslides, slope failure, and debris flow. The land of Croatia has a complex, fragile terrain and geological structure affected by earth faults and folds. Sediment disaster are common at the alternation of sandstone-shale strata that is prone to weathering, as well as at slopes with marl layer containing large amounts of clay with low friction angle. Local flood (flash flood) occurs at limestone regions where water roads are easily formed in the strata.

Sprawling of cities is causing the accumulation of assets and population growth in sub-urban areas, but many of these areas are at high risk of such disasters in Croatia, thus raising concerns about increasing damages by flash floods and landslides. In some areas, disaster risk is likely to become even higher with a change in rainfall patterns due to climate change.

In Croatia, however, techniques to assess flash-flood/landslide risk and mechanisms to take measures on the risk assessment are not yet developed. Sprawling control as well as disaster warning systems and evacuation rules are not in place yet, either. Towards such disaster risk management, researches are required to develop methodologies for hazard mapping and risk assessment based on scientific data of these phenomena, and to improve the land use taking into consideration such disaster risks.

In this context, this Project was requested by the Government of Croatia. Based on a detailed planning survey in January 2009 and a following consultation mission in March 2009, the R/D of the Project was signed on 27 March 2009 under the scheme of SATREPS. In July 2012, about the halfway point of the Project period, a mid-term review is to be conducted as dictated by the Article V of the signed R/D.

1.2 Objectives of the Mid-term Review Study

The objectives of the Mid-term review are to:

1) confirm actual inputs, activities and implementation process, the degree of achievements of the outputs, and the prospect of achieving the project purpose according to the Master Plan.
2) assess the Project from the five evaluation criteria - Relevance, Effectiveness, Efficiency, Impact and Sustainability – based on the JICA's guideline for project evaluation.
3) make common understanding of indicator for the Project purpose and output.
4) make recommendations on the measures to be taken during the remaining project period in consultation with agencies concerned.

1.3 Members of the Review Team

The review was conducted by the team composed by the following members:

Name	Position	Title
Mr. Hideo MIYAMOTO	Leader	Senior Advisor to the Director General, Water Resources and Disaster Management Group, Global Environment Department, JICA
Mr. Jun MURAKAMI	Survey Planning	Water Resources and Disaster Management Group, Global Environmental Department, JICA
Mr. Hiroyuki OKUDA	Evaluation and Analysis	Tekizaitekisho, LLC
Dr. Yoshimori HONKURA	SATREPS Evaluation	Program officer of Natural Disaster Prevention, Research Partnership for Sustainable Development Division, JST
Mr. Masayuki SATO	SATREPS Evaluation	Principal Researcher, Research Partnership for Sustainable Development Division, JST
Dr. Koichi TSUKIOKA	SATREPS Evaluation	Senior Staff, Research Partnership for Sustainable Development Division, JST
Ms. Kikuko SAKAI	SATRPES Evaluation	Senior Program Coordinator, JST Paris Office

1.4 Schedule of the Mission

The schedule of the mission is attached (Annex 3)

1.5 Methodology of the Review

The Mid-term review is carried out in accordance with “the JICA New Guideline for Project Evaluation, Ver. 1 (June 2010)”, which mainly follows “the Principles for Evaluation of Development Assistance, 1991” issued by OECD-DAC. The master plan in the R/D with the statement of the project purpose, outputs and activities is used as the basic reference point for the review. (Annex 1 is a revised master plan, draft, with proposed indicators).

As a framework to collect and sort out relevant data and information as prescribed in the JICA Guideline, two types of grid - Result Grid and Evaluation Grid - were prepared in reference to reports and documents on the Project. To collect information for the Evaluation Grid, questionnaires were prepared and forwarded in advance to the counterpart organizations. During the review mission, the team conducted interviews with counterparts based on the questionnaires, hearings with JICA experts, and visited target areas (Annex 3, 4).

Findings and information from reports, interviews, questionnaire survey and site visits were collected and analyzed in the grids. The team confirmed the achievements, assessed the Project based on the five criteria, made recommendations, and drew lessons learned.

The criteria used for the evaluation are the following five criteria: relevance, effectiveness, efficiency, impact and sustainability.

Relevance	Relevance is reviewed by the validity of the Project Purpose in light of Croatia’s development policies and needs and Japanese cooperation policies.
Effectiveness	Effectiveness is assessed to what extent the Project is achieving the Project Purpose, clarifying the relationship between the Project Purpose and Outputs.
Efficiency	Efficiency is analyzed with emphasis on the relationship between Outputs and Inputs in terms of timing, quality, and quantity.
Impact	Impact is assessed in terms of positive/negative and intended/unintended influence caused by the Project.

Sustainability	Sustainability is assessed in terms of institutional, financial, and technical aspects by examining the extent to which the achievements of the Project will be sustained after the Project is completed.

Chapter 2: Outline of the Project

2.1 Project Purpose

Integrated landslide/flood hazard mapping technology and land-use guidelines formulation methodologies are developed for nation-wide application in Croatia.

2.2 Output

1. Methodologies for landslide risk assessment, prediction of affecting areas, and early warning systems are developed adapting to hydrological and geological conditions in Croatia.
2. Flash-flood/debris-flow simulation models and early warning systems are developed adapting to hydrological and geological conditions in Croatia.
3. Integrated landslide/flood hazard maps and land-use guidelines for landslide/flood risk mitigation are developed for study areas.

Chapter 3: Achievements of the Project

3.1. Results of Inputs

The R/D of the project was signed on 27 March 2009, but it was 9 March 2010 when the Note Verbal was exchanged for launching the Project as it took long time for Croatian side to conduct necessary inter-organizational coordination. Behind the original schedule by one year, inputs as per agreed in the Master Plan begun with the dispatch of Japanese expert in May 2010.

(Japanese side)

1) Dispatch of Japanese researchers

Since May 2010 until July 2012, total 17 researchers have been dispatched, short-term 82 times, totaling 997 days. Each researcher is attached to working group 1, 2 or 3. In addition, one project coordinator has been dispatched by JICA since May 2010. (Annex 5)

2) Counterpart Training

4 researchers and 7 researchers from CGS, UZM, UR and US attended short-term trainings in Japan in 2010

and 2011, respectively, conducted in Tohoku Gakuin University, Yamagata University, Niigata University, ICL, and Kyoto University. (Annex 6).

3) Provision of Machinery and Equipment

Activities of the Project started in May 2010, one year behind the signature of the R/D. In addition, due to the absence of referential precedence on VAT exemption procedure in concerned agencies in Croatia and resulting delay of administrative clearance, a piece of equipment which was planned to be procured in Croatia ended up being purchased in Japan and shipped to Croatia instead. Machinery and equipment for landslide and flash-flood analysis was provided by the Japanese side, the total amount of which are 128,416,000 JPY for 2010 and 2011. (Annex 7)

4) Local Costs

Japanese side provided a part of necessary expenses for carrying out project activities. Apart from the costs of machinery and equipment of 128,416,000 JPY, the expenses include the dispatch of Japanese researchers and project coordinator, training of Croatian Researchers in Japan, Operational expenses such as travel expenses in Croatia, local consultant fee, and meetings. The total amount, including that of machinery and equipment, is 237,101,000 JPY for 2010 and 2011. (Annex 8)

(Croatian side)

1) Assignment of Counterpart Personnel

Project Director (Mr. Purgar) and Project Manager (Prof. Ožanić) have been assigned by MZOS and UR, respectively. The Deputy Project Manager (Assoc.Prof. Mihalić) and Project Coordinator (Prof Kisić) have been assigned by UZM and UZA, respectively. The change of the Project Manager from Prof. Bonacci to Prof Ožanić, and the Deputy Project Manager from Prof. Ožanić to Assoc.Prof. Mihalić was officially announced with a letter dated 28 March 2012 issued by MZOS. Although there is no official letter on the assignment of counterpart, so far 35 researchers have been recognized as counterpart personnel at the time of mid-term review. (Annex 9)

2) Local Operational Cost

MZOS has been financing the project – lump sum of 360,000 Kuna/year we well as salaries of 9 young researchers working for the Project, shipment and installation costs of purchased equipment, and travel of researchers. Each faculty engaged in the Project – Faculty of Mining, Geology and Petroleum Engineering, University of Zagreb, Faculty of Civil Engineering, University of Rijeka, and Faculty of Civil Engineering, Agriculture and Geodesy, University of Split – has also borne a part of operational costs. The total amount, however, could not be confirmed during the mid-term review mission. (Annex 8)

3.2. Progress and Achievements of the Project

1) Achievement of the Project outputs

(Output 1)

- There are four model sites selected: Kostanjek Landslide (a part of Medvednica Hilly Area, City of Zagreb), Grohovo Landslide (a part of Rječina River Basin, Primorsko-Goranska County, Rijeka), Duće and Omiš areas (Split-Dalmatian County).
- A low-cost undrained shear test apparatus was developed in Japan, and two Croatian researchers were trained for the operation of and the testing with the apparatus. (Activity 1-1). Activity 1-1 was completed.
- Soil samples from model sites (Kostanjek landslide and Grohovo landslide) were sent to Japan and tested with the apparatus. At the time of mid-term review, 2 July 2012, the apparatus was at the Croatian custom still on its way for shipping to the University of Rijeka. (Activity 1-2)
- Researchers indicated that the installation of monitoring equipment (GPS, extensometers, total station, prism, pore pressure gauge) has completed more than 90% at Grohovo site; most part of which were set up in August through September 2011, and the monitoring has been in progress. As for Kostanjek landslide, monitoring equipment is expected to be set up this year, in July 2012. (Activity 1-3)
- The development of methods of landslide risk assessment (Activity 1-4) and the prediction of landslide affecting areas based on landslide dynamics (Activity 1-5) are linked and undertaken concurrently.
- The monitoring is going on at Grohovo to accumulate data to feed into the establishment of early warning system. At Kostanjek, extensometers were installed, largely depending on which an early warning system is to be established. (Activity 1-6)
- The level of progress to date as per generally perceived by researchers are: 100% for Activity 1-1, 70% for Activity 1-2, 60% for Activity 1-3, 40% for Activity 1-4 and 1-5, and 40% for Activity 6.

(Output 2)

- There are five model sites selected: Rječina River Basin, Dubračina River Basin, and Mošćenička Draga (Primorsko-Goranska County, Rijeka), Imotski and Sutina-Karakašica (Split-Dalmatian County).
- Rainfall measurement equipment was installed at model sites in Rijeka and the data are being collected. The analysis of rainfall-discharge characteristics continues with new hydro-meteorological data. Since 2011, however, due to the absence of heavy rainfall events, the data accumulation so far has not been adequate as expected. Meteorological measurement device has been installed in the municipality office building of Mošćenička Draga, where the data also has been utilized by the local authority. (Activity 2-1, 2-2)
- Physical experiments of debris-flow have been carried out in Kyoto University where the Croatian trainees jointed the experiments. Two peer review papers have been accepted. The development of flashflood and debris flow simulation model (Hydro-Debris 3D) for Dubračina River is completed. (Activity 2-3)
- The procurement of radar (Furuno) to cover the three model sites in Rijeka are in progress, which will constitute the early warning system to be established. (Activity 2-4)

- The level of progress to date as per generally perceived by researchers are: 50% for Activity 2-1, 40% for Activity 2-2, 50% for Activity 2-3, and 40% for Activity 2-4.

(Output 3)

- There are five model sites selected: Hilly area of the Medvednica Mountain (Zagreb), Rječina River and Dubračina River basin (Primorsko-Goranska County, Rijeka) and Duće and Omiš areas (Split-Dalmatian County).
- In Zagreb and Rijeka, topography interpretation of model sites and surrounding areas, mainly based on aerial photos, were completed. In addition, digital topography maps are being created based on LiDAR scanning with airplane. In Split, WG4 is conducting ground-based LiDAR scanning once a month since September 2011 (Activity 3-1,3-2).
- In Zagreb and Rijeka, WG3 is preparing land slide inventory maps and conducting landslide susceptibility analysis using AHP methodology. WG2 is undertaking researches in Rijeka alone in the recognition that there is no flashflood threat in Zagreb due to the retention dam, and hence the integrated landslide/flood hazard map in Zagreb will cover only landslide aspects. In Split, rock fall in Duće/Omiš areas and flashfloods in Imotski/Sutina-Karakašica are not linked phenomena. As such, the integrated landslide/flood hazard map WG4 will develop actually means two individual hazard maps for landslide and flashfloods. (Activity 3-3)
- The development of land-use guidelines (Activity 3-4) and manuals of integrated landslide/flood hazard mapping (Activity 3-5) has not really started yet, but researchers of the implementing universities meet local authorities more often than not, raising their awareness for the preparation of land-use guidelines incorporating hazard assessment.
- The level of progress to date as per generally perceived by researchers are: 50% for Activity 3-1 and 3-2, 20% for Activity 3-3, 10% for Activity 3-4 and 3-5.

2) Achievement towards the Project Purpose

The project purpose is “integrated landslide/flood hazard mapping technology and land-use guidelines formulation methodologies are developed for nation-wide application in Croatia. Indicators for the Project Purpose were not set in the Master Plan included in the signed R/D. At present, the project is making a steady progress of research activities at each output level as summarized in the above section. Considering the overall progress towards attaining the Project Purpose, in spite of the delay of launching the Project and setting up the monitoring equipment at model sites, the Project has a good potential to achieve its goal by the end of project period, March 2014.

3.3 Implementation Process

The project formed three working groups (WG) – WG1 for detailed landslide investigation, WG2 for flash-floods and debris-flows, and WG3 for regional landslide investigation. After the 1st JCC on 23rd February

2012, the formation ofWG4 was proposed in order to accelerate the research activities in Split by direct contact between the project manager and the leader ofWG4.

Chapter 4: Evaluation by the Five Criteria

4.1 Relevance

The relevance of the Project is high.

- There are several laws and policies speaking to the importance of disaster mitigation in Croatia; they are: Protection and Rescue Plan for Croatia (Official Gazette 96/10), Evaluation of Endangerment of Croatia from Natural and Technological Disasters, Croatian National Platform for Disaster Risk Reduction, Protection and Rescue Law (Official Gazette 127/10), Law on Protection from Natural Disasters (Official Gazette 73/97), and also various international agreements on protection and rescue in case of natural disaster. The project, aiming at the development of integrated landslide/flood hazard mapping technology and land-use guidelines formulation methodology for nation-wide application in Croatia, is aligned with these Croatian laws/policies, and contributes to their realization.
- The model sites of the Project were proposed by Croatian researchers. The Kostanjek in Zagreb is the largest landslide in Croatia, and one of primal concerns of the Emergency Management Office in the City of Zagreb. At present, the physical plan of the City of Zagreb doesn't include the assessment of landslide risk. At the downstream of Rječina River located the city of Rijeka, and the flood waters can cause significant damage to the city; it could be an even higher hazard in case of concurrent rock avalanche at Grohovo landslide. The City of Rijeka has a land-use guideline for construction purpose, but it does not contain a hazard map. The model sites in Split are Omiš and Duće where a rock fall is quite frequent, causing damages and posing threats to many houses and population in the towns. The project can also meet the needs and expectation of these local authorities by monitoring the sites, setting up early warning systems, preparing hazard maps as well as land-use guidelines incorporating disaster risk mitigation.
- Disaster reduction is identified as one of specific issues Japan's ODA gives priority. The Initiative for Disaster Reduction through ODA was announced at the United Nations World Conference on Disaster Reduction held in Kobe, Hyogo prefecture, in January 2005. Furthermore, JICA's Issue-specific Guideline for Disaster Reduction sets out "building disaster-resilient communities and societies" as one of development strategy goals to be achieved. This Project aims at the development of landslide/flood hazard mapping technology and early warning system, thus applying these outputs to land-use guidelines prepared by local authorities for disaster reduction. The Project is aligned with Japan's ODA policy, and such methods and technologies can also be utilized for other disaster risk management projects.

4.2 Effectiveness

The effectiveness of the Project is medium.

- The basic design of the Project is clear as per summarized in the Master Plan, and the three outputs are

essential components for the Project to achieve its purpose. As described in the above section, the Project has set up equipment, accumulating monitoring data and analysis. At present, the project is making a steady progress of research activities at each output level, and in spite of the delay of launching the project and setting up monitoring equipment at model sites, it is widely indicated that the project has a good potential to achieve its goal by the end of project period, March 2014. It is also expected that activities can be undertaken even faster once all equipment is installed because timeline of research activities can become more predictable and preparing a research plan can become meaningful.

- Output 3, where the results of Output 1 and Output 2 are to be synthesized to achieve the Project Purpose, has so far made rather limited progress. Moreover, the PO doesn't describe the process and schedule of how each output can be integrated or utilized in Output 3 to attain the Project Purpose. Specific PO for the 2nd half of the project period is necessary, including the process and timeline towards the Project Purpose, thereby the prospect of achieving the project goal can become clearer.
- It is also important the specific PO provide further breakdown of each activity to show how each activity can be conducted and completed for the next two years. The breakdown of each activity with timeline is helpful for better understanding and communication among researchers of different working group and also between Croatian and Japanese researchers. In addition, a detailed PO is beneficial for effective monitoring of each activity, whereby the effectiveness of the Project can be further increased.
- The development of integrated landslide/flood hazard maps and land-use guidelines for landslide/flood risk mitigation are set as tangible targets of Output 3. In the City of Zagreb, one of the three study areas, the Project will not prepare such map and guideline because Zagreb is not likely to have flush flood. WG2 is not undertaking flash-floods and debris-flows research in Zagreb, and hence the output of WG3 is to be a landslide susceptibility/hazard map, not including flash-flood analysis, and a land-use guideline incorporating only landslide aspects. In the case of WG4, a map and a guideline will be evaluated for rock falls as a special case of landslides.
- Indicators, which will be used to verify the attainment of each output and Project Purpose at the time of terminal evaluation, were not set in the Master Plan included in the signed R/D. Mid-term review is a good opportunity to review the project progress so far, and discuss and agree on indicators by foreseeing the goal to be reached two years ahead.
- The project will develop methods and models such as landslide risk assessment, prediction of landslide affecting areas, flashflood/debris-flow simulation model, and integrated landslide/hazard mapping technology. The verification of these methods and models are conducted with measurement and data from physical experiments while actual hazardous events don't occur so often. Within the project period, the verification by natural events depends on weather, but refinement of methods and models will continue.
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4.3 Efficiency

Efficiency of the Project is medium.

- The R/D of the project was signed on 27 March 2009, but it was 9 March 2010 when the Note Verbal, a form

of diplomatic document, was exchanged after a long process of conducting inter-organizational coordintion on Croatian side. This is a five-year project, planned to start in March 2009 and end in March 2014, but due to this delay of launching the Project for one year, now all activities are to be competed in four years.

- Concerning the procurement of project equipment, the exemption of VAT (25%) was agreed on the R/D but administrative procedures for this VAT's exemption to become effective was not clear among concerned agencies both in Japanese and Croatian side. As a result, the first batch of equipment installation was in August through September 2011 at Grohovo Landslide due to the change of procedures - from domestic procurement in Croatia to international procurement in Japan - and the associated time it took for this change. This delay in setting up equipment at model sites has affected the research plan.
- For project implementation, MZOS has prepared a counter-budget, which includes the lump-sum 360,000 Kuna/year, salary payments of nine young researchers who are expected to obtain doctor's degree through researches in the Project, payment for equipment installation and maintenance, and travel allowance & accommodation for researchers. Each faculty of the three universities implementing project activities also has borne a part of operational costs such as conference and travel.
- The Project organizes annual international conferences to share the research progress and findings. The 1st conference was in Dubrovnik in November 2010 and the 2nd conference was at the University of Rijeka in December 2011. An internal Croatian workshop is planned to be held in Zagreb in December 2012, financed by Croatian Water for the prepration of the next conference. The 3rd conference is currently planned in Zagreb in February 2013 inviting more participants from local authorities as well as promoting public relations. Meetings and communication for research coordination between Japanese researchers and their Croatian counterparts have been properly held as and when necessary. On the other hand, communication of researchers among different working groups is much less and confined to such opportunities as the annual international conferences and JCC.
- The project held the 1st JCC on 23rd February 2012 at the Faculty of Agriculture, UZ, where counter personnel from the three universities and Croatian Geological Survey attended, including representatives of local community (City of Zagreb's EMO). This JCC was the first meeting where administrative instructions for the project such as equipment and procurement were shared among all those who were involved in the Project. Meetings for administrative purpose could have been very helpful if it had been held at the very beginning of the Project to share the knowledge, rules and regulations associate with Project implementation.
- Counterpart personnel have not been fixed by, for example, an assignment letter by organizations or an acknowledgement at JCC. Assignment of counterpart personnel has been flexible, subject to change in accordance with the situation and progress of researches.
- The formation of WG4 based in US is a response to administrative issues of project coordination such as the distance between US and UR/UZM and resulting difficulty for US to have meetings and smooth communication as a part of WG1, WG2 and WG3. Research subject and activities remain unchanged, though, in US with the formation of WG4, and the leader of WG4 as US is now able to directly contact with Project Manager in UR. Partner researchers from Japanese side are not assigned to WG4, but work together as and when necessary.

4.4 Impacts

It is still premature to evaluate the impact of the Project

- Positive impacts such as measures against natural hazard and disaster risk mitigation can be expected once the Project achieves its purpose and the application of research results to local/national government policies starts realized. At the time of mid-term review, such expected impacts have not been observed yet.
- It is widely indicated that the relationship between the universities and the local governments has been forged and strengthened due to the presence of the Project. Representative of local governments are not listed as counterpart in the R/D, but they are now recognized as essential partners of the Project by researchers towards achieving the Project goal. For example, EMO in the City of Zagreb was newly established in 2009 to take responsibility for all Zagreb's natural disaster, among which an earthquake is the major disaster. Before the Project, EMO was not very much aware of the importance of addressing landslide issue, but now has become concerned and has provided the Project with support such as issuing a permit for equipment installation.
- The maintenance of installed equipment is also discussed among EMO and UZM. An idea is that at the end of the Project UZM could hand over the equipment to the City of Zagreb, which could bear the costs for its maintenance while UZM could provide constant inspection of the equipment and provide the City with monitoring data collected thereof. As such, efforts to promote the application of research results and to seek an arrangement for follow-on support have already been undertaken.
- The town of Omiš prepared a project document to contain potential rock falls in the town. The leader of WG4 of the Project is a reviewer of the project document, and expects that the LiDAR scanning conducted in the Project will also help identify critical points of potential rock falls, and will contribute to the implantation of the town's project. The Ministry of Finance of Croatian Government will finance the project once the project document is signed.
- Through international conference organized by the Project, research results and findings on landslides and flash-floods/debris-flow are shared among researchers from neighboring countries such as Serbia, Bosnia and Herzegovina, Kosovo, Macedonia, and Slovenia, where studies on disaster risk management are important and required for societies.
- Formalization of international cooperation with neighboring countries is underway in the frame of ICL regional network (Adriatic-Balkan) and thematic network (Landslide Monitoring), which were proposed in the 1st conference in Duvrovnik in Nov 2010. Two faculties (UZ and UR) have become members of ICL and have been assigned as coordinators for the networks due to the presence of the Project.
- UR, with Department of Local Government and the management of the city of Rijeka, is preparing a program to enlarge the Grohovo monitoring system on wider area in Rjecina river valley.
- The Project Manger, on behalf of MZOS, has become a member of National Protection and Rescue Directorate since 2012 due to her function in the Project.
- University of Split, Faculty of Civil Engineering and Architecture, has been institutionally connected with National Protection and Rescue Directorate during the development of Croatian 112 emergency system, as well as with their department in Divulje near Split on various emergency and disaster related activities.

4.5 Sustainability

The prospect of sustainability of project activities is medium.

- Prospect of sustainability from the viewpoints of human resource and technical capacity is indicated more than medium. Currently, nine young researchers, doctoral students, are sponsored by MZOS to work for the Project. It will lead to a significant human resource capacity when they obtain doctorates. Equipment installed in model sites is currently well maintained; a container of inclinometer casing, pore pressure gauge and GPS, a fence around solar panels, concrete base of a pole for the prism, and insurance policy for equipment. MZOS bears the costs of these protective and maintenance measures. Also, follow-on arrangement for maintenance of equipment after the end of the Project is currently being explored by the implementing universities.
- At present, MZOS has prepared a counter-budget, financing a part of project operation. From a financial viewpoint, however, the prospect of sustainability is indicated relatively low based on the recognition of Croatian economy growth recording negative, and resulting uncertainty of budgetary commitment in future.
- From an institutional viewpoint, it is still further clarified how the research results will be incorporated into the local government policy such as the preparation of land-use guideline. The relationship between the local authorities and the universities is still at the personal level, yet the relationship should be institutionalized as a system for disaster risk management between the two entities. Additionally, for research results to feed into disaster management policies, an involvement of disaster management agency, namely National Protection and Rescue Directorate, will become more important in future.

Chapter 5: Results of the Mid-term Review

5.1 Conclusion

The relevance of the Project is high - the Project is not only aligned with national laws and policies associated with disaster mitigation, but also meets the needs of local authorities and population. The effectiveness of the Project is medium as the Project is properly constructed, but the process and timeline for the remaining 2 years need to be further clarified and agreed toward achieving the Project Purpose. The efficiency of the project to date is rated medium mainly due to the initial delay of project launching and further delay of equipment installation. It is still premature to evaluate the impact of the Project at the time of Mid-term review. The prospect of sustainability of the Project is medium as technical and human resource capacity are indicated enough to sustain Project activities, but it is still uncertain from institutional and financial viewpoints.

5.2 Recommendations

1. The project has a good potential to achieve its goal by the end of project period, March 2014, in spite of the delay of launching the project and setting up monitoring equipment at model sites. The followings are recommended to ensure the goal to be attained: clarification of activities and plan, cooperation among working groups, and

implementation monitoring.

1-1. A revised Master Plan has been drafted, as per Annex 1, with indicators. The Project will be carried out based on the revised Master Plan.

1-2. A revised PO has been drafted, as per Annex 2, with activity breakdown and timeline for the next two years. The implementation will be undertaken according to the revised PO, which is subject to change and updated as and when necessary.

1-3. WG2 (flash-floods/debris-flow research) and WG1 & WG3 (landslide research) are to promote coordination and cooperation on the image of research outputs and its time of completion so that the results of both researches can be synthesized to produce integrated landslide/flood hazard maps.

1-4. Communication and cooperation among WG1, WG2, WG3 and WG4 is to be further promoted towards the intended Project Purpose; meetings in between the annual conference can be considered, not only among WG leaders but also of all researchers involved. .

2. In order for the application of research results, the followings are recommended: coordination with local authorities and continuous data collection.

2-1. The data that can be collected within Project period is limited, and hence the arrangement for continuous data collection after the project should be established for better research outputs, including the maintenance of installed equipment.

2-2. A system to strengthen the relationship between the local authorities and the universities in the study areas need to be explored - such as standardized procedures, documentation of protocol, memorandum of understanding – towards the application of research results.

2-3. For nation-wide application in Croatia of the Project outputs in future, the involvement of national authority for disaster risk management need to be explored while the Project is being undertaken.

3. The terminal evaluation can be conducted as a joint evaluation by both Japanese and Croatian evaluators.

Annex 1: Revised Master Plan (Draft)

1. Project Purpose

Integrated landslide/flood hazard mapping technology and land-use guidelines formulation methodologies are developed for nation-wide application in Croatia.

Indicator 1 :Number of manual book to develop integrated landslide/flood hazard map (1 manual)
2 : Number of manual book to develop land-use guideline for landslide/flood risk mitigation (1 manual)

2. Outputs

(1) Methodologies for landslide risk assessment, prediction of affecting areas, and early warning systems are developed adapting to hydrological and geological conditions in Croatia.

Indicator 1-1: Number of manual book of methodologies for landslide risk assessment (1 manual)
1-2: Number of model sites to develop a simulation for landslide predictions on dynamics (2 model sites: Kostanjek, Grohovo)
1-3: Number of model sites to establish landslide early warning systems (2 model site: Kostanjek, Grohovo)

(2) Flash-flood/debris-flow simulation models and early warning systems are developed adapting to hydrological and geological conditions in Croatia.

Indicator 2-1: Number of model sites to formulate a flash-flood/debris-flow simulation model (5 model sites: Rječina River Basin, Dubračina River Basin, Mošćenička Draga, Imotski, Sutina-Karakašica)
2-2: Number of model sites to establish a flash-flood early warning system at Rijeka (2 model sites: Rječina River Basin, Mošćenička Draga)
2-3: Number of model site to clarify essential factors on flash-flood/debris-flow simulation model, considering sustainable land management to mitigate water erosion on different tillage treatments (1 model site: Daruvar)

(3) Integrated landslide/flood hazard maps and land-use guidelines for landslide/flood risk mitigation are developed for study areas.

Indicator 3-1: Number of study areas to develop an integrated landslide/flood hazard map (3 areas: Zagreb, Rijeka and Split)
3-2: Number of study areas to develop land-use guidelines for landslide/flood risk mitigation (3 areas: Rijeka, Split, Zagreb)
Note 1): Indicator 3-1 for Split area means two individual hazard maps for landslide (rock fall) and flash flood.
Note 2):Indicator 3-1 for Zagreb area and Moscenicka Draga (in Rijeka area) means individual hazard maps for landslide and flash flood depending on model site conditions

3. Activities

(1)-1. Development of a low-cost undrained shear test apparatus.
(1)-2. Soil tests using the shear test apparatus.
(1)-3. Field survey and monitoring at landslide risk sites in model sites.
(1)-4. Development of landslide risk assessment methods based on landslide dynamics, and their application to the model sites.
(1)-5. Development of methods for the prediction of landslide affecting areas, and their application to the model sites.

(1)-6. Development of land slide early warning systems, and their application to the model sites.

(2)-1. Collection of existing hydro-meteorological data and analysis of rainfall-discharge characteristics in model sites.
(2)-2. Installation of rainfall measurement equipment, and collection of rainfall data.
(2)-3. Development of flashflood and debris flow simulation models in model sites.
(2)-4. Development of flashflood and debris flow early warning systems and their application to the model sites.

(3)-1. Preparation of digital topography maps of the study areas and the model sites based on the photo interpretation.
(3)-2. Development of wide-area landslide risk assessment methods using the Analytical Hierarchy Process (AHP) method, and their application to the study areas.
(3)-3. Development of integrated landslide/flood hazard mapping technology, and formulation of integrated hazard maps for the study areas and model sites.
(3)-4. Development of land-use guidelines formulation methodology, and formulation of land-use guidelines for disaster mitigation in study areas.
(3)-5. Preparation of a manual of integrated landslide/flood hazard mapping, and a manual of land-use guidelines formulation that are applicable nation-wide in Croatia.

Note: (3)-2 was originally listed as (1)-4 in the master plan, then later moved.

Annex 2: Revised Plan of Operation (Draft)

Outputs and Activities		1st JFY 2009/2010	2nd JFY 2010/2011	3rd JFY 2011/2012	4th JFY 2012/2013	5th JFY 2013/2014
	JCC			①	② ③	④ ⑤
	②:with mid-term review mission (Jul. 2012), ③:with 3rd conference(Mar. 2013), ④:with final evaluation mission(Dec. 2013), ⑤:with final conference(Mar. 2014)					
Output 1: Methodologies for landslide risk assessment, prediction of affecting areas, and early warning systems are developed adapting to hydrological and geological conditions in Croatia.						
1-1	Development of a low-cost undrained shear test apparatus					
1-2	Soil tests using the shear apparatus					
	① Set up the undrained shear test apparatus in UR					
	② Conduct additional soil tests of samples from the 2 model sites (Kostanjek, Grohovo)					
1-3	Field survey and monitoring at landslide risk sites in model sites					
	① Procurement and Set up GPS and other monitoring system for Kostanjek landslide					
	② Monitoring Kostanjek landslide and Grohovo					
1-4	Development of landslide risk assessment methods based on landslide dynamics, and their application to the model sites					
	① Obtain the parameters thorough the soil tests in 1-2					
	② Carry out the landslide risk assessment at the 2 model sites (Kostanjek, Grohovo) with using the parameters					
1-5	Development of methods for the prediction of landslide affecting areas, and their application to the model sites					
	① Obtain the parameters thorough the soil tests in 1-2					
	② Carry out the prediction of affecting area at the 2 model sites (Kostanjek, Grohovo) with using the parameters					
1-6	Development of landslide early warning systems, and their application to the model sites					
	① Fix the necessary standard data for establishment of early warning system at Kostanjek and Grohovo landslide and development the early warning system					
	② Fix the contents of manual book of methodologies for landslide risk assessment					
	③ Development the manual book of methodologies for landslide risk assessment and share it with necessary organizations					

Outputs and Activities		1st JFY 2009/2010	2nd JFY 2010/2011	3rd JFY 2011/2012	4th JFY 2012/2013	5th JFY 2013/2014
JCC				①	② ③	④ ⑤
②:with mid-term review mission (Jul. 2012), ③:with 3rd conference(Mar. 2013), ④:with final evaluation mission(Dec. 2013), ⑤:with final conference(Mar. 2014)						
Output 2:Flash-flood/debris-flow simulation models and early warning systems are developed adapting to hydrological and geological conditions in Croatia.						
2-1	Collection of existing hydro-meteorological data and analysis of rainfall-discharge characteristics in model sites					
	① Analysis of rainfall-discharge characteristics in 5 model sites (Rjecina River Basin, Dubracina River Basin, Moscenicka Draga, Imotski, Stinakarakaticka)					
2-2	Installation of rainfall measurement equipment, and collection of rainfall data					
	① Installation of rainfall measurement equipment at UR					
	② Collection and analysis of rainfall data					
2-3	Development of flashflood and debris flow simulation models in model sites					
	① Development of flashflood and debris flow simulation model (Hydro-Debris3D)					
	② Application the simulation model into 5 model sites (Rjecina River Basin, Dubracina River Basin, Moscenicka Draga, Imotski, Sutina-Karakasica)					
	③ Development of the flashflood and debris flow simulation model considering sustainable land management to mitigate water erosion ondifferent tillage treatments					
	④ Application of the simulation model considering sustainable land management to mitigate water erosion ondifferent tillage treatments					
2-4	Development of flashflood and debris flow early warning systems, and their application to the model sites					
	① Procurement and set up of radar to cover the 2 model sites (Rjecina River Basin, Moscenicka Draga)					
	② Fix the necessary standard data for establishment of early warning system at Rijeka (2 model sites; Rjecina River Basin, Moscenicka Draga)					
	③ Development the early warning system and share it with necessary organizations					

Outputs and Activities		1st JFY 2009/2010	2nd JFY 2010/2011	3rd JFY 2011/2012	4th JFY 2012/2013	5th JFY 2013/2014
	JCC			①	② ③	④ ⑤
	②:with mid-term review mission (Jul. 2012), ③:with 3rd conference(Mar. 2013), ④:with final evaluation mission(Dec. 2013), ⑤:with final conference(Mar. 2014)					
Output 3: Integrated landslide/flood hazard maps and land-use guidelines for landslide/flood risk mitigation are developed for study areas.						
3-1	Preparation of digital topography maps of the study areas and the model sites based on the photo interpretation					
3-2	Development of wide-area landslide risk assessment methods using the Analytical Hierarchy Process (AHP) method, and their application to the study areas					
	① Preparation of landslide inventory and risk assessment by applying the AHP method for 3 areas (Medvednica, Rjecina River Basin, Dubracina River Basin, Duce, Omis)					
	② Fix the contents of manual book of methodologies for landslide risk assessment					
3-3	Development of integrated landslide/flood hazard mapping technology, and formulation of integrated hazard map for the study areas and model sites					
	① Arrange the work scheme to synthesize the landslide and flashflood/debris flow					
	② Development of integrated landslide/flood hazard map for 2 model sites (Rjecina River Basin, Dubracina River Basin) by synthesizing the wide-area landslide risk assessment using AHP method (3-2), result of flashflood and debris flow simulation (2-3), landslide risk assessment on landslide dynamics (1-4), and prediction on landslide affected area (1-5)					
	③ Development of sepalate landslide/flood hazard map for 3 areas (Rijeka, split, Zagreb) by synthesizing the wide-area landslide risk assessment using AHP method (3-2), result of flashflood and debris flow simulation (2-3), landslide risk assessment on landslide dynamics (1-4), and prediction on landslide affected area (1-5)					
	④ Share the integrated and sepalate hazard map with necessary organizations					
3-4	Development of land-use guidelines formulation methodology, and formulation of land-use guidelines for disaster mitigation in study areas					
	① Fix the contents of land-use guideline for disaster mitigation for 3 areas (Rijeka, Zagreb, Split)					
	② Development of land-use guideline for 3 areas (Rijeka, Zagreb, Split)					
	③ Share the land-use guideline with necessary organizations					
3-5	Preparation of a manual of integrated landslide/flood hazard mapping, and a manual of land-use guidelines formulation that are applicable nation-wide in Croatia					
	① Fix the contents of manual of integrated landslide/flood hazard mapping, and a manual of land-use guidelines formulation that are applicable nation-wide in Croatia					
	② Development of manual of integrated landslide/flood hazard mapping, and a manual of land-use guidelines formulation that are applicable nation-wide in Croatia, and share them with necessary organization					

Original plan ←→ Past activity ——— Revised plan - - - →

Annex 3: Schedule of Review Mission

Date	Mr. Miyamoto, Mr. Murakami	Mr. Okuda	JST members
25 Mon June	-	09:45 Narita – 14:30 Frankfurt 18:00 Frankfurt – 19:25 Zagreb	-
26 Tue	-	09:30 MZOS courtesy call / interview 14:00 Japanese Embassy courtesy call	-
27 Wed	-	10:00 Interview with EMO, City of Zagreb 13:00 Interview with Prof.Mihalić, UZM	-
28 Thu	-	09:30 Interview with WG3 13:30 Interview with Prof. Kisić, UZA	-
29 Fri	-	09:30 Field Visit (Kostanjek Landslide) 14:00 Croatian Water 15:30 Interview with WG1 of UZM	
30 Sat	-	Report preparation	
1 Sun July	-	Zagreb → Rijeka (by car)	
2 Mon		09:30 Interview with Prof. Oţanić, UR 13:00 Interview with WG2	
3 Tue		09:30 Interview with Prof. Arbanas, UR 13:00 Interview with WG1 of UR	
4 Wed		08:30 Field visit (Grohovo Landslide) 13:00 City of Zagreb 16:00 Rijeka → Split (by car)	01:00 Haneda – 06:10 Frankfurt 12:05 Frankfurt – 13:45 Splits (Mr.Sato, Dr.Tsukioka)
5 Thu		09:30 Interview with Mr. Miscevic, Ms.Knezic and WG4 13:00 Site Visit (Imotski)	
6 Fri		10:00 Courtesy Call to the Mayor of the Town of Omiš 11:00 Field visit (Omiš, Duće) 19:45 Split – 20:30 Zagreb	
7 Sat	09:45 Narita – 14:30 Frankfurt 15:55 Frankfurt – 17:15 Zagreb	Report Preparation	
8 Sun	09:00 Internal Meeting		
9 Mon	09:00 Pre-meeting with Japanese Researchers		
10 Tue	15:00 Comments from Croatian Researchers.		(Ms. Sakai arrived)
11 Wed	10:00 – 15:30 JCC		(Dr. Honkura arrived)
12 Thu	09:30- Site Visit (Kostanjek Landslide)		
13 Fri	10:00 Signature on the Minutes of Meeting at UZA 18:00 Japanese embassy		(Dr. Honkura, Mr. Sato leave)
14 Sat	09:05 Zagreb – 10:40 Frankfurt 13:50 Frankfurt -		
15 Sun	- 07:55 Narita		

Annex 4: List of Interviewees

1 Croatian Side			
1) Counterparts			
1	Mr. Vinko Purgar	Head of the Department for Multilateral Cooperation, MZOS (PD)	26 June
2	Ms. Snjeţana Mihalić	Associate Professor, UZM (Deputy PM, Leader WG3, WG1)	27, 28, 29 June
3	Mr. Martin Krkač	Assistant, UZM (WG1)	27, 29 June
4	Mr. Pavle Ferić	Assistant, UZM (WG3)	27, 28 June
5	Mr. Ţeljko Miklin	Adviser, Engineering Geologist, CGS (WG3)	28 June
6	Ms. Jasmina Martinčević	Researcher, CGS (WG3)	28 June
7	Mr. Laszlo Podolszki	Researcher, CGS (WG3)	28 June
8	Mr. Aleksandar Toševski	Assistant, UZM (WG3)	28 June
9	Ms. Petra Đomlija	Assistant, UR (WG3)	28 June
10	Ms. Sanja Bernat	External Researcher (WG3, WG3)	28, 29 June
11	Mr. Čedomir Benac	Professor, UR (WG3)	28 June
12	Mr. Ivica Kisić	Associate Professor, UZA (Project Coordinator)	28 June
13	Ms. Bojana Horvat	Chief Engineer, Water Management Institute, Croatian Water	29 June
14	Ms. Karolina Gradiški	Assistant, UZM (WG1)	29 June
15	Ms. Nevenka Oţanić	Vice-Rector for R&D, Professor, UR (Project Manager, Leader WG2)	2 July
16	Mr. Nino Krvavica	Assistant, UR (WG2)	2 July
17	Ms. Barbara Karleuša	Professor, UR (WG2)	2 July
18	Ms. Nevena Dragičević	Assistant, UR (WG2)	2 July
19	Mr. Elvis Ţic	Assistant, UR (WG2)	2 July
20	Ms. Ivana Sušanj	Assistant, UR (WG2)	2 July
21	Mr. Ţeljko Arbanas	Vice-dean for postgraduate studies, associate professor, UR (Leader WG1)	3, 4 July
22	Ms. Martina Vivoda	Assistant, UR (WG1)	3 July
23	Mr. Vedran Jagodnik	Assistant, UR (WG1)	3 July
24	Mr. Kristijan Ljutić	Assistant, UR (WG1)	3 July
25	Mr. Ivan Vrkljan	Vice President at Large, International Society for Rock Mechanics, UR (WG1)	3 July
26	Mr. Predrag Miščević	Professor, Faculty of Civil Engineering, Architecture and Geodesy (Leader WG4)	5 July
27	Ms. Snjeţana Knezić	Professor, US (WG4)	5 July
28	Mr. Goran Vlastelica	Assistant, US (WG4)	5 July
29	Ms. Suzana Antunović	Assistant, US (WG4)	5 July
30	Mr. Ivo Andrić	Assistant, US (WG4)	5 July
2) Organizations			
1	Mr. Pavle Kalinić	Head of Office, EMO, City of Zagreb	27 June
2	Mr. Dalibor Belegić	Operations Officer, EMO City of Zagreb	27 June
3	Mr. Mario Hrgović	Senior Expert Associate Operations, EMO, City of Zagreb	27 June
4	Mr. Mladen Vukelić	Head, Local Government & Management Department, City of Rijeka	4 July
5	Mr. Marijan Vundać	City of Rijeka	4 Juy
6	Mr. Goran Šarić	City of Rijeka	4 July
7	Mr. Boţo Meštrović	City of Rijeka	4 July
3) Project Site			
1	Mr. Nenad Smolčak	Geomatika	29 June
2	Ivan Škaričić	Mayor of the Town of OmiŠ	6 July
2 Japanese Side			
1) Project			
1	Mr. Hideaki Marui	Director, Research Institute for Natural Hazards and Disaster Recovery, Niigata University	7 June
2	Mr. Hideaki Komiyama	Project Coordinator	26 June
3	Ms. Ana Zakosek	Assistant to Project Coordinator	26 June
4	Mr. Chunxiang Wang	Associate Professor, Niigata University	26 June
5	Mr. Yosuke Yamashiki	Associate Professor, Disaster Prevention Research Institute, Kyoto University	6 July
2) Japanese Embassy			
1	Mr. Masaru Tsuji	Ambassador Extraordinary and Plenipotentiary	26 June
2	Mr. Yuichi Inouye	Counselor, Embassy of Japan in Croatia	26 June
3	Mr. Takuya Momma	Embassy of Japan	26 June

Annex 5: List of Japanese Experts Dispatched

As of July 2012

Group	Name and Field	Arrival Date and Departure Date (number of days in Croatia)												Total Days
		FY2010(H22)					FY2011(H23)					FY2012(H24)		
		1st (6th)	2nd	3rd	4th	5th	1st (6th)	2nd (7th)	3rd	4th	5th	1st	2nd	
1	Kyoji SASSA	5/15-27 (13)	9/16-25 (10)	11/20-27 (8)			4/25-29 (5)	2/22-26 (5)						(41)
	Osamu NAGAI	5/19-27 (9)	7/13-23 (11)	9/14-28 (15)	3/17-27 (11)		5/25-6/4 (11)	10/10-21 (12)	12/13-19 (7)					(76)
	Hiroshi FUKUOKA	9/18-27 (10)					9/25-10/2 (8)							(18)
	Bin HE						4/25-29 (5)							(5)
	Kouji MATSUNAMI						9/26-10/2 (7)							(7)
	Gen FURUYA	5/19-27 (9)	7/12-23 (12)	9/14-28 (15)	11/21-27 (7)	3/16-27 (12)	5/22-6/4 (14)	7/16-30 (15)	9/6-10/2 (27)	10/10-21 (12)	1/27-2/5 (10)			(133)
	Naoki WATANABE						7/16-28 (13)	9/5-20 (16)	11/17-27 (11)	12/14-18 (5)	3/19-25 (7)	6/1-17 (17)		(69)
2	Yosuke YAMASHIKI	7/15-22 (8)	9/13-21 (9)	11/20-11/30 (11)			4/21-28 (8)	7/13-18 (6)	9/12-22 (11)			5/10-17 (8)	7/6-10 (5)	(66)
	Takahiro SAYAMA	7/17-23 (7)												(7)
	Tamotsu TAKAHASHI	9/13-21 (9)					9/12-22 (11)							(20)
	Shigeo FUJIKI	9/13-21 (9)	11/19-11/30 (12)	2/24-3/7 (13)			9/12-22 (11)					5/9-17 (9)		(54)
	Naoko KIMURA	11/17-26 (10)	2/24-3/7 (15)				4/21-27 (7)	9/12-22 (11)	12/13-18 (6)	1/23-2/13 (22)		5/5-13 (9)		(80)
3	Hideaki MARUI	5/20-25 (6)	7/12-23 (12)	9/14-28 (15)	11/20-27 (8)	1/16-20 (5)	5/22-27 (6)	7/16-28 (13)	9/7-11 (5)	9/16-21 (6)	12/13-19 (7)	7/8-14 (7)		(108)
		3/19-26 (8)					2/19-25 (7)	3/9-11 (3)						
	Chunxiang WANG	3/16-27 (12)					5/2-29 (28)	6/9-7/20 (42)	9/4-10/2 (29)	10/10-11/29 (20)	1/8-2/25 (49)	5/24-7/24 (62)		(242)
	Toyohiko MIYAGI	9/18-28 (11)					5/1-8 (8)	12/14-17 (4)						(23)
	Hiroshi YAGI	9/18-28 (11)					5/1-14 (14)							(25)
	Eisaku HAMAZAKI	9/18-28 (11)					10/10-21 (12)							(23)
														(997)
Long-term	Hideaki KOMIYAMA	11 May 2010 – 10 May 2013												

Annex 6: List of Trainings and Business Trip for Counterpart in Japan

As of July 2012

Scheme	Term	Name	Institution	Period (Departure and Arrival)	Visited Institutions and Course
Business Trip	Short-term	Ms. Snjeţana Mihalić	Associate Professor, UZM (WG3)	6 Nov 2011 – 26 Nov 2011	Tohoku Gakuin University, Niigata University, Yamagata University
				15 Jan 2012 – 28 Jan 2012	Kyoto University, ICL
		Mr. Ţeljko Arbanas	Associate Professor, UR (WG1)	13 Nov 2011 – 26 Nov 2011	Tohoku Gakuin University, Niigata University, Yamagata University
				9 Jan 2012 – 28 Jan 2012	Kyoto University, ICL
				17 May 2012 – 27 May 2012	Kyoto University, ICL
		Mr. Ognjen Bonacci	Professor, US (WG2)	10 Apr 2012 – 15 Apr 2012	Niigata University
		Ms Nevenka Oţanić	Professor, UR (WG2)	10 Apr 2012 – 17 Apr 2012	Niigata University
		Mr. Ivica Kisić	UZA (WG2)	10 Apr 2012 – 17 Apr 2012	Niigata University
		M. Ivan Vrkljan	UR (WG1)	10 Apr 2012 – 17 Apr 2012	Niigata University
		Mr. Ţeljko Miklin	CGS (WG3)	10 Apr 2012 – 17 Apr 2012	Niigata University
C/P Training	Short-term	Mr. Laszlo Podolszki	Researcher, CGS, (WG3)	6 Oct 2010 – 6 Dec 2010	Tohoku Gakuin University (aerial photo interpretation, AHP, ADCALC) Yamagata University (aerial photo interpretation) Niigata University (integrated landslide hazard map)
				18 Oct 2011 – 7 Dec 2011	Tohoku Gakuin University (aerial photo interpretation, AHP, ADCALC) Yamagata University (aerial photo interpretation) Niigata University (integrated landslide hazard map)
		Mr. Martin Krkač	Assistant, UZM (WG1)	6 Oct 2010 – 6 Dec 2010	Tohoku Gakuin University (aerial photo interpretation, AHP, ADCALC) Yamagata University (aerial photo interpretation) Niigata University (integrated landslide hazard map)
				30 Nov 2011 – 30 Jan 2012	ICL (shear test apparatus, simulation of landslide affecting area)
		Mr. Goran Vlastelica	Assistant, US, (WG1)	6 Oct 2010 – 6 Dec 2010	Tohoku Gakuin University (aerial photo interpretation, AHP, ADCALC) Yamagata University (aerial photo interpretation) Niigata University (integrated landslide hazard map)
		Mr. Sanja Dugonjić	Assistant, UR, (WG1)	6 Oct 2010 – 6 Dec 2010	Tohoku Gakuin University (aerial photo interpretation, AHP, ADCALC) Yamagata University (aerial photo interpretation) Niigata University (integrated landslide hazard map)
		Mr. Pavle Ferić	Assistant, UZM, (WG3)	18 Oct 2011 – 7 Dec 2011	Tohoku Gakuin University (aerial photo interpretation, AHP, ADCALC) Yamagata University (aerial photo interpretation) Niigata University (integrated landslide hazard map)
		Mr. Ivana Sušanj	Assistant, UR, (WG2)	6 Nov 2011 – 25 Jan 2012	DPRI, Kyoto University (sediment discharge, its flow and change flood/debris-flow analysis, 3D program software)
		Mr. Ivo Andrić	Assistant, US, (WG2)	6 Nov 2011 – 20 Dec 2011	DPRI, Kyoto University (sediment discharge, its flow and change flood/debris-flow analysis, 3D program software)
		Mr. Kristijan Ljutić	Assistant, UR, (WG1)	30 Nov 2011 – 30 Jan 2012	ICL (shear test apparatus, simulation of landslide affecting area)
				11 Apr 2012 – 1 Jun 2012	ICL
		Mr. Darija Bilandţija	Assistant, UZA, (WG2)	11 Jan 2012 – 14 Feb 2012	DPRI, Kyoto University (sediment discharge, its flow and change flood/debris-flow analysis, 3D program software)
		Ms. Vivoda Martina	Assistant, UR, (WG1)	11 Apr 2012 – 1 Jun 2012	ICL

Annex 7: List of Machinery and Equipment Provided

(FY2010)

No.	Item (brand/maker and model)	Allocation	Delivery date
1	Extensometer NetLG-501E	UZ	24 Jun
2	Network Controller NetCT-1E	UZ	24 Jun
3	RS232C Converter NetGW-1E	UZ	6/24
4	Hub NetHUB-1E	UZ	6/24
5	Water Level Detector DS-1	UZ	6/24
6	Water Level Data Logger NetLG-001E	UZ	6/24
7	Rain Gauge and Transmitter RS-1	UZ	6/24
8	Precipitation Data Logger NetLG-201E	UZ	6/24
9	Alarm Unit AL-Type AE	UZ	6/24
10	NetLG501 Container SUS2	UZ	6/24
11	Invar Wire	UZ	6/24
12	Invar Wire	UR	9/19
13	Communication Cable	UR	9/19
14	Extensometer NetLG-501E	UR	11/11
15	Network Controller NetCT-1E	UR	11/11
16	RS232C Converter NetGW-1E	UR	11/11
17	Hub NetHUB-1E	UR	11/11
18	Water Level Detector DS-1	UR	11/11
19	Water Level Data Logger NetLG-001E	UR	11/11
20	Rain Gauge and Transmitter RS-1	UR	11/11
21	Precipitation Data Logger NetLG-201E	UR	11/11
22	Alarm Unit AL-Type AE	UR	11/11
23	NetLG501 Container SUS2	UR	11/11
24	Extensometer NetLG-501E	UR	12/22
25	Hub NetHUB-1E	UR	12/22
26	NetLG501 Container SUS2	UR	12/22
27	Communication Cable	UR	12/22
28	Portable Direct Shear Apparatus MIS-233-1-71	UR	1/17
29	Constant-volume Direct Shear Test Apparatus MIS-233-1-72	UR	1/17
30	Water level pressure sensor（Schlumberger: Mini Diver）	UR	3/2
31	Water level pressure sensor (Fondriest:RuggedTROLL100）	UR	3/2
32	Weather station（Davis: Vantage Pro2）	UR	3/23
33	Current Meter（Teledyne RD:ADCP Sentinel (WHSZ1200)）	UR	3/23
34	Surface current meter （RYUKAN WJ7661）	UR	3/2
35	3D photograph chart making and counting system（Kuraves-G2）	UR	3/2
36	Ion measuring instrument（HORIBA W-23XD）	UR	3/3
37	Ion measuring instrument（CTD Diver）	UR	3/2
38	VAIO Notebook PC VPCZ14 (data collection)	UR	3/2
39	Camera to collect photo data（Cannon KISS X4）	UR	3/2
40	Water level pressure sensor（Fondriest:RuggedTROLL100）	US	3/4
41	Weather station（Davis: Vantage Pro2）	US	3/4
42	Current Meter（Teledyne RD:ADCP Monitor （WHMZ1200)）	US	3/4
43	Surface current meter（RYUKAN WJ7661）	US	3/4
44	3D photograph chart making and counting system（Kuraves-G2）	US	3/4
45	Ion measuring instrument（HORIBA W-23XD）	US	3/4
46	VAIO Notebook PC VPCZ14 (data collection)	US	3/4
47	Camera to collect photo data（Cannon KISS X4）	US	3/4
48	Piezometer KPB-500KPA	UR	4/6

(FY2011)

No.	Item (brand/maker and model)	Allocation	Delivery date
1	Reflection Stereoscope	Univ. of Zagreb	5/1
2	Cone penetration testing apparatus	Univ. of Zagreb	7/29
3	Extensometer NetLG-501E	Univ. of Zagreb	9/15
4	Inclinometer	Univ. of Zagreb	8/1
5	Laser Scanner	Univ. of Split	8/10
6	Landslide Simulation Software × 2	Univ. of Zagreb	5/26
7	A set of GPS and Total Station	Univ. of Rijeka	7/29
8	Extensometer Container	Univ. of Rijeka	Local procurement
9	Extensometer Pole	Univ. of Rijeka	Local procurement
10	Pole for GPS	Univ. of Rijeka	Local procurement
11	Boring for Borehole (Without Core, L=90m)	Univ. of Rijeka	Local procurement
12	Boring for Accelerometer(Without Core L=10m)	Univ. of Rijeka	Local procurement
13	Dell PC	Univ. of Rijeka	6/20
14	ArcGIS Software	Univ. of Rijeka	6/20
15	Workstation	Univ. of Rijeka	11/8
16	Inclinometer Casing	Univ. of Rijeka	6/20
17	Dell PC	Univ. of Zagreb	6/20
18	ArcGIS Software	Univ. of Zagreb	6/20
19	DEM (Altitude Data) of Model sites	Univ. of Zagreb	6/20
20	Aerial photographs	Univ. of Zagreb	6/30
21	Workstation	Univ. of Zagreb	8/25
22	Pole and Pulleys	Univ. of Zagreb	11/8
23	Copy Machine	Univ. of Zagreb	12/20
24	LPS Software	Univ. of Zagreb	8/25
25	Notebook PC × 2	Univ. of Zagreb	Local procurement
26	LIDER data of model sites	Univ. of Zagreb	Local procurement
27	Inclinometer Casing	Univ. of Zagreb	Local procurement
28	Dell PC	Univ. of Split	6/20
29	Tripod for Laser Scanner	Univ. of Split	9/23

Note) Procurement of No.7 was delayed to respond to VAT issues.

Annex 8: Operational Costs

Japanese Side (Currency: JPY×1,000)

Items	FY2010	FY2011	FY2012 (Planned)	Total
Dispatch of Japanese Researchers and Project Coordinator	34,283	33,840	37,707	105,830
Machinery and Equipment	73,871	54,545	43,377	171,793
Dispatch of Mission	478	853	4,372	5,703
Training of Croatian Researchers in Japan	357	8,218	17,890	26,465
Operational Expenses (Ordinary Expenses, Travel Expenses, Local Consultant Fee, Staff Salary, Meeting, etc.)	13,879	12,517	12,926	39,322
Others	2,423	1,837	2,344	6,604
Total	125,291	111,810	118,616	355,717

Croatian Side (Currency: HRK)

Items	FY2010	FY2011	FY2012 (Planned)	Total
Lump sum (MZOS)	360,000	360,000	360,000	
Salary for 9 researchers (MZOS)				
Costs for installation of equipment, insurance policy (MZOS)				
Travel allowance and costs (MZOS)				
Disbursement from universities				
Total				

The amount of budget the Croatian side used for project operation could not be confirmed during the mid-term review.

付属資料1

Annex 9: List of Counterpart Personnel

As of July 2012

	Name	Title and Organization	Role/Responsibility in the Project	Remarks (Period)
1	Vinko Purgar	Head of the Department for Multilateral Cooperation, Directorate for International Cooperation and European Integration, MZOS	Project Director	
2	Ognjen Bonacci	Professor, Faculty of Civil Engineering, US	WG2	Project Manager until March 2012
3	Nevenka Oţanić	Vice rector, Professor, UR	Project Manager, WG2 Leader	
4	Snjeţana Mihalić	Associate Professor, UZM	Deputy Project Manager, WG3 Leader	
5	Ivica Kisić	Professor, UZA	Project Coordinator	
6	Ţeljko Arbanas	Vice Dean, Associate Professor, UR	WG1 Leader	
7	Predrag Miščević	Professor, US	WG4 Leader	
8	Snjezana Knezić	Professor, US	WG4 Administrator	
9	Ivan Vrkljan	Professor, UR	WG1	
10	Čedomir Benac	Professor, UR	WG1, WG2, WG3	
11	Sanja Dugonjić	Assistant, UR	WG1	
12	Kristijan Ljutić	Assistant, UR	WG1	
13	Martina Vivoda	Assistant, UR	WG1	Employed by MZOS budget for the Project
14	Vedran Jagodnik	Assistant, UR	WG1	
15	Martin Krkač	Assistant, UZM	WG1	
16	Karolina Gradiški	Assistant, UZM	WG1	Employed by MZOS budget for the Project
17	Sanja Bernat	External Researcher,, UZM	WG1	
18	Ivana Sušanj	Assistant, UR	WG2	Employed by MZOS budget for the Project
19	Elvis Ţic	Assistant, UR	WG2	
20	Nevena Dragičević	Assistant, UR	WG2	
21	Barbara Karleuša	Vice Dean, Associate Professor, UR	WG2	
22	Nino Krvavica	Assistant, UR	WG2	
23	Igor Ruţić	Assistant, UR	WG2	
24	Darija Bilandţija	Assistant, UZA	WG2	Employed by MZOS budget for the Project
25	Danko Biondić	Principal, CW	WG2	
26	Bojana Horvat	Officer, CW	WG2	
27	Pavle Ferić	Assistant, UZM	WG3	
28	Aleksandar Toševski	Assistant, UZM	WG3	Employed by MZOS budget for the Project
29	Petra Đomlija	Assistant, UR	WG3	Employed by MZOS budget for the Project
30	Ţeljko Miklin	Researcher, CGS	WG3	
31	Laszlo Podolszki	Researcher, CGS	WG3	
32	Jasmina Martinčević	Researcher, CGS	WG3	Employed by MZOS budget for the Project
33	Mr. Ivo Andrić	Researcher, US	WG4	
34	Mr. Goran Vlastelica	Researcher, US	WG4	
35	Ms. Suzana Antunović	Researcher, US	WG4	Employed by MZOS budget for the Project

This is the list of personnel the mission was introduced, (and those were met in highlight), as counterparts during the mid-term review.

Annex 10: Result Grid (Progress of the Project)

As of July 2012

Project Purpose: Integrated landslide/flood hazard mapping technology and land-use guidelines formulation methodologies are developed for nation-wide application in Croatia.
Indicator 1 : Number of manual book to develop integrated landslide/flood hazard map (1 manual)
2 : Number of manual book to develop land-use guideline for landslide/flood risk mitigation (1 manual)

Activity	Progress of activities to date	Responsible Researchers	Level of Progress (%)	Way forward for completion
Output 1 : Methodologies for landslide risk assessment, prediction of affecting areas, and early warning systems are developed adapting to hydrological and geological conditions in Croatia. Indicator 1-1: Number of manual book of methodologies for landslide risk assessment (1 manual) 1-2: Number of model sites to develop a simulation for landslide predictions on dynamics (2 model sites; Kostanjek, Grohovo) 1-3: Number of model sites to establish landslide early warning systems (2 model site; Kostanjek, Grohovo)				
1-1 Development of a low-cost undrained shear test apparatus.	・ The development of undrained shear test apparatus that can conduct landslide reproduction tests was completed. ・ Two Croatian researchers were trained in Japan (2 researchers × 2 months × 2 times) for the operation of and the tests with the apparatus. ・ Croatian researchers are proficient in conducting the tests for themselves. ・ The shear test apparatus shipped from Japan was at the custom office on 2 July, 2012, and is to be in Rijeka in the same week.	Sassa Arbanas	100%	・ The apparatus is currently being shipped to Croatia and will be set up by late July 2012.
1-2 Soil tests using the shear test apparatus.	・ Soil samples from model site were sent to Japan and tested with the undrained shear test apparatus.	Sassa Arbanas	70%	・ Once the apparatus is set up in Croatia, Croatian researchers will conduct additional soil tests of samples from the model site.
1-3. Field survey and monitoring at landslide risk sites in model sites.	・ Field surveys were conducted several times for the model sites. ・ As for the Grohovo model site (Rijeka), real-time comprehensive monitoring equipment was installed and the monitoring is going on. ・ As for the Kostanjek landslide model site (Zagreb), extensometer were installed and the monitoring has already began.	Sassa, Marui, Watanabe, Furuya, Nagai Arbanas, Vrkljan, Mihalić	60%	・ For Kostanjek landslide, GPS and other monitoring system are currently being procured. The equipment will be set up by this fall, and the monitoring is scheduled to start.
1-4. Development of landslide risk assessment methods based on landslide dynamics, and their application to the model sites.	・ The activity 1-4 and 1-5 are linked and to be undertaken concurrently. Methods of landslide risk assessment and the prediction of landslide affecting areas based on landslide dynamics have been basically developed, and there are already some examples of applications in other areas.	Sassa, Nagai Arbanas	40%	・ Landslide risks assessment (1-4) and the prediction of affecting areas (1-5) will be carried out at model sites, based on parameters obtained through the soil tests in 1-2.
1-5. Development of methods for the prediction of landslide affecting areas, and their application to the model sites.	・ (see activity 1-4)		40%	
1-6. Development of land slide early warning systems, and their application to the model sites.	・ At Kostanjek model site (Zagreb), extensometers were installed, largely depending on which an early warning system is to be developed. ・ The monitoring is going on to accumulate data to feed into the establishment of early warning system.	Sassa, Nagai, Marui, Furuya Arbanas, Mihalić	40%	・ Additional extensometers will be introduced to the model site, and their installation suitable for early warning system will be completed by this fall.
Output 2: Flash-flood/debris-flow simulation models and early warning systems are developed adapting to hydrological and geological conditions in Croatia. Indicator 2-1: Number of model sites to formulate a flash-flood/debris-flow simulation model (5 model sites; Rječina River Basin, Dubračina River Basin, Mošćenička Draga, Imotski, Sutina-Karakašica) 2-2: Number of model sites to establish a flash-flood early warning system at Rijeka (2 model sites; Rječina River Basin, Mošćenička Draga)				
2-1. Collection of existing hydro-meteorological data and	・ Existing hydro-meteorological data are being collected, and rainfall-discharge characteristics in model sites are being analyzed.	Yamashiki, Kimura	50%	・ The analysis will be continued with additional hydro-meteorological data.

analysis of rainfall-discharge characteristics in model sites.		Oţanić, Kisić		
2-2. Installation of rainfall measurement equipment, and collection of rainfall data.	・ Rain gauges were installed at model sites in Rijeka and the precipitaion data are being collected.	Yamashiki, Fujiki, Kimura Oţanić, Kisić	40%	・ The precipitation data collection will be continued. ・ Rader rain gauge will be set up at the University of Rijeka in fall this year.
2-3. Development of flashflood and debris flow simulation models in model sites.	・ The development of flashflood and debris flow simulation model (Hydro-Debris3D) is completed.	Yamashiki, Fujiki, Kimura, Oţanić, Kisić	50%	・ The simulation model will be applied to the model sites in the second half of this year.
2-4. Development of flashflood and debris flow early warning systems, and their application to the model sites.	・ The flashflood and debris flow early warning systems are being developed.	Yamashiki, Fujiki, Kimura, Oţanić, Kisić	40%	・ The early warning system will be installed at the model sites in the second half of this year.
Output 3: Integrated landslide/flood hazard maps and land-use guidelines for landslide/flood risk mitigation are developed for study areas. Indicator 3-1: Number of study areas to develop an integrated landslide/flood hazard map (3 areas; Rijeka, Split, Zagreb) 3-2: Number of study areas to develop land-use guidelines for landslide/flood risk mitigation (3 areas; Rijeka Split, Zagreb) Note): Indicator 3-1 for Split area means two individual hazard maps for landslide (rock fall) and flashflood. Note): Indicator 3-1 for Zagreb area and Moscenicka Draga (in Rijeka area) means individual hazard maps for landslide and flash flood depending on model site conditions				
3-1. Preparation of digital topography maps of the study areas and the model sites based on the photo interpretation.	・ Topography interpretation for model sites and surrounding areas, mainly based on aerial photos, were completed. ・ Digital maps were prepared for sites as necessary. ・ For some sites, digital topography maps were created based on LiDAR scanning with airplane.	Sassa, Nagai, Wang,Furuya Arbanas, Mihalić	50%	・ Topography interpretation for the study areas based on aerial photos will be completed in 2012.
3-2. Development of wide-area landslide risk assessment methods using the Analytical Hierarchy Process (AHP) method, and their application to the study areas.	・ Basic topography and geological survey were conducted several times for the application of AHP to landslide hazard mapping in Croatia. ・ Evaluation criteria for AHP application were prepared. ・ The drafts of manuals to develop landslide inventory and risk assessment were prepared.	Hamazaki, Marui, Furuya, Wang Mihalić, Arbanas, Podolszki	50%	・ Landslide inventory and risk assessment willbeprepared, by applying the AHP method, for targeted sites in Croatia in the latter half of 2012. ・ The drafts of manuals will be refined.
3-3. Development of integrated landslide/flood hazard mapping technology, and formulation of integrated hazard maps for the study areas and model sites.	・ Integrated hazard map (3-3) will be prepared by synthesizing the wide-area landslide risk assessment using AHP (3-2), results of flashflood and debris flow simulation (2-3), landslide risk assessment on landslide dynamics (1-4), and prediction on landslide affecting areas (1-5). ・ At present, a work arrangement is under investigation to synthesize the above results.	Marui, Sassa, Yamashiki, Wang, Furuya, Watanabe, Hamasaki, Nagai Oţanić, Arbanas Mihalić, Kisić, Vrkljan	20%	・ A work arrangement to synthesize all the results will be elaborated in 2012. ・ A draft of integrated landslide/flood hazard map for model sites will be developed in the first half of the 2013.
3-4. Development of land-use guidelines formulation methodology, and formulation of land-use guidelines for disaster mitigation in study areas.	・ Land-use guidelines (3-4) will be prepared based on the integrated landslide/flood hazard map (3-3). ・ At present, contents that should be included in the land-use guidelines is under investigation.	Marui, Sassa, Yamashiki, Herath, Wang, Furuya, Watanabe, Hamazaki, Nagai Oţanić, Arbanas, Mihalić, Kisić, Vrkljan	10%	・ Drafting of land-use guideline will start in the first half of 2013.
3-5. Preparation of a manual of integrated landslide/flood hazard mapping, and a manual of land-use guidelines formulation that are applicable nation-wide in Croatia.	・ Manuals (3-5) will be prepared based on the land-use guidelines (3-4). ・ At present, contents that should be included in the land-use guidelines is under investigation.	Marui, Sasssa, Yamashiki, Herath, Wang, Furuya, Watanabe, Hamazaki, Nagai Oţanić, Arbanas, Mihalić, Kisić, Vrkljan	10%	・ Drafting of manuals will start in the second half of 2013.

Annex 11: Result Grid (Pilot Site)

<table>
<tr><th>Study Area
WG</th><th>Zagreb
City of Zagreb (county) (640km^2)</th><th>Rijeka
Primorsko-Goranska County (3,800km^2)</th><th>Split
Split-Dalmatian County</th></tr>
<tr><td>WG 1
Detailed Landslide Investigation

Prof. Arbanas (UR)</td><td>Kostanjek Landslide (1.2km^2) - Medvednica Hilly area.
1.2 One borehole for soil sampling and inclinometer (100m, Feb 2012)
1.3 (Martin Krkač)
<table>
<tr><th>Equipment to be installed</th><th>Already installed</th></tr>
<tr><td>15 GPS</td><td>0</td></tr>
<tr><td>9 extensometers</td><td>5</td></tr>
<tr><td>3 piezometers</td><td>0</td></tr>
<tr><td>6 accelerometers</td><td>0</td></tr>
<tr><td>3 water level sensors in well</td><td>3</td></tr>
<tr><td>2 water level sensors in weirs</td><td>2</td></tr>
<tr><td>1 rain gauge</td><td>1</td></tr>
<tr><td>1 inclinometer casing</td><td>1</td></tr>
</table>
・ GPS and extensometers will be set up in one month, currently waiting for the delivery of poles for extensometer.
・ Setting up piezometers requires drilling and UZM need to work with suppliers.</td><td>Grohovo Landslide (0.5km^2) - Rječina River Basin
1.2 Two boreholes for soil sampling (20m and 25m, May 2011)
1.3
<table>
<tr><th>Equipment in place</th><th>Additional installation</th></tr>
<tr><td>10 GPS</td><td></td></tr>
<tr><td>15 extensometers (3 short span)</td><td>1 extensometer</td></tr>
<tr><td>4 vertical extensometers</td><td></td></tr>
<tr><td>1 total station</td><td></td></tr>
<tr><td>25 prisms</td><td></td></tr>
<tr><td>4 pore pressure gauge</td><td></td></tr>
<tr><td></td><td>1 water level gauge</td></tr>
<tr><td></td><td>1 rain gauge</td></tr>
</table>
・ Equipment was in place in Aug - Sep 2011.
・ 1 extensometer just arrived from Japan on 3 July 2012.
1.6
・ Data transmission of GPS was being done with existing system.
・ Downloading data from extensometer and pore pressure gauge at sites takes lots of time. It requires for all the data to be automatically transmitted and connected for EWS.</td><td>N/A</td></tr>
<tr><td>WG 2
Flash-floods and debris-flows

Prof. Ožanić (UR)</td><td>N/A
・ Zagreb is not likely to have flush flood.
・ There is no Hydrologist in UZM.</td><td>Rječina River Basin (22km^2)
2.1 - 2.2(60%, Elvis Zic)
・ Equipment in place
1 weather station
・ Another new meteorological station will be set up in August 2012.

Dubračina River Basin (Salt Creek) (43km^2)
・ Dominant natural hazard are landslide and erosion, and not flash food
2.1 - 2.2 (90%, Ivana Sušanj)
・ Equipment in place
11 mini divers (water level pressure sensor)
2 weather stations

Mošćenička Draga (11km^2)
・ There are no landslides, but erosion.
2.1 - 2.2 (70%, Igor Ruţ ić)
・ Equipment in place
7 rugged TROLL100 (water level pressure sensor
1 rugged TROLL100 (for calibration)
2 weather station

2.3 – 2.4 (45%, Oţ anić, Karleuša, Dragičević, Krvavica)
・ Flash-flood/debris flow simulation model for Salt Creek (Dubračina River Basin) is completed (Application of solfec program written in Python Cod).
・ Radar (Furundo) will be set up and connected to EWS.</td><td>N/A</td></tr>
</table>

WG 3 Regional landslide Investigation Prof. Mihalić (UZM)	**Hilly area of the Medvednica Mountain** (180km^2) 3.1 – 3.2 – 3.3 ・Landslide inventory based on aerial photo interpretation and landslide susceptibility analysis using AHP methodology (55%, Podolszki) ・Landslide inventory based on LiDAR interpretation and landslide susceptibility analysis using statistical analysis methodology (45%, Ferić) ・Landslide causal factor – geological (lithology) based on soil/rock sampling from Kostanjek and mineralogical analysis. (10%, Martinčević) ・Landslide causal factor – morphological and land-cover based on spatial analysis of DEM and aerial photos. (40%, Ferić) ・ Output is to be a landslide susceptibility/hazard map, not including flash-flood analysis. 3.4 ・ Output is to be a land-use guideline taking into consideration the landslide maps (inventory and susceptibility) (Mihalić, Arbanas) 3.5 ・ Output is to be a manual for production of landslide inventory and susceptibility maps for use in the system of land-use and emergency management. (Mihalić, Arbanas)	**Rječina River** (22km^2) 3.1 – 3.2 ・Landslide inventory based on aerial photo interpretation (Japanese researchers). It is necessary to check additionally. (50%, Đomlija) ・Landslide causal factor – geological (lithology) based on compilation of existing data/maps (25%, Đomlija) ・Landslide causal factor – morphological and land-cover based on spatial analysis of DEM and aerial photos (25%, Đomlija) ・Landslide inventory based on LiDAR interpretation and landslide susceptibility analysis using statistical analysis methodology (20%, Đomlija) 3.3 ・ Integrated map will be developed when flash-flood map is derived in GIS optionally from WG2. 3.4 – 3.5 ・ Guideline and manual (Benac, Mihalić, Arbanas) **Dubračina River Basin** (43km^2) 3.1 – 3.2 – 3.3 ・Landslide inventory based on aerial photo interpretation (Japanese researchers). Not appropriate methodology due to the scale of photos (100%, Toševski) ・Landslide causal factor – geological (lithological) based on soil/rock sampling and geotechnical and mineralogical analysis (10%, Toševski) ・Landslide causal factor – morphological and land-cover based on spatial analysis of DEM and aerial photos (40%, Toševski) ・Landslide inventory based on LiDAR interpretation and landslide susceptibility analysis using statistical analysis methodology (20%, Toševski) ・ Output is to be a landslide susceptibility/hazard map, not including flash-flood analysis. 3.4 -3.5 ・ Same as those of Medvednica Mountain, Zagreb.	N/A
WG 4 Split for all outputs Prof. Miscevic (US)	N/A	N/A	Landslide (Output 1 & Output 3) **Duće** (0.1km^2), **Omiš** „(0.3km^2) ・ Ground-based scanning of the model sites with portable LiDAR equipment once a month since September 2011. ・ WG4 plans to buy a software in 2012 to compare the scanned data in a constant way. ・ Hazard assessment for both sites will be performed with methodology already developed at US. The methodology which couples GIS and MCA has been adapting to the Project"s pilot sites&areas and chosen multicirteria method (AHP). ・ After preliminary results from Omiš and Duće sites, areas affected by rockfalls will be appraised.

			Flash Flood (Output 2) **Imotski –** Blue Lake, Red Lake (0.14km^2), ・ Mouth of Sutina River located the town of Omiš. ・ In Red Lake in Imotski an hourly data set is obtained for the whole hydrological year. The analysis of collected data resulted with publication in international scientific journal. **Sutina-Karakašica** (13km^2) ・ The data record on water level and water temperature in the Sutina Karakašica basin is present since March of 2011 at 5 different stations. ・ Meteorological data is provided by Meteorological and hydrological institute of Croatia, a governmental service. ・ Event based measurements on water quality are carried out on different points of studied watershed.

Annex 12: Evaluation Grid based on the 5 Criteria

Evaluation Criteria	Evaluation Question	Source	Findings through Questionnaire, Interview and relevant reports
1. Relevance	1.1 National and development policies/strategies associated with disaster mitigation of landslide and floods in Croatia	MZOS	・ Protection and Rescue Plan for Croatia (Official Gazette 96/10) ・ Evaluation of Endangerment of Croatia from Natural and Technological Disasters, Croatian National Platform for Disaster Risk Reduction, Protection and Rescue Law (Official Gazette 127/10) ・ Law on Protection from Natural Disasters (Official Gazette 73/97) ・ Various international agreements on protection and rescue in case of natural disaster
	1.2 Changes of mandate/structure and staff of implementing agencies that may affect the Project implementation	UR	・ MZOS issued a letter dated 28 March 2012, announcing the change of Croatian administrative personnel from Annex V of the R/D: ・ Prof. Nevenka Oţanić, Dean of the Faculty of Civil Engineering, UR, is a new Project Manager, ・ Assoc. Prof Snjezana Mihalić, Faculty of Mining, Geology and Petroleum Engineering, UZ, is a Deputy Project Manager. ・ Additional working group 4 was created in order to accelerate the research activities in Split by direct contact between the project manager and the leader of WG4. ・ Prof. Ognjen Bonacci (former Project Manager) will be retired in Oct. 2012.
	1.3 Alignment of the Project with the needs and expectation of the implementing agencies. (Research plan and priority)	MZOS	・ In a social context, the project would fall within a scope of duties performed by National Protection and Rescue Directorate. On the other hand, this is a scientific project and it"s under the authority of MZOS ・ MZOS doesn"t have a comprehensive disaster management study.
		EMO	・ The Kostanjek is the largest landslide in Croatia. The project initiated the cooperation between the EMO and UZM. ・ There are many hazard maps prepared, but there is so far only one official landslide inventory map, which is available in the internet. The city, however, hasn"t utilized the map. ・ https://geoportal.zagreb.hr/Karta ・ According to the one official landslide inventory, there are 770 landslide areas in Zagreb. The Kostanjek is displacing from 1980 over more than 30 years and the city has set some stabilizations. Kostanjek is not a catastrophic landslide, usually very slow, but EMO neither know a proper management nor have standardized operational procedures. EMO doesn"t t have data, either. ・ The physical plan of the City of Zagreb should include a landslide inventory map which is based on more scientific research. ・ The city doesn"t have a land-use guideline taking landslide into consideration. There is one available in Official Gazette, but it is for the construction and not incorporating risk assessment. This guideline should be revised reflecting this project. http://www1.zagreb.hr/SlGlasnik.nsf/VPD/45D18FA1A71D6EB3C1256DDD00491EA1?OpenDocument&19
		CW	・ CW is responsible for all the water body in Croatia. The project is receiving necessary data from CW, and will also provide CW with new data from the project.
		City of Rijeka	・ City of Rijeka has a land use guideline for construction purpose, but it does not contain a hazard map. There is no rule/regulation on torrential flow. ・ Spatial Planning Document of the City of Rijeka is available on the open site. http://www3.rijeka.hr/gup1/framesetup.asp
		UR	・ Research assistants can get a job, be educated, have a dissertation topic, acquire knowledge through trainings in abroad, work as a teaching assistant, cooperate with other researchers, and publish scientific papers. ・ The results of the project will be beneficial to local communities, so the faculty has an opportunity to improve the professional cooperation between local authorities and faculty itself.
	1.4 Priority areas of the Government of Japan for the development assistance to Croatia.	JICA	・ The Initiative for Disaster Reduction through ODA was announced at the United Nations World Conference on Disaster Reduction held in Kobe, Hyogo prefecture, in January 2005. ・ JICA"s Issue-specific Guideline for Disaster Reduction sets out “building disaster-resilient communities and societies” as one of development strategy goals to be achieved
	1.5 Appropriateness of the selection of model	UZA	・ The Kostanjek is the largest landslide in Croatia and also one of primal concerns of EMO.

	sites		・ At present, the physical plan of the City of Zagreb doesn"t include the assessment of landslide risk
		UR	・ In the Adriatic Sea catchment area, there are no big rivers. It is all torrent area. ・ The researchers from Croatian side proposed the model site. (pilot areas) ・ At the downstream of Rječina River located the city of Rijeka, and the flood waters can cause significant damage to the city; it could be an even higher hazard in case of concurrent rock avalanche at Grohovo landslide.
		US	・ The model sites in Split are Omiš and Duće where a rock fall is quite frequent, causing damages and posing threats to many houses and population in the towns
2. Effectiveness	2.1 Progress of Output 1 – Methodologies for landslide risk assessment, prediction of affecting areas, and early warning systems are developed adapting to hydrological and geological conditions in Croatia	MZOS	・ Once equipment is in place, then scientist will start putting out various achievements (measurement and publication).
		UR, UZM	・ For early warning system, local government must define procedures. ・ (Activity 1.1).100% (The shear test apparatus shipped from Japan is at the custom office on 2 July, and is to be in Rijeka in that same week) ・ (Activity 1.2) 30% (Soil samples from Kostanjek and Grohovo were sent to Kyoto. Two young researchers were in Japan for short-term training on soil testing. 30%, not in term of the amount to be tested, but in terms of data to help landslide analysis. Soil in Kostanjek is complex) ・ (Activity 1.3: equipment) The installation of equipment has completed more than 90% at Grohovo site. This year, the installation of equipment at Kostanjek will be undertaken, more than 80% of equipment are ready for installation and with Seismographs at the end of September, the installation will be completed. ・ (Activity 1.3: field survey) For Grohovo, many field surveys were conducted in 1998 through 2000. As for Kostanjek, the survey will continue as Kostanjek is wider and more complicated than Grohovo. ・ (Activity 1.4) In Grohovo, basic methodology for flysch formation analysis is completed 80%. Testing by the shear test apparatus is necessary for confirmation. Kostanjek (0～30% progress) is deep sheeted, different geological formation and monitoring results are required. One year from now, enough data may have been obtained. ・ (Activity 1.5) same as (Activity 1.4)
	2.2 Progress of Output 2 – Flash flood/debris-flow simulation models and early warning systems are developed adapting to hydrological and geological conditions in Croatia.	CW	・ Croatian Water is only providing hydrological and meteorological data to the project, and so far having no feedback. ・ CW doesn"t have a flood hazard map at present. ・ In Daruvar (dominant agricultural area), the Faculty of Agriculture established an experimental field to measure CO^2 on climate change and has been conducting a research on flood mitigation.
		UR	・ Levels of progress for each activity are: ・ 2.1) 50%, ・ 2.2) 50%, ・ 2.3) -, Flash-flood/debris-flow simulation model for Salt Creek (Slani potok-Dubračina area) is competed (Application of Solfec program written in Python Cod). ・ Formulation of a model requires inputs of data ・ 2.4) – Currently preparing all papers and permits for Rader (Furundo) installation. ・ Three scenario can be considered; 1) flash-flood, 2) flash-flood + landslide, 3) flash-flood + landslide + dam breakdown ・ Activities of WG2 will move faster in the 2nd half as WG2 now fully realizes what need to be done – clear presentation of main objectives, specific objectives, research program and expected results and impacts. At the beginning of the project, WG2 didn"t have a clear picture, but now WG2 does. ・ Verification of the developed model requires measurement and data of flashflood and debris flow, which don"t happen so often. Model verification is not likely within this project period.
	2.3 Progress of Output 3 – Integrated landslide/flood hazard maps and land-use guidelines for landslide/flood risk mitigation are developed for study areas.	MZOS	・ As far as the City of Zagreb is concerned, due to the involvement of the EMO, the authority is sure to incorporate the handbook and guideline to their policy and regulation. ・ The Minister of MZOS is from Rijeka, and he is aware of this project. Even though MZOS doesn"t have interest in interfere with the city, scientists do - they can advise to the city. ・ The handbook and guideline are more important than scientific publication.
		EMO	・ As for the contents of guideline, it is difficult for EMO to make a specific request at present.

			・ EMO, established in May 2008, has 21 staff members, responsible for all Zagreb"s natural disaster, among which an earthquake is the major disaster. EMO has a plan of operation, but doesn"t have a standardized operational procedure. The budget is increasing as EMO is still a new institution. ・ Before the project, EMO was not very aware of landslide, and EMO"s staff doesn"t know very much about landslides. ・ The application of landslide guideline is not at the national level, but local level matter. The City Council needs to approve the landslide assessment and protection plan.
		UZM	・ As the 1st promotion for public awareness, we held a press conference at the time of the equipment installed. ・ We are now planning the 2nd promotion - 2nd press conferences – to announce the system established, not for educational but informative purpose with participants from national level, too.
		UR	・ Output 3 of Dubračina River basin is to be the integrated landslide/hydrological condition map – hydrological condition, not as a map but an equation with about 7 parameters such as precipitation, water level, air pressure, etc. ・ It is now possible to prepare a plan with timeline for the next two years as everything is clear. Rader installation will be a milestone event. ・ UR held a presentation meeting to the City of Rijeka on 21 March 2011, also on 11 May 2012 on Mošćenička Draga, and on 15 My 2012 on Dubračina (Salt Creek)
		US	・ Split-Dalmatian County is supposed to revise the current physical master plan. ・ Officials of county are also architect and geologist, in the same area of researchers, US. ・ Two meetings were held with the town of Omiš
	2.4 Prospect of the Project Purpose to be achieved by the end of project period. (Prospect of actual implementation of research results)	MZOS	・ The project start-up was delayed, but a major achievement to date is 1) the good cooperation among Croatian universities and good team work, and 2) involvement of local authorities. ・ Issues are 1) better coordination regarding necessary equipment, and 2) Clearer role of various players on Japanese side.
		UZ, UR, US	・ Project is most likely to be able to achieve its purpose.
3. Efficiency	3.1 Clarity of the overall plan of the Project. Master Plan PO	UR, UZM	・ Activity of WG1 is very clear from the beginning.
		US,	・ Different from the beginning of the Project, now, the activities and goal is very clear. ・ Plan is necessary to prepare the activities well and conduct monitoring.
	3.2 Inputs of Japanese side – dispatch of experts/researchers.	UZM	・ Prof Marui and Furuya, when visiting Croatia, are working on administrative issues. ・ Dr. Wang is working on spatial analysis all the time.
	3.3 Inputs of Japanese side – trainings.	UZM, US	・ Trainings were very useful, narrow and focused. ・ Trainings for shear test apparatus was very good, ・ “Portable ring shear apparatus ICL-1 Manual” (Kyoto 2012) was prepared.
	3.4 Inputs of Japanese side – provision of machinery/equipment.	MZOS	・ Sometimes wrong amount in donation letters, and until recently no distinction in donation letter whether it"s local purchase or purchase in Japan. ・ Until recently local purchase were not in line with national VAT (25%) regulation, and purchase in Japan were not in line with needs in the field (e.g. need for heavy-duty laptops for field research). ・ It"s unclear who decide on the Japanese side what is needed (JICA, JST, Niigata University?) ・ We didn"t know the administration of implementing an international project. This is a delay of administration, not a delay of procurement. Researchers applied a purchase but we didn"t know that tax extensive exemption is required. Regarding local purchase for universities, it requires of invoice, donation letter, and VAT exemption letter. Now it"s been settled and the delay will not recur any more. ・ We still have unsettled payments from the 2nd workshop in December 2011 (travel allowance paid to participants were less than expected amount). It was very embarrassing; yet still don"t know who can settle the difference, JICA, JST or Niigata Univ. ・ For the 1st workshop in November 2010, the project paid travel cost, allowance, and honorarium. MZOS is willing to pay only for accommodation and fee of train 2nd-class for researchers. Project Director should be consulted with these administrative as well as substantial matters of a workshop beforehand, rather than just being invited as a speaker.

		UR	・ Equipment for Grohovo was delivered in the summer holiday season, 2011. It was very hot and civil works for installation was off for holidays.
	3.5 Inputs of Croatian side – assignment of counterpart personnel (University researchers and other staff, Officials of municipalities)	UZA	・ New WG4 was established in order to speed up research activities in Split. ・ MZOS supports the salary of 9 young researchers, who are all PhD candidates.
	3.6 Inputs of Croatian side – share of operational costs.	MZOS	・ MZOS finances: 1) Lump-sum of 360,000 Kuna / year 2) payment for 9 young researchers (their salaries are paid by MZOS, and they are supposed to get doctors" degree), 3) Traveling of researchers, and 4) payment for equipment installation and maintenance.
		UR	・ It is very important to finish the installation of equipment, in particular at Kostanjek. ・ Shipment and installation of equipment cost money. In 2010, no equipment and budget set aside were not used. In contrast, in 2011, lots of equipment, requiring budget, too. For 2012 and 2013, we don"t know and it"s not easy to prepare budget on Croatian side. We only know the equipment for the next six month.
	3.7 Communication (periodical and daily) for project coordination – between JICA and implementing agencies.	UZ UR	・ 1st JCC was held on 23rd Feb 2012 at the Faculty of Agriculture, UZ. ・ The Project held two international workshops. 1) 1st WS at Dubrovnik in November 2010 (paid by JICA budget) 2) 2nd WS at Rijeka University in December 2011 (paid by JST budget through Niigata University) 3) 3rd WS is planned in Zagreb in February 2013, inviting more participants from local administration, EMO, more public promotion.
		UR	・ It is not clear what a project manager can manage, equipment, budget? The Croatian side should be more informed.
		US	・ Sometimes, it takes time to receive response from Japanese researchers via email.
	3.8 Communication (periodical and daily) for project coordination – among Croatian agencies.	MZOS	・ The Project has a very good cooperation with the EMO in the City of Zagreb. The project will have two major outputs: 1) guideline and handbook, 2) academic and scientific findings. The guidelines and handbooks will be used by the local authority.
		UZM	・ EMO are providing permissions to install monitoring system in city lands (as for private lands, private permission), and may provide financial support to maintain installed equipment. In return, UZM can introduce new data to city"s land management. ・ In Jan 2012, there was a conference in Kyoto, Japan, and ICL and EMO financed researchers travel.
		UZ, UR	・ At the 1st JCC, Representative of local communities (City of Rijeka, City of Split, and EMO of City of Zagreb) attended as observers.
	3.9 Methods and contents of technology transfer from JICA experts to Croatian researchers.	UR	・ Training in Japan has been very important for young researchers, who were introduced to landslide issues and exposed to a new apparatus. ・ There are no similar apparatus in Croatia.
	3.10 Promoting/hindering factors that may have affected the Project implementation.	MZOS	・ Complete lack and understanding of what is needed at the start of project. Project started on a wrong premise that no funds or involvement from MZOS are necessary. ・ Croatian side is to need an agency which could appoint project director and do extra work for the project. ・ Project Director (Croatian Side) and Project Coordinator (Project Coordinator) had to fill in the gap between the preliminary study and actual implementation. Because of the gap, a year was lost at the project start-up, but the job was done and the Croatian sides are satisfied, expecting now to make it up.
		UR	・ All researchers can attend the once-a-year workshop, but probably meeting at every six-month, not only among WG leaders but all researchers, can facilitate the cooperation among WG2 and other WGs.
4. Impact	4.1 Any positive/negative impact brought about by the Project (Policy and research development, Poverty reduction, environmental protection, and gender equality.)	MZOS	・ Positive impact is the research development of young researchers. Also, raised awareness of the public as well as the commitment of municipalities.
		UZA	・ 9 PhD students being trained in Japan is one of best effects in Project.
		Japanese researchers	・ Through international conference organized by the Project, research results and findings on landslides and flash-floods/debris-flow are shared among researchers from neighboring countries such as Serbia,

			Bosnia-Herzegovina, Kosovo, Macedonia, and Slovenia, where studies on disaster risk management are important and required for societies.
	4.2 Activities beyond the scope of Master Plan.	US	・ The town of Omiš prepared a project document to contain potential rock falls in the town. ・ The leader of WG4 of the Project is a reviewer of the project document, and expects that the RiDAR scanning conducted in the Project will also help identify critical points of potential rock falls, and will contribute to the implantation of the town"s project. ・ The Ministry of Finance of Croatian Government will finance the project once the project document is signed.
	4.3 Ongoing/possible collaborations, if any, with multi/bi-lateral development partners (UN, NGO, civil society, and private sector).	US	・ Project of rockfall protection in Omiš city (Conex-st, Split) ・ Collecting of meteorological data (Meteorological and Hydrological Service, Croatia) ・ Maintenance and meteorological station (CROMETEO, NGO)
5. Sustainability	5.1 Prospect from institutional viewpoint (Legislation and policies Rule and regulation, standard operational procedures Responsible organization and division, Participation of stakeholders)	MZOS	・ As far as MZOS is concerned, problems are now solved and the project is going well. ・ Dissemination seminars for local communities are required.
	5.2 Prospect from technical viewpoint (Technology/knowledge and its update Equipment and its maintenance Educational materials Training opportunities)	UZM	・ Follow-on maintenance of equipment after the end of the Project is currently being explored by the implementing universities. ・ The maintenance of installed equipment is also discussed among EMO and UZM. An idea is that at the end of the Project UZM could hand over the equipment to the City of Zagreb, which could bear the costs for its maintenance while UZM could provide constant inspection of the equipment and provide the City with monitoring data collected thereof.
		UR	・ Equipment installed in model sites is currently well maintained; a container of inclinometer casing, pore pressure gauge and GPS, a fence around solar panels, concrete base of a pole for the prism, and insurance policy for equipment. MZOS bears the costs of these protective and maintenance measures. ・ Possibility of follow-on maintenance could be: New proposal to EU, MZOS Local authority, City of Rijeka Croatian Water
	5.3 Prospect from Human Resource viewpoint (Number of staff, Assignment of responsible personnel, His/her qualification and motivation, New recruitment and volunteer)	UZOS	・ Currently, nine young researchers, doctoral students, are sponsored by MZOS to work for the Project. It will lead to a significant human resource capacity when they obtain doctorates.
	5.4 Prospect from Funding viewpoint (Budget allocation for the activities, External financing from donor/private sector)	MZOS	・ At present, MZOS has prepared a counter-budget, financing a part of project operation. ・ The prospect of sustainability is more than medium, except for its financial aspect considering the current economic situation. Croatian economy growth recording negative and resulting budget constraints. ・ There are funds available from Croatian Science Foundation (HRZZ)

MINUTE OF MEETINGS
BETWEEN
THE JAPANESE MID-TERM REVIEW TEAM
AND
THE AUTHORITIES CONCERNED OF THE CROATIA
ON JAPANESE TECHNICAL COOPERATION (SATREPS)
FOR
PROJECT ON RISK IDENTIFICATION AND LAND-USE PLANNING
FOR DISASTER MITIGATION OF LANDSLIDES AND FLOODS
IN CROATIA

The Japanese Mid-term Review Team (hereinafter referred to as "the Team"), organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Hideo Miyamoto jointly with Japan Science and Technology Agency, visited Croatia from June 25, 2012 to July 14, 2012 for the purpose of conducting the mid-term review on the Japanese technical cooperation (SATREPS: Science and Technology Research Partnership for Sustainable Development) for the Project on Risk Identification and Land-use Planning for Disaster Mitigation of Landslides and Floods in Croatia (hereinafter referred to as "the Project").

During its stay, the Team exchanged views and had a series of discussion with the Croatian authorities concerned. And the second Joint Coordinating Committee (hereinafter referred to as "JCC") was held on July 11, 2012.

As the result of the discussion, the Team submitted the mid-term review report as attached hereto and both sides agreed upon on the description of the report.

Zagreb, July 13, 2012

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Mid-term Review Report

for

the Project on Risk Identification and Land-use Planning for Disaster Mitigation of Landslides and Floods in Croatia

July 2012

Mid-term Review Team

Abbreviations

AHP	Analytical Hierarchy Process
CGS	Croatian Geological Survey
CW	Croatian Water
DEM	Digital Elevation Model
DPRI	Disaster Prevention Research Institute, Kyoto University
DUZS	*Državna uprava za zaštitu i spašavanje* (National Protection and Rescue Directorate)
EMO	Emergency Management Office, City of Zagreb
GIS	Geographic Information System
HRK	Croatian Kuna (international abbreviation)
ICL	International Consortium on Landslides
JCC	Joint Coordination Committee
JPY	Japanese Yen
JICA	Japan International Cooperation Agency
JST	Japan Science and Technology Agency
LIDAR	Laser Imaging Detection and Ranging
M/M	Minutes of Meetings
MZOS	*Ministarstvo obrazovanja, znanosti i sporta* (Ministry of Science, Education and Sport)
PO	Plan of Operation
R/D	Record of Discussion
SATREPS	Science and Technology Research Partnership for Sustainable Development
UR	University of Rijeka, Faculty of Civil Engineering
US	University of Split, Faculty of Civil Engineering, Architecture and Geodesy
UZM	University of Zagreb, Faculty of Mining, Geology and Petroleum Engineering
UZA	University of Zagreb, Faculty of Agriculture
VAT	Value Added Tax

Contents

Chapter 1: Outline of the Review Study

1.1 Background

Croatia has frequent earthquakes and, along the Adriatic coast, has a large amount of precipitation. At some places, average annual rainfall is 3,500mm and more. Triggered by such earthquakes and rainfall, sediment disasters occur quite often such as landslides, slope failure, and debris flow. The land of Croatia has a complex, fragile terrain and geological structure affected by earth faults and folds. Sediment disaster are common at the alternation of sandstone-shale strata that is prone to weathering, as well as at slopes with marl layer containing large amounts of clay with low friction angle. Local flood (flash flood) occurs at limestone regions where water roads are easily formed in the strata.

Sprawling of cities is causing the accumulation of assets and population growth in sub-urban areas, but many of these areas are at high risk of such disasters in Croatia, thus raising concerns about increasing damages by flash floods and landslides. In some areas, disaster risk is likely to become even higher with a change in rainfall patterns due to climate change.

In Croatia, however, techniques to assess flash-flood/landslide risk and mechanisms to take measures on the risk assessment are not yet developed. Sprawling control as well as disaster warning systems and evacuation rules are not in place yet, either. Towards such disaster risk management, researches are required to develop methodologies for hazard mapping and risk assessment based on scientific data of these phenomena, and to improve the land use taking into consideration such disaster risks.

In this context, this Project was requested by the Government of Croatia. Based on a detailed planning survey in January 2009 and a following consultation mission in March 2009, the R/D of the Project was signed on 27 March 2009 under the scheme of SATREPS. In July 2012, about the halfway point of the Project period, a mid-term review is to be conducted as dictated by the Article V of the signed R/D.

1.2 Objectives of the Mid-term Review Study

The objectives of the Mid-term review are to:

1) confirm actual inputs, activities and implementation process, the degree of achievements of the outputs, and the prospect of achieving the project purpose according to the Master Plan.
2) assess the Project from the five evaluation criteria - Relevance, Effectiveness, Efficiency, Impact and Sustainability – based on the JICA's guideline for project evaluation.
3) make common understanding of indicator for the Project purpose and output.
4) make recommendations on the measures to be taken during the remaining project period in consultation with agencies concerned.

1.3 Members of the Review Team

The review was conducted by the team composed by the following members:

Name	Position	Title
Mr. Hideo MIYAMOTO	Leader	Senior Advisor to the Director General, Water Resources and Disaster Management Group, Global Environment Department, JICA
Mr. Jun MURAKAMI	Survey Planning	Water Resources and Disaster Management Group, Global Environmental Department, JICA
Mr. Hiroyuki OKUDA	Evaluation and Analysis	Tekizaitekisho, LLC
Dr. Yoshimori HONKURA	SATREPS Evaluation	Program officer of Natural Disaster Prevention, Research Partnership for Sustainable Development Division, JST
Mr. Masayuki SATO	SATREPS Evaluation	Principal Researcher, Research Partnership for Sustainable Development Division, JST
Dr. Koichi TSUKIOKA	SATREPS Evaluation	Senior Staff, Research Partnership for Sustainable Development Division, JST
Ms. Kikuko SAKAI	SATRPES Evaluation	Senior Program Coordinator, JST Paris Office

1.4 Schedule of the Mission

The schedule of the mission is attached (Annex 3)

1.5 Methodology of the Review

The Mid-term review is carried out in accordance with "the JICA New Guideline for Project Evaluation, Ver. 1 (June 2010)", which mainly follows "the Principles for Evaluation of Development Assistance, 1991" issued by OECD-DAC. The master plan in the R/D with the statement of the project purpose, outputs and activities is used as the basic reference point for the review. (Annex 1 is a revised master plan, draft, with proposed indicators).

As a framework to collect and sort out relevant data and information as prescribed in the JICA Guideline, two types of grid - Result Grid and Evaluation Grid - were prepared in reference to reports and documents on the Project. To collect information for the Evaluation Grid, questionnaires were prepared and forwarded in advance to the counterpart organizations. During the review mission, the team conducted interviews with counterparts based on the questionnaires, hearings with JICA experts, and visited target areas (Annex 3, 4).

Findings and information from reports, interviews, questionnaire survey and site visits were collected and analyzed in the grids. The team confirmed the achievements, assessed the Project based on the five criteria, made recommendations, and drew lessons learned.

The criteria used for the evaluation are the following five criteria: relevance, effectiveness, efficiency, impact and sustainability.

Relevance	Relevance is reviewed by the validity of the Project Purpose in light of Croatia's development policies and needs and Japanese cooperation policies.
Effectiveness	Effectiveness is assessed to what extent the Project is achieving the Project Purpose, clarifying the relationship between the Project Purpose and Outputs.
Efficiency	Efficiency is analyzed with emphasis on the relationship between Outputs and Inputs in terms of timing, quality, and quantity.
Impact	Impact is assessed in terms of positive/negative and intended/unintended influence caused by the Project.

Sustainability	Sustainability is assessed in terms of institutional, financial, and technical aspects by examining the extent to which the achievements of the Project will be sustained after the Project is completed.

Chapter 2: Outline of the Project

2.1 Project Purpose

Integrated landslide/flood hazard mapping technology and land-use guidelines formulation methodologies are developed for nation-wide application in Croatia.

2.2 Output

1. Methodologies for landslide risk assessment, prediction of affecting areas, and early warning systems are developed adapting to hydrological and geological conditions in Croatia.
2. Flash-flood/debris-flow simulation models and early warning systems are developed adapting to hydrological and geological conditions in Croatia.
3. Integrated landslide/flood hazard maps and land-use guidelines for landslide/flood risk mitigation are developed for study areas.

Chapter 3: Achievements of the Project

3.1. Results of Inputs

The R/D of the project was signed on 27 March 2009, but it was 9 March 2010 when the Note Verbal was exchanged for launching the Project as it took long time for Croatian side to conduct necessary inter-organizational coordination. Behind the original schedule by one year, inputs as per agreed in the Master Plan begun with the dispatch of Japanese expert in May 2010.

(Japanese side)

1) Dispatch of Japanese researchers

Since May 2010 until July 2012, total 17 researchers have been dispatched, short-term 82 times, totaling 997 days. Each researcher is attached to working group 1, 2 or 3. In addition, one project coordinator has been dispatched by JICA since May 2010. (Annex 5)

2) Counterpart Training

4 researchers and 7 researchers from CGS, UZM, UR and US attended short-term trainings in Japan in 2010

and 2011, respectively, conducted in Tohoku Gakuin University, Yamagata University, Niigata University, ICL, and Kyoto University. (Annex 6).

3) Provision of Machinery and Equipment

Activities of the Project started in May 2010, one year behind the signature of the R/D. In addition, due to the absence of referential precedence on VAT exemption procedure in concerned agencies in Croatia and resulting delay of administrative clearance, a piece of equipment which was planned to be procured in Croatia ended up being purchased in Japan and shipped to Croatia instead. Machinery and equipment for landslide and flash-flood analysis was provided by the Japanese side, the total amount of which are 128,416,000 JPY for 2010 and 2011. (Annex 7)

4) Local Costs

Japanese side provided a part of necessary expenses for carrying out project activities. Apart from the costs of machinery and equipment of 128,416,000 JPY, the expenses include the dispatch of Japanese researchers and project coordinator, training of Croatian Researchers in Japan, Operational expenses such as travel expenses in Croatia, local consultant fee, and meetings. The total amount, including that of machinery and equipment, is 237,101,000 JPY for 2010 and 2011. (Annex 8)

(Croatian side)

1) Assignment of Counterpart Personnel

Project Director (Mr. Purgar) and Project Manager (Prof. Ožanić) have been assigned by MZOS and UR, respectively. The Deputy Project Manager (Assoc.Prof. Mihalić) and Project Coordinator (Prof Kisić) have been assigned by UZM and UZA, respectively. The change of the Project Manager from Prof. Bonacci to Prof Ožanić, and the Deputy Project Manager from Prof. Ožanić to Assoc.Prof. Mihalić was officially announced with a letter dated 28 March 2012 issued by MZOS. Although there is no official letter on the assignment of counterpart, so far 35 researchers have been recognized as counterpart personnel at the time of mid-term review. (Annex 9)

2) Local Operational Cost

MZOS has been financing the project – lump sum of 360,000 Kuna/year we well as salaries of 9 young researchers working for the Project, shipment and installation costs of purchased equipment, and travel of researchers. Each faculty engaged in the Project – Faculty of Mining, Geology and Petroleum Engineering, University of Zagreb, Faculty of Civil Engineering, University of Rijeka, and Faculty of Civil Engineering, Agriculture and Geodesy, University of Split – has also borne a part of operational costs. The total amount, however, could not be confirmed during the mid-term review mission. (Annex 8)

3.2. Progress and Achievements of the Project

1) Achievement of the Project outputs

(Output 1)

- There are four model sites selected: Kostanjek Landslide (a part of Medvednica Hilly Area, City of Zagreb), Grohovo Landslide (a part of Rječina River Basin, Primorsko-Goranska County, Rijeka), Duće and Omiš areas (Split-Dalmatian County).
- A low-cost undrained shear test apparatus was developed in Japan, and two Croatian researchers were trained for the operation of and the testing with the apparatus. (Activity 1-1). Activity 1-1 was completed.
- Soil samples from model sites (Kostanjek landslide and Grohovo landslide) were sent to Japan and tested with the apparatus. At the time of mid-term review, 2 July 2012, the apparatus was at the Croatian custom still on its way for shipping to the University of Rijeka. (Activity 1-2)
- Researchers indicated that the installation of monitoring equipment (GPS, extensometers, total station, prism, pore pressure gauge) has completed more than 90% at Grohovo site; most part of which were set up in August through September 2011, and the monitoring has been in progress. As for Kostanjek landslide, monitoring equipment is expected to be set up this year, in July 2012. (Activity 1-3)
- The development of methods of landslide risk assessment (Activity 1-4) and the prediction of landslide affecting areas based on landslide dynamics (Activity 1-5) are linked and undertaken concurrently.
- The monitoring is going on at Grohovo to accumulate data to feed into the establishment of early warning system. At Kostanjek, extensometers were installed, largely depending on which an early warning system is to be established. (Activity 1-6)
- The level of progress to date as per generally perceived by researchers are: 100% for Activity 1-1, 70% for Activity 1-2, 60% for Activity 1-3, 40% for Activity 1-4 and 1-5, and 40% for Activity 6.

(Output 2)

- There are five model sites selected: Rječina River Basin, Dubračina River Basin, and Mošćenička Draga (Primorsko-Goranska County, Rijeka), Imotski and Sutina-Karakašica (Split-Dalmatian County).
- Rainfall measurement equipment was installed at model sites in Rijeka and the data are being collected. The analysis of rainfall-discharge characteristics continues with new hydro-meteorological data. Since 2011, however, due to the absence of heavy rainfall events, the data accumulation so far has not been adequate as expected. Meteorological measurement device has been installed in the municipality office building of Mošćenička Draga, where the data also has been utilized by the local authority. (Activity 2-1, 2-2)
- Physical experiments of debris-flow have been carried out in Kyoto University where the Croatian trainees jointed the experiments. Two peer review papers have been accepted. The development of flashflood and debris flow simulation model (Hydro-Debris 3D) for Dubračina River is completed. (Activity 2-3)
- The procurement of radar (Furuno) to cover the three model sites in Rijeka are in progress, which will constitute the early warning system to be established. (Activity 2-4)

- The level of progress to date as per generally perceived by researchers are: 50% for Activity 2-1, 40% for Activity 2-2, 50% for Activity 2-3, and 40% for Activity 2-4.

(Output 3)

- There are five model sites selected: Hilly area of the Medvednica Mountain (Zagreb), Rječina River and Dubračina River basin (Primorsko-Goranska County, Rijeka) and Duće and Omiš areas (Split-Dalmatian County).
- In Zagreb and Rijeka, topography interpretation of model sites and surrounding areas, mainly based on aerial photos, were completed. In addition, digital topography maps are being created based on LiDAR scanning with airplane. In Split, WG4 is conducting ground-based LiDAR scanning once a month since September 2011 (Activity 3-1,3-2).
- In Zagreb and Rijeka, WG3 is preparing land slide inventory maps and conducting landslide susceptibility analysis using AHP methodology. WG2 is undertaking researches in Rijeka alone in the recognition that there is no flashflood threat in Zagreb due to the retention dam, and hence the integrated landslide/flood hazard map in Zagreb will cover only landslide aspects. In Split, rock fall in Duće/Omiš areas and flashfloods in Imotski/Sutina-Karakašica are not linked phenomena. As such, the integrated landslide/flood hazard map WG4 will develop actually means two individual hazard maps for landslide and flashfloods. (Activity 3-3)
- The development of land-use guidelines (Activity 3-4) and manuals of integrated landslide/flood hazard mapping (Activity 3-5) has not really started yet, but researchers of the implementing universities meet local authorities more often than not, raising their awareness for the preparation of land-use guidelines incorporating hazard assessment.
- The level of progress to date as per generally perceived by researchers are: 50% for Activity 3-1 and 3-2, 20% for Activity 3-3, 10% for Activity 3-4 and 3-5.

2) Achievement towards the Project Purpose

The project purpose is "integrated landslide/flood hazard mapping technology and land-use guidelines formulation methodologies are developed for nation-wide application in Croatia. Indicators for the Project Purpose were not set in the Master Plan included in the signed R/D. At present, the project is making a steady progress of research activities at each output level as summarized in the above section. Considering the overall progress towards attaining the Project Purpose, in spite of the delay of launching the Project and setting up the monitoring equipment at model sites, the Project has a good potential to achieve its goal by the end of project period, March 2014.

3.3 Implementation Process

The project formed three working groups (WG) – WG1 for detailed landslide investigation, WG2 for flash-floods and debris-flows, and WG3 for regional landslide investigation. After the 1st JCC on 23rd February

2012, the formation ofWG4 was proposed in order to accelerate the research activities in Split by direct contact between the project manager and the leader ofWG4.

Chapter 4: Evaluation by the Five Criteria

4.1 Relevance

The relevance of the Project is high.

- There are several laws and policies speaking to the importance of disaster mitigation in Croatia; they are: Protection and Rescue Plan for Croatia (Official Gazette 96/10), Evaluation of Endangerment of Croatia from Natural and Technological Disasters, Croatian National Platform for Disaster Risk Reduction, Protection and Rescue Law (Official Gazette 127/10), Law on Protection from Natural Disasters (Official Gazette 73/97), and also various international agreements on protection and rescue in case of natural disaster. The project, aiming at the development of integrated landslide/flood hazard mapping technology and land-use guidelines formulation methodology for nation-wide application in Croatia, is aligned with these Croatian laws/policies, and contributes to their realization.
- The model sites of the Project were proposed by Croatian researchers. The Kostanjek in Zagreb is the largest landslide in Croatia, and one of primal concerns of the Emergency Management Office in the City of Zagreb. At present, the physical plan of the City of Zagreb doesn't include the assessment of landslide risk. At the downstream of Rječina River located the city of Rijeka, and the flood waters can cause significant damage to the city; it could be an even higher hazard in case of concurrent rock avalanche at Grohovo landslide. The City of Rijeka has a land-use guideline for construction purpose, but it does not contain a hazard map. The model sites in Split are Omiš and Duće where a rock fall is quite frequent, causing damages and posing threats to many houses and population in the towns. The project can also meet the needs and expectation of these local authorities by monitoring the sites, setting up early warning systems, preparing hazard maps as well as land-use guidelines incorporating disaster risk mitigation.
- Disaster reduction is identified as one of specific issues Japan's ODA gives priority. The Initiative for Disaster Reduction through ODA was announced at the United Nations World Conference on Disaster Reduction held in Kobe, Hyogo prefecture, in January 2005. Furthermore, JICA's Issue-specific Guideline for Disaster Reduction sets out "building disaster-resilient communities and societies" as one of development strategy goals to be achieved. This Project aims at the development of landslide/flood hazard mapping technology and early warning system, thus applying these outputs to land-use guidelines prepared by local authorities for disaster reduction. The Project is aligned with Japan's ODA policy, and such methods and technologies can also be utilized for other disaster risk management projects.

4.2 Effectiveness

The effectiveness of the Project is medium.

- The basic design of the Project is clear as per summarized in the Master Plan, and the three outputs are

essential components for the Project to achieve its purpose. As described in the above section, the Project has set up equipment, accumulating monitoring data and analysis. At present, the project is making a steady progress of research activities at each output level, and in spite of the delay of launching the project and setting up monitoring equipment at model sites, it is widely indicated that the project has a good potential to achieve its goal by the end of project period, March 2014. It is also expected that activities can be undertaken even faster once all equipment is installed because timeline of research activities can become more predictable and preparing a research plan can become meaningful.

- Output 3, where the results of Output 1 and Output 2 are to be synthesized to achieve the Project Purpose, has so far made rather limited progress. Moreover, the PO doesn't describe the process and schedule of how each output can be integrated or utilized in Output 3 to attain the Project Purpose. Specific PO for the 2nd half of the project period is necessary, including the process and timeline towards the Project Purpose, thereby the prospect of achieving the project goal can become clearer.
- It is also important the specific PO provide further breakdown of each activity to show how each activity can be conducted and completed for the next two years. The breakdown of each activity with timeline is helpful for better understanding and communication among researchers of different working group and also between Croatian and Japanese researchers. In addition, a detailed PO is beneficial for effective monitoring of each activity, whereby the effectiveness of the Project can be further increased.
- The development of integrated landslide/flood hazard maps and land-use guidelines for landslide/flood risk mitigation are set as tangible targets of Output 3. In the City of Zagreb, one of the three study areas, the Project will not prepare such map and guideline because Zagreb is not likely to have flush flood. WG2 is not undertaking flash-floods and debris-flows research in Zagreb, and hence the output of WG3 is to be a landslide susceptibility/hazard map, not including flash-flood analysis, and a land-use guideline incorporating only landslide aspects. In the case of WG4, a map and a guideline will be evaluated for rock falls as a special case of landslides.
- Indicators, which will be used to verify the attainment of each output and Project Purpose at the time of terminal evaluation, were not set in the Master Plan included in the signed R/D. Mid-term review is a good opportunity to review the project progress so far, and discuss and agree on indicators by foreseeing the goal to be reached two years ahead.
- The project will develop methods and models such as landslide risk assessment, prediction of landslide affecting areas, flashflood/debris-flow simulation model, and integrated landslide/hazard mapping technology. The verification of these methods and models are conducted with measurement and data from physical experiments while actual hazardous events don't occur so often. Within the project period, the verification by natural events depends on weather, but refinement of methods and models will continue.
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4.3 Efficiency

Efficiency of the Project is medium.

- The R/D of the project was signed on 27 March 2009, but it was 9 March 2010 when the Note Verbal, a form

of diplomatic document, was exchanged after a long process of conducting inter-organizational coordintion on Croatian side. This is a five-year project, planned to start in March 2009 and end in March 2014, but due to this delay of launching the Project for one year, now all activities are to be competed in four years.

- Concerning the procurement of project equipment, the exemption of VAT (25%) was agreed on the R/D but administrative procedures for this VAT's exemption to become effective was not clear among concerned agencies both in Japanese and Croatian side. As a result, the first batch of equipment installation was in August through September 2011 at Grohovo Landslide due to the change of procedures - from domestic procurement in Croatia to international procurement in Japan - and the associated time it took for this change. This delay in setting up equipment at model sites has affected the research plan.
- For project implementation, MZOS has prepared a counter-budget, which includes the lump-sum 360,000 Kuna/year, salary payments of nine young researchers who are expected to obtain doctor's degree through researches in the Project, payment for equipment installation and maintenance, and travel allowance & accommodation for researchers. Each faculty of the three universities implementing project activities also has borne a part of operational costs such as conference and travel.
- The Project organizes annual international conferences to share the research progress and findings. The 1st conference was in Dubrovnik in November 2010 and the 2nd conference was at the University of Rijeka in December 2011. An internal Croatian workshop is planned to be held in Zagreb in December 2012, financed by Croatian Water for the prepration of the next conference. The 3rd conference is currently planned in Zagreb in February 2013 inviting more participants from local authorities as well as promoting public relations. Meetings and communication for research coordination between Japanese researchers and their Croatian counterparts have been properly held as and when necessary. On the other hand, communication of researchers among different working groups is much less and confined to such opportunities as the annual international conferences and JCC.
- The project held the 1st JCC on 23rd February 2012 at the Faculty of Agriculture, UZ, where counter personnel from the three universities and Croatian Geological Survey attended, including representatives of local community (City of Zagreb's EMO). This JCC was the first meeting where administrative instructions for the project such as equipment and procurement were shared among all those who were involved in the Project. Meetings for administrative purpose could have been very helpful if it had been held at the very beginning of the Project to share the knowledge, rules and regulations associate with Project implementation.
- Counterpart personnel have not been fixed by, for example, an assignment letter by organizations or an acknowledgement at JCC. Assignment of counterpart personnel has been flexible, subject to change in accordance with the situation and progress of researches.
- The formation of WG4 based in US is a response to administrative issues of project coordination such as the distance between US and UR/UZM and resulting difficulty for US to have meetings and smooth communication as a part of WG1, WG2 and WG3. Research subject and activities remain unchanged, though, in US with the formation of WG4, and the leader of WG4 as US is now able to directly contact with Project Manager in UR. Partner researchers from Japanese side are not assigned to WG4, but work together as and when necessary.

4.4 Impacts

It is still premature to evaluate the impact of the Project

- Positive impacts such as measures against natural hazard and disaster risk mitigation can be expected once the Project achieves its purpose and the application of research results to local/national government policies starts realized. At the time of mid-term review, such expected impacts have not been observed yet.
- It is widely indicated that the relationship between the universities and the local governments has been forged and strengthened due to the presence of the Project. Representative of local governments are not listed as counterpart in the R/D, but they are now recognized as essential partners of the Project by researchers towards achieving the Project goal. For example, EMO in the City of Zagreb was newly established in 2009 to take responsibility for all Zagreb's natural disaster, among which an earthquake is the major disaster. Before the Project, EMO was not very much aware of the importance of addressing landslide issue, but now has become concerned and has provided the Project with support such as issuing a permit for equipment installation.
- The maintenance of installed equipment is also discussed among EMO and UZM. An idea is that at the end of the Project UZM could hand over the equipment to the City of Zagreb, which could bear the costs for its maintenance while UZM could provide constant inspection of the equipment and provide the City with monitoring data collected thereof. As such, efforts to promote the application of research results and to seek an arrangement for follow-on support have already been undertaken.
- The town of Omiš prepared a project document to contain potential rock falls in the town. The leader of WG4 of the Project is a reviewer of the project document, and expects that the LiDAR scanning conducted in the Project will also help identify critical points of potential rock falls, and will contribute to the implantation of the town's project. The Ministry of Finance of Croatian Government will finance the project once the project document is signed.
- Through international conference organized by the Project, research results and findings on landslides and flash-floods/debris-flow are shared among researchers from neighboring countries such as Serbia, Bosnia and Herzegovina, Kosovo, Macedonia, and Slovenia, where studies on disaster risk management are important and required for societies.
- Formalization of international cooperation with neighboring countries is underway in the frame of ICL regional network (Adriatic-Balkan) and thematic network (Landslide Monitoring), which were proposed in the 1st conference in Duvrovnik in Nov 2010. Two faculties (UZ and UR) have become members of ICL and have been assigned as coordinators for the networks due to the presence of the Project.
- UR, with Department of Local Government and the management of the city of Rijeka, is preparing a program to enlarge the Grohovo monitoring system on wider area in Rjecina river valley.
- The Project Manger, on behalf of MZOS, has become a member of National Protection and Rescue Directorate since 2012 due to her function in the Project.
- University of Split, Faculty of Civil Engineering and Architecture, has been institutionally connected with National Protection and Rescue Directorate during the development of Croatian 112 emergency system, as well as with their department in Divulje near Split on various emergency and disaster related activities.

4.5 Sustainability

The prospect of sustainability of project activities is medium.

- Prospect of sustainability from the viewpoints of human resource and technical capacity is indicated more than medium. Currently, nine young researchers, doctoral students, are sponsored by MZOS to work for the Project. It will lead to a significant human resource capacity when they obtain doctorates. Equipment installed in model sites is currently well maintained; a container of inclinometer casing, pore pressure gauge and GPS, a fence around solar panels, concrete base of a pole for the prism, and insurance policy for equipment. MZOS bears the costs of these protective and maintenance measures. Also, follow-on arrangement for maintenance of equipment after the end of the Project is currently being explored by the implementing universities.
- At present, MZOS has prepared a counter-budget, financing a part of project operation. From a financial viewpoint, however, the prospect of sustainability is indicated relatively low based on the recognition of Croatian economy growth recording negative, and resulting uncertainty of budgetary commitment in future.
- From an institutional viewpoint, it is still further clarified how the research results will be incorporated into the local government policy such as the preparation of land-use guideline. The relationship between the local authorities and the universities is still at the personal level, yet the relationship should be institutionalized as a system for disaster risk management between the two entities. Additionally, for research results to feed into disaster management policies, an involvement of disaster management agency, namely National Protection and Rescue Directorate, will become more important in future.

Chapter 5: Results of the Mid-term Review

5.1 Conclusion

The relevance of the Project is high - the Project is not only aligned with national laws and policies associated with disaster mitigation, but also meets the needs of local authorities and population. The effectiveness of the Project is medium as the Project is properly constructed, but the process and timeline for the remaining 2 years need to be further clarified and agreed toward achieving the Project Purpose. The efficiency of the project to date is rated medium mainly due to the initial delay of project launching and further delay of equipment installation. It is still premature to evaluate the impact of the Project at the time of Mid-term review. The prospect of sustainability of the Project is medium as technical and human resource capacity are indicated enough to sustain Project activities, but it is still uncertain from institutional and financial viewpoints.

5.2 Recommendations

1. The project has a good potential to achieve its goal by the end of project period, March 2014, in spite of the delay of launching the project and setting up monitoring equipment at model sites. The followings are recommended to ensure the goal to be attained: clarification of activities and plan, cooperation among working groups, and

implementation monitoring.

1-1. A revised Master Plan has been drafted, as per Annex 1, with indicators. The Project will be carried out based on the revised Master Plan.

1-2. A revised PO has been drafted, as per Annex 2, with activity breakdown and timeline for the next two years. The implementation will be undertaken according to the revised PO, which is subject to change and updated as and when necessary.

1-3. WG2 (flash-floods/debris-flow research) and WG1 & WG3 (landslide research) are to promote coordination and cooperation on the image of research outputs and its time of completion so that the results of both researches can be synthesized to produce integrated landslide/flood hazard maps.

1-4. Communication and cooperation among WG1, WG2, WG3 and WG4 is to be further promoted towards the intended Project Purpose; meetings in between the annual conference can be considered, not only among WG leaders but also of all researchers involved. .

2. In order for the application of research results, the followings are recommended: coordination with local authorities and continuous data collection.

2-1. The data that can be collected within Project period is limited, and hence the arrangement for continuous data collection after the project should be established for better research outputs, including the maintenance of installed equipment.

2-2. A system to strengthen the relationship between the local authorities and the universities in the study areas need to be explored - such as standardized procedures, documentation of protocol, memorandum of understanding – towards the application of research results.

2-3. For nation-wide application in Croatia of the Project outputs in future, the involvement of national authority for disaster risk management need to be explored while the Project is being undertaken.

3. The terminal evaluation can be conducted as a joint evaluation by both Japanese and Croatian evaluators.

Annex 1: Revised Master Plan (Draft)

1. Project Purpose

Integrated landslide/flood hazard mapping technology and land-use guidelines formulation methodologies are developed for nation-wide application in Croatia.

Indicator 1 :Number of manual book to develop integrated landslide/flood hazard map (1 manual)
2 : Number of manual book to develop land-use guideline for landslide/flood risk mitigation (1 manual)

2. Outputs

(1) Methodologies for landslide risk assessment, prediction of affecting areas, and early warning systems are developed adapting to hydrological and geological conditions in Croatia.

Indicator 1-1: Number of manual book of methodologies for landslide risk assessment (1 manual)
1-2: Number of model sites to develop a simulation for landslide predictions on dynamics (2 model sites: Kostanjek, Grohovo)
1-3: Number of model sites to establish landslide early warning systems (2 model site: Kostanjek, Grohovo)

(2) Flash-flood/debris-flow simulation models and early warning systems are developed adapting to hydrological and geological conditions in Croatia.

Indicator 2-1: Number of model sites to formulate a flash-flood/debris-flow simulation model (5 model sites: Rječina River Basin, Dubračina River Basin, Mošćenička Draga, Imotski, Sutina-Karakašica)
2-2: Number of model sites to establish a flash-flood early warning system at Rijeka (2 model sites: Rječina River Basin, Mošćenička Draga)
2-3: Number of model site to clarify essential factors on flash-flood/debris-flow simulation model, considering sustainable land management to mitigate water erosion on different tillage treatments (1 model site: Daruvar)

(3) Integrated landslide/flood hazard maps and land-use guidelines for landslide/flood risk mitigation are developed for study areas.

Indicator 3-1: Number of study areas to develop an integrated landslide/flood hazard map (3 areas: Zagreb, Rijeka and Split)
3-2: Number of study areas to develop land-use guidelines for landslide/flood risk mitigation (3 areas: Rijeka, Split, Zagreb)
Note 1): Indicator 3-1 for Split area means two individual hazard maps for landslide (rock fall) and flash flood.
Note 2):Indicator 3-1 for Zagreb area and Moscenicka Draga (in Rijeka area) means individual hazard maps for landslide and flash flood depending on model site conditions

3. Activities

(1)-1. Development of a low-cost undrained shear test apparatus.
(1)-2. Soil tests using the shear test apparatus.
(1)-3. Field survey and monitoring at landslide risk sites in model sites.
(1)-4. Development of landslide risk assessment methods based on landslide dynamics, and their application to the model sites.
(1)-5. Development of methods for the prediction of landslide affecting areas, and their application to the model sites.

(1)-6. Development of land slide early warning systems, and their application to the model sites.

(2)-1. Collection of existing hydro-meteorological data and analysis of rainfall-discharge characteristics in model sites.
(2)-2. Installation of rainfall measurement equipment, and collection of rainfall data.
(2)-3. Development of flashflood and debris flow simulation models in model sites.
(2)-4. Development of flashflood and debris flow early warning systems and their application to the model sites.

(3)-1. Preparation of digital topography maps of the study areas and the model sites based on the photo interpretation.
(3)-2. Development of wide-area landslide risk assessment methods using the Analytical Hierarchy Process (AHP) method, and their application to the study areas.
(3)-3. Development of integrated landslide/flood hazard mapping technology, and formulation of integrated hazard maps for the study areas and model sites.
(3)-4. Development of land-use guidelines formulation methodology, and formulation of land-use guidelines for disaster mitigation in study areas.
(3)-5. Preparation of a manual of integrated landslide/flood hazard mapping, and a manual of land-use guidelines formulation that are applicable nation-wide in Croatia.

Note: (3)-2 was originally listed as (1)-4 in the master plan, then later moved.

Annex 2: Revised Plan of Operation (Draft)

Outputs and Activities		1st JFY 2009/2010	2nd JFY 2010/2011	3rd JFY 2011/2012	4th JFY 2012/2013	5th JFY 2013/2014
JCC				①	② ③	④ ⑤
②:with mid-term review mission (Jul. 2012), ③:with 3rd conference(Mar. 2013), ④:with final evaluation mission(Dec. 2013), ⑤:with final conference(Mar. 2014)						
Output 1: Methodologies for landslide risk assessment, prediction of affecting areas, and early warning systems are developed adapting to hydrological and geological conditions in Croatia.						
1-1	Development of a low-cost undrained shear test apparatus					
1-2	Soil tests using the shear apparatus					
	① Set up the undrained shear test apparatus in UR					
	② Conduct additional soil tests of samples from the 2 model sites (Kostanjek, Grohovo)					
1-3	Field survey and monitoring at landslide risk sites in model sites					
	① Procurement and Set up GPS and other monitoring system for Kostanjek landslide					
	② Monitoring Kostanjek landslide and Grohovo					
1-4	Development of landslide risk assessment methods based on landslide dynamics, and their application to the model sites					
	① Obtain the parameters thorough the soil tests in 1-2					
	② Carry out the landslide risk assessment at the 2 model sites (Kostanjek, Grohovo) with using the parameters					
1-5	Development of methods for the prediction of landslide affecting areas, and their application to the model sites					
	① Obtain the parameters thorough the soil tests in 1-2					
	② Carry out the prediction of affecting area at the 2 model sites (Kostanjek, Grohovo) with using the parameters					
1-6	Development of landslide early warning systems, and their application to the model sites					
	① Fix the necessary standard data for establishment of early warning system at Kostanjek and Grohovo landslide and development the early warning system					
	② Fix the contents of manual book of methodologies for landslide risk assessment					
	③ Development the manual book of methodologies for landslide risk assessment and share it with necessary organizations					

Outputs and Activities		1st JFY 2009/2010	2nd JFY 2010/2011	3rd JFY 2011/2012	4th JFY 2012/2013	5th JFY 2013/2014
JCC				①	② ③	④ ⑤
②:with mid-term review mission (Jul. 2012), ③:with 3rd conference(Mar. 2013), ④:with final evaluation mission(Dec. 2013), ⑤:with final conference(Mar. 2014)						
Output 2:Flash-flood/debris-flow simulation models and early warning systems are developed adapting to hydrological and geological conditions in Croatia.						
2-1	Collection of existing hydro-meteorological data and analysis of rainfall-discharge characteristics in model sites					
	① Analysis of rainfall-discharge characteristics in 5 model sites (Rjecina River Basin, Dubracina River Basin, Moscenicka Draga, Imotski, Stinakarakaticka)					
2-2	Installation of rainfall measurement equipment, and collection of rainfall data					
	① Installation of rainfall measurement equipment at UR					
	② Collection and analysis of rainfall data					
2-3	Development of flashflood and debris flow simulation models in model sites					
	① Development of flashflood and debris flow simulation model (Hydro-Debris3D)					
	② Application the simulation model into 5 model sites (Rjecina River Basin, Dubracina River Basin, Moscenicka Draga, Imotski, Sutina-Karakasica)					
	③ Development of the flashflood and debris flow simulation model considering sustainable land management to mitigate water erosion ondifferent tillage treatments					
	④ Application of the simulation model considering sustainable land management to mitigate water erosion ondifferent tillage treatments					
2-4	Development of flashflood and debris flow early warning systems, and their application to the model sites					
	① Procurement and set up of radar to cover the 2 model sites (Rjecina River Basin, Moscenicka Draga)					
	② Fix the necessary standard data for establishment of early warning system at Rijeka (2 model sites; Rjecina River Basin, Moscenicka Draga)					
	③ Development the early warning system and share it with necessary organizations					

	Outputs and Activities	1st JFY 2009/2010	2nd JFY 2010/2011	3rd JFY 2011/2012	4th JFY 2012/2013	5th JFY 2013/2014
	JCC			①	② ③	④ ⑤
	②:with mid-term review mission (Jul. 2012), ③:with 3rd conference(Mar. 2013), ④:with final evaluation mission(Dec. 2013), ⑤:with final conference(Mar. 2014)					
	Output 3: Integrated landslide/flood hazard maps and land-use guidelines for landslide/flood risk mitigation are developed for study areas.					
3-1	Preparation of digital topography maps of the study areas and the model sites based on the photo interpretation					
3-2	Development of wide-area landslide risk assessment methods using the Analytical Hierarchy Process (AHP) method, and their application to the study areas					
	① Preparation of landslide inventory and risk assessment by applying the AHP method for 3 areas (Medvednica, Rjecina River Basin, Dubracina River Basin, Duce, Omis)					
	② Fix the contents of manual book of methodologies for landslide risk assessment					
3-3	Development of integrated landslide/flood hazard mapping technology, and formulation of integrated hazard map for the study areas and model sites					
	① Arrange the work scheme to synthesize the landslide and flashflood/debris flow					
	② Development of integrated landslide/flood hazard map for 2 model sites (Rjecina River Basin, Dubracina River Basin) by synthesizing the wide-area landslide risk assessment using AHP method (3-2), result of flashflood and debris flow simulation (2-3), landslide risk assessment on landslide dynamics (1-4), and prediction on landslide affected area (1-5)					
	③ Development of sepalate landslide/flood hazard map for 3 areas (Rijeka, split, Zagreb) by synthesizing the wide-area landslide risk assessment using AHP method (3-2), result of flashflood and debris flow simulation (2-3), landslide risk assessment on landslide dynamics (1-4), and prediction on landslide affected area (1-5)					
	④ Share the integrated and sepalate hazard map with necessary organizations					
3-4	Development of land-use guidelines formulation methodology, and formulation of land-use guidelines for disaster mitigation in study areas					
	① Fix the contents of land-use guideline for disaster mitigation for 3 areas (Rijeka, Zagreb, Split)					
	② Development of land-use guideline for 3 areas (Rijeka, Zagreb, Split)					
	③ Share the land-use guideline with necessary organizations					
3-5	Preparation of a manual of integrated landslide/flood hazard mapping, and a manual of land-use guidelines formulation that are applicable nation-wide in Croatia					
	① Fix the contents of manual of integrated landslide/flood hazard mapping, and a manual of land-use guidelines formulation that are applicable nation-wide in Croatia					
	② Development of manual of integrated landslide/flood hazard mapping, and a manual of land-use guidelines formulation that are applicable nation-wide in Croatia, and share them with necessary organization					

Original plan ←——→ Past activity ——— Revised plan - - - - ->

付属資料2

Annex 3: Schedule of Review Mission

Date	Mr. Miyamoto, Mr. Murakami	Mr. Okuda	JST members
25 Mon June	-	09:45 Narita – 14:30 Frankfurt 18:00 Frankfurt – 19:25 Zagreb	-
26 Tue	-	09:30 MZOS courtesy call / interview 14:00 Japanese Embassy courtesy call	-
27 Wed	-	10:00 Interview with EMO, City of Zagreb 13:00 Interview with Prof.Mihalić, UZM	-
28 Thu	-	09:30 Interview with WG3 13:30 Interview with Prof. Kisić, UZA	-
29 Fri	-	09:30 Field Visit (Kostanjek Landslide) 14:00 Croatian Water 15:30 Interview with WG1 of UZM	
30 Sat	-	Report preparation	
1 Sun July	-	Zagreb → Rijeka (by car)	
2 Mon		09:30 Interview with Prof. Ožanić, UR 13:00 Interview with WG2	
3 Tue		09:30 Interview with Prof. Arbanas, UR 13:00 Interview with WG1 of UR	
4 Wed		08:30 Field visit (Grohovo Landslide) 13:00 City of Zagreb 16:00 Rijeka → Split (by car)	01:00 Haneda – 06:10 Frankfurt 12:05 Frankfurt – 13:45 Splits (Mr.Sato, Dr.Tsukioka)
5 Thu		09:30 Interview with Mr. Miscevic, Ms.Knezic and WG4 13:00 Site Visit (Imotski)	
6 Fri		10:00 Courtesy Call to the Mayor of the Town of Omiš 11:00 Field visit (Omiš, Duće) 19:45 Split – 20:30 Zagreb	
7 Sat	09:45 Narita – 14:30 Frankfurt 15:55 Frankfurt – 17:15 Zagreb	Report Preparation	
8 Sun	09:00 Internal Meeting		
9 Mon	09:00 Pre-meeting with Japanese Researchers		
10 Tue	15:00 Comments from Croatian Researchers.		(Ms. Sakai arrived)
11 Wed	10:00 – 15:30 JCC		(Dr. Honkura arrived)
12 Thu	09:30- Site Visit (Kostanjek Landslide)		
13 Fri	10:00 Signature on the Minutes of Meeting at UZA 18:00 Japanese embassy		(Dr. Honkura, Mr. Sato leave)
14 Sat	09:05 Zagreb – 10:40 Frankfurt 13:50 Frankfurt -		
15 Sun	- 07:55 Narita		

Annex 4: List of Interviewees

1	Croatian Side		
1)	Counterparts		
1	Mr. Vinko Purgar	Head of the Department for Multilateral Cooperation, MZOS (PD)	26 June
2	Ms. Snježana Mihalić	Associate Professor, UZM (Deputy PM, Leader WG3, WG1)	27, 28, 29 June
3	Mr. Martin Krkač	Assistant, UZM (WG1)	27, 29 June
4	Mr. Pavle Ferić	Assistant, UZM (WG3)	27, 28 June
5	Mr. Željko Miklin	Adviser, Engineering Geologist, CGS (WG3)	28 June
6	Ms. Jasmina Martinčević	Researcher, CGS (WG3)	28 June
7	Mr. Laszlo Podolszki	Researcher, CGS (WG3)	28 June
8	Mr. Aleksandar Toševski	Assistant, UZM (WG3)	28 June
9	Ms. Petra Đomlija	Assistant, UR (WG3)	28 June
10	Ms. Sanja Bernat	External Researcher (WG3, WG3)	28, 29 June
11	Mr. Čedomir Benac	Professor, UR (WG3)	28 June
12	Mr. Ivica Kisić	Associate Professor, UZA (Project Coordinator)	28 June
13	Ms. Bojana Horvat	Chief Engineer, Water Management Institute, Croatian Water	29 June
14	Ms. Karolina Gradiški	Assistant, UZM (WG1)	29 June
15	Ms. Nevenka Ožanić	Vice-Rector for R&D, Professor, UR (Project Manager, Leader WG2)	2 July
16	Mr. Nino Krvavica	Assistant, UR (WG2)	2 July
17	Ms. Barbara Karleuša	Professor, UR (WG2)	2 July
18	Ms. Nevena Dragičević	Assistant, UR (WG2)	2 July
19	Mr. Elvis Žic	Assistant, UR (WG2)	2 July
20	Ms. Ivana Sušanj	Assistant, UR (WG2)	2 July
21	Mr. Željko Arbanas	Vice-dean for postgraduate studies, associate professor, UR (Leader WG1)	3, 4 July
22	Ms. Martina Vivoda	Assistant, UR (WG1)	3 July
23	Mr. Vedran Jagodnik	Assistant, UR (WG1)	3 July
24	Mr. Kristijan Ljutić	Assistant, UR (WG1)	3 July
25	Mr. Ivan Vrkljan	Vice President at Large, International Society for Rock Mechanics, UR (WG1)	3 July
26	Mr. Predrag Miščević	Professor, Faculty of Civil Engineering, Architecture and Geodesy (Leader WG4)	5 July
27	Ms. Snježana Knezić	Professor, US (WG4)	5 July
28	Mr. Goran Vlastelica	Assistant, US (WG4)	5 July
29	Ms. Suzana Antunović	Assistant, US (WG4)	5 July
30	Mr. Ivo Andrić	Assistant, US (WG4)	5 July
2)	Organizations		
1	Mr. Pavle Kalinić	Head of Office, EMO, City of Zagreb	27 June
2	Mr. Dalibor Belegić	Operations Officer, EMO City of Zagreb	27 June
3	Mr. Mario Hrgović	Senior Expert Associate Operations, EMO, City of Zagreb	27 June
4	Mr. Mladen Vukelić	Head, Local Government & Management Department, City of Rijeka	4 July
5	Mr. Marijan Vundać	City of Rijeka	4 Juy
6	Mr. Goran Šarić	City of Rijeka	4 July
7	Mr. Božo Meštrović	City of Rijeka	4 July
3)	Project Site		
1	Mr. Nenad Smolčak	Geomatika	29 June
2	Ivan Škaričić	Mayor of the Town of Omiš	6 July
2	Japanese Side		
1)	Project		
1	Mr. Hideaki Marui	Director, Research Institute for Natural Hazards and Disaster Recovery, Niigata University	7 June
2	Mr. Hideaki Komiyama	Project Coordinator	26 June
3	Ms. Ana Zakosek	Assistant to Project Coordinator	26 June
4	Mr. Chunxiang Wang	Associate Professor, Niigata University	26 June
5	Mr. Yosuke Yamashiki	Associate Professor, Disaster Prevention Research Institute, Kyoto University	6 July
2)	Japanese Embassy		
1	Mr. Masaru Tsuji	Ambassador Extraordinary and Plenipotentiary	26 June
2	Mr. Yuichi Inouye	Counselor, Embassy of Japan in Croatia	26 June
3	Mr. Takuya Momma	Embassy of Japan	26 June

Annex 5: List of Japanese Experts Dispatched

As of July 2012

Group	Name and Field	Arrival Date and Departure Date (number of days in Croatia)												Total Days
		FY2010(H22)					FY2011(H23)					FY2012(H24)		
		1st (6th)	2nd	3rd	4th	5th	1st (6th)	2nd (7th)	3rd	4th	5th	1st	2nd	
1	Kyoji SASSA	5/15-27 (13)	9/16-25 (10)	11/20-27 (8)			4/25-29 (5)	2/22-26 (5)						(41)
	Osamu NAGAI	5/19-27 (9)	7/13-23 (11)	9/14-28 (15)	3/17-27 (11)		5/25-6/4 (11)	10/10-21 (12)	12/13-19 (7)					(76)
	Hiroshi FUKUOKA	9/18-27 (10)					9/25-10/2 (8)							(18)
	Bin HE						4/25-29 (5)							(5)
	Kouji MATSUNAMI						9/26-10/2 (7)							(7)
	Gen FURUYA	5/19-27 (9)	7/12-23 (12)	9/14-28 (15)	11/21-27 (7)	3/16-27 (12)	5/22-6/4 (14)	7/16-30 (15)	9/6-10/2 (27)	10/10-21 (12)	1/27-2/5 (10)			(133)
	Naoki WATANABE						7/16-28 (13)	9/5-20 (16)	11/17-27 (11)	12/14-18 (5)	3/19-25 (7)	6/1-17 (17)		(69)
2	Yosuke YAMASHIKI	7/15-22 (8)	9/13-21 (9)	11/20-11/30 (11)			4/21-28 (8)	7/13-18 (6)	9/12-22 (11)			5/10-17 (8)	7/6-10 (5)	(66)
	Takahiro SAYAMA	7/17-23 (7)												(7)
	Tamotsu TAKAHASHI	9/13-21 (9)					9/12-22 (11)							(20)
	Shigeo FUJIKI	9/13-21 (9)	11/19-11/30 (12)	2/24-3/7 (13)			9/12-22 (11)					5/9-17 (9)		(54)
	Naoko KIMURA	11/17-26 (10)	2/24-3/7 (15)				4/21-27 (7)	9/12-22 (11)	12/13-18 (6)	1/23-2/13 (22)		5/5-13 (9)		(80)
3	Hideaki MARUI	5/20-25 (6)	7/12-23 (12)	9/14-28 (15)	11/20-27 (8)	1/16-20 (5)	5/22-27 (6)	7/16-28 (13)	9/7-11 (5)	9/16-21 (6)	12/13-19 (7)	7/8-14 (7)		(108)
		3/19-26 (8)					2/19-25 (7)	3/9-11 (3)						
	Chunxiang WANG	3/16-27 (12)					5/2-29 (28)	6/9-7/20 (42)	9/4-10/2 (29)	10/10-11/29 (20)	1/8-2/25 (49)	5/24-7/24 (62)		(242)
	Toyohiko MIYAGI	9/18-28 (11)					5/1-8 (8)	12/14-17 (4)						(23)
	Hiroshi YAGI	9/18-28 (11)					5/1-14 (14)							(25)
	Eisaku HAMAZAKI	9/18-28 (11)					10/10-21 (12)							(23)
														(997)
Long-term	Hideaki KOMIYAMA	11 May 2010 – 10 May 2013												

Annex 6: List of Trainings and Business Trip for Counterpart in Japan

As of July 2012

Scheme	Term	Name	Institution	Period (Departure and Arrival)	Visited Institutions and Course
Business Trip	Short-term	Ms. Snježana Mihalić	Associate Professor, UZM (WG3)	6 Nov 2011 – 26 Nov 2011	Tohoku Gakuin University, Niigata University, Yamagata University
				15 Jan 2012 – 28 Jan 2012	Kyoto University, ICL
		Mr. Željko Arbanas	Associate Professor, UR (WG1)	13 Nov 2011 – 26 Nov 2011	Tohoku Gakuin University, Niigata University, Yamagata University
				9 Jan 2012 – 28 Jan 2012	Kyoto University, ICL
				17 May 2012 – 27 May 2012	Kyoto University, ICL
		Mr. Ognjen Bonacci	Professor, US (WG2)	10 Apr 2012 – 15 Apr 2012	Niigata University
		Ms Nevenka Ožanić	Professor, UR (WG2)	10 Apr 2012 – 17 Apr 2012	Niigata University
		Mr. Ivica Kisić	UZA (WG2)	10 Apr 2012 – 17 Apr 2012	Niigata University
		M. Ivan Vrkljan	UR (WG1)	10 Apr 2012 – 17 Apr 2012	Niigata University
		Mr. Željko Miklin	CGS (WG3)	10 Apr 2012 – 17 Apr 2012	Niigata University
C/P Training	Short-term	Mr. Laszlo Podolszki	Researcher, CGS, (WG3)	6 Oct 2010 – 6 Dec 2010	Tohoku Gakuin University (aerial photo interpretation, AHP, ADCALC) Yamagata University (aerial photo interpretation) Niigata University (integrated landslide hazard map)
				18 Oct 2011 – 7 Dec 2011	Tohoku Gakuin University (aerial photo interpretation, AHP, ADCALC) Yamagata University (aerial photo interpretation) Niigata University (integrated landslide hazard map)
		Mr. Martin Krkač	Assistant, UZM (WG1)	6 Oct 2010 – 6 Dec 2010	Tohoku Gakuin University (aerial photo interpretation, AHP, ADCALC) Yamagata University (aerial photo interpretation) Niigata University (integrated landslide hazard map)
				30 Nov 2011 – 30 Jan 2012	ICL (shear test apparatus, simulation of landslide affecting area)
		Mr. Goran Vlastelica	Assistant, US, (WG1)	6 Oct 2010 – 6 Dec 2010	Tohoku Gakuin University (aerial photo interpretation, AHP, ADCALC) Yamagata University (aerial photo interpretation) Niigata University (integrated landslide hazard map)
		Mr. Sanja Dugonjić	Assistant, UR, (WG1)	6 Oct 2010 – 6 Dec 2010	Tohoku Gakuin University (aerial photo interpretation, AHP, ADCALC) Yamagata University (aerial photo interpretation) Niigata University (integrated landslide hazard map)
		Mr. Pavle Ferić	Assistant, UZM, (WG3)	18 Oct 2011 – 7 Dec 2011	Tohoku Gakuin University (aerial photo interpretation, AHP, ADCALC) Yamagata University (aerial photo interpretation) Niigata University (integrated landslide hazard map)
		Mr. Ivana Sušanj	Assistant, UR, (WG2)	6 Nov 2011 – 25 Jan 2012	DPRI, Kyoto University (sediment discharge, its flow and change flood/debris-flow analysis, 3D program software)
		Mr. Ivo Andrić	Assistant, US, (WG2)	6 Nov 2011 – 20 Dec 2011	DPRI, Kyoto University (sediment discharge, its flow and change flood/debris-flow analysis, 3D program software)
		Mr. Kristijan Ljutić	Assistant, UR, (WG1)	30 Nov 2011 – 30 Jan 2012	ICL (shear test apparatus, simulation of landslide affecting area)
				11 Apr 2012 – 1 Jun 2012	ICL
		Mr. Darija Bilandžija	Assistant, UZA, (WG2)	11 Jan 2012 – 14 Feb 2012	DPRI, Kyoto University (sediment discharge, its flow and change flood/debris-flow analysis, 3D program software)
		Ms. Vivoda Martina	Assistant, UR, (WG1)	11 Apr 2012 – 1 Jun 2012	ICL

Annex 7: List of Machinery and Equipment Provided

(FY2010)

No.	Item (brand/maker and model)	Allocation	Delivery date
1	Extensometer NetLG-501E	UZ	24 Jun
2	Network Controller NetCT-1E	UZ	24 Jun
3	RS232C Converter NetGW-1E	UZ	6/24
4	Hub NetHUB-1E	UZ	6/24
5	Water Level Detector DS-1	UZ	6/24
6	Water Level Data Logger NetLG-001E	UZ	6/24
7	Rain Gauge and Transmitter RS-1	UZ	6/24
8	Precipitation Data Logger NetLG-201E	UZ	6/24
9	Alarm Unit AL-Type AE	UZ	6/24
10	NetLG501 Container SUS2	UZ	6/24
11	Invar Wire	UZ	6/24
12	Invar Wire	UR	9/19
13	Communication Cable	UR	9/19
14	Extensometer NetLG-501E	UR	11/11
15	Network Controller NetCT-1E	UR	11/11
16	RS232C Converter NetGW-1E	UR	11/11
17	Hub NetHUB-1E	UR	11/11
18	Water Level Detector DS-1	UR	11/11
19	Water Level Data Logger NetLG-001E	UR	11/11
20	Rain Gauge and Transmitter RS-1	UR	11/11
21	Precipitation Data Logger NetLG-201E	UR	11/11
22	Alarm Unit AL-Type AE	UR	11/11
23	NetLG501 Container SUS2	UR	11/11
24	Extensometer NetLG-501E	UR	12/22
25	Hub NetHUB-1E	UR	12/22
26	NetLG501 Container SUS2	UR	12/22
27	Communication Cable	UR	12/22
28	Portable Direct Shear Apparatus MIS-233-1-71	UR	1/17
29	Constant-volume Direct Shear Test Apparatus MIS-233-1-72	UR	1/17
30	Water level pressure sensor (Schlumberger: Mini Diver)	UR	3/2
31	Water level pressure sensor (Fondriest:RuggedTROLL100)	UR	3/2
32	Weather station (Davis: Vantage Pro2)	UR	3/23
33	Current Meter (Teledyne RD:ADCP Sentinel (WHSZ1200))	UR	3/23
34	Surface current meter (RYUKAN WJ7661)	UR	3/2
35	3D photograph chart making and counting system (Kuraves-G2)	UR	3/2
36	Ion measuring instrument (HORIBA W-23XD)	UR	3/3
37	Ion measuring instrument (CTD Diver)	UR	3/2
38	VAIO Notebook PC VPCZ14 (data collection)	UR	3/2
39	Camera to collect photo data (Cannon KISS X4)	UR	3/2
40	Water level pressure sensor (Fondriest:RuggedTROLL100)	US	3/4
41	Weather station (Davis: Vantage Pro2)	US	3/4
42	Current Meter (Teledyne RD:ADCP Monitor (WHMZ1200))	US	3/4
43	Surface current meter (RYUKAN WJ7661)	US	3/4
44	3D photograph chart making and counting system (Kuraves-G2)	US	3/4
45	Ion measuring instrument (HORIBA W-23XD)	US	3/4
46	VAIO Notebook PC VPCZ14 (data collection)	US	3/4
47	Camera to collect photo data (Cannon KISS X4)	US	3/4
48	Piezometer KPB-500KPA	UR	4/6

(FY2011)

No.	Item (brand/maker and model)	Allocation	Delivery date
1	Reflection Stereoscope	Univ. of Zagreb	5/1
2	Cone penetration testing apparatus	Univ. of Zagreb	7/29
3	Extensometer NetLG-501E	Univ. of Zagreb	9/15
4	Inclinometer	Univ. of Zagreb	8/1
5	Laser Scanner	Univ. of Split	8/10
6	Landslide Simulation Software × 2	Univ. of Zagreb	5/26
7	A set of GPS and Total Station	Univ. of Rijeka	7/29
8	Extensometer Container	Univ. of Rijeka	Local procurement
9	Extensometer Pole	Univ. of Rijeka	Local procurement
10	Pole for GPS	Univ. of Rijeka	Local procurement
11	Boring for Borehole (Without Core, L=90m)	Univ. of Rijeka	Local procurement
12	Boring for Accelerometer(Without Core L=10m)	Univ. of Rijeka	Local procurement
13	Dell PC	Univ. of Rijeka	6/20
14	ArcGIS Software	Univ. of Rijeka	6/20
15	Workstation	Univ. of Rijeka	11/8
16	Inclinometer Casing	Univ. of Rijeka	6/20
17	Dell PC	Univ. of Zagreb	6/20
18	ArcGIS Software	Univ. of Zagreb	6/20
19	DEM (Altitude Data) of Model sites	Univ. of Zagreb	6/20
20	Aerial photographs	Univ. of Zagreb	6/30
21	Workstation	Univ. of Zagreb	8/25
22	Pole and Pulleys	Univ. of Zagreb	11/8
23	Copy Machine	Univ. of Zagreb	12/20
24	LPS Software	Univ. of Zagreb	8/25
25	Notebook PC × 2	Univ. of Zagreb	Local procurement
26	LIDER data of model sites	Univ. of Zagreb	Local procurement
27	Inclinometer Casing	Univ. of Zagreb	Local procurement
28	Dell PC	Univ. of Split	6/20
29	Tripod for Laser Scanner	Univ. of Split	9/23

Note) Procurement of No.7 was delayed to respond to VAT issues.

Annex 8: Operational Costs

Japanese Side (Currency: JPY×1,000)

Items	FY2010	FY2011	FY2012 (Planned)	Total
Dispatch of Japanese Researchers and Project Coordinator	34,283	33,840	37,707	105,830
Machinery and Equipment	73,871	54,545	43,377	171,793
Dispatch of Mission	478	853	4,372	5,703
Training of Croatian Researchers in Japan	357	8,218	17,890	26,465
Operational Expenses (Ordinary Expenses, Travel Expenses, Local Consultant Fee, Staff Salary, Meeting, etc.)	13,879	12,517	12,926	39,322
Others	2,423	1,837	2,344	6,604
Total	125,291	111,810	118,616	355,717

Croatian Side (Currency: HRK)

Items	FY2010	FY2011	FY2012 (Planned)	Total
Lump sum (MZOS)	360,000	360,000	360,000	
Salary for 9 researchers (MZOS)				
Costs for installation of equipment, insurance policy (MZOS)				
Travel allowance and costs (MZOS)				
Disbursement from universities				
Total				

The amount of budget the Croatian side used for project operation could not be confirmed during the mid-term review.

Annex 9: List of Counterpart Personnel

As of July 2012

	Name	Title and Organization	Role/Responsibility in the Project	Remarks (Period)
1	Vinko Purgar	Head of the Department for Multilateral Cooperation, Directorate for International Cooperation and European Integration, MZOS	Project Director	
2	Ognjen Bonacci	Professor, Faculty of Civil Engineering, US	WG2	Project Manager until March 2012
3	Nevenka Ožanić	Vice rector, Professor, UR	Project Manager, WG2 Leader	
4	Snježana Mihalić	Associate Professor, UZM	Deputy Project Manager, WG3 Leader	
5	Ivica Kisić	Professor, UZA	Project Coordinator	
6	Željko Arbanas	Vice Dean, Associate Professor, UR	WG1 Leader	
7	Predrag Miščević	Professor, US	WG4 Leader	
8	Snjezana Knezić	Professor, US	WG4 Administrator	
9	Ivan Vrkljan	Professor, UR	WG1	
10	Čedomir Benac	Professor, UR	WG1, WG2, WG3	
11	Sanja Dugonjić	Assistant, UR	WG1	
12	Kristijan Ljutić	Assistant, UR	WG1	
13	Martina Vivoda	Assistant, UR	WG1	Employed by MZOS budget for the Project
14	Vedran Jagodnik	Assistant, UR	WG1	
15	Martin Krkač	Assistant, UZM	WG1	
16	Karolina Gradiški	Assistant, UZM	WG1	Employed by MZOS budget for the Project
17	Sanja Bernat	External Researcher,, UZM	WG1	
18	Ivana Sušanj	Assistant, UR	WG2	Employed by MZOS budget for the Project
19	Elvis Žic	Assistant, UR	WG2	
20	Nevena Dragičević	Assistant, UR	WG2	
21	Barbara Karleuša	Vice Dean, Associate Professor, UR	WG2	
22	Nino Krvavica	Assistant, UR	WG2	
23	Igor Ružić	Assistant, UR	WG2	
24	Darija Bilandžija	Assistant, UZA	WG2	Employed by MZOS budget for the Project
25	Danko Biondić	Principal, CW	WG2	
26	Bojana Horvat	Officer, CW	WG2	
27	Pavle Ferić	Assistant, UZM	WG3	
28	Aleksandar Toševski	Assistant, UZM	WG3	Employed by MZOS budget for the Project
29	Petra Đomlija	Assistant, UR	WG3	Employed by MZOS budget for the Project
30	Željko Miklin	Researcher, CGS	WG3	
31	Laszlo Podolszki	Researcher, CGS	WG3	
32	Jasmina Martinčević	Researcher, CGS	WG3	Employed by MZOS budget for the Project
33	Mr. Ivo Andrić	Researcher, US	WG4	
34	Mr. Goran Vlastelica	Researcher, US	WG4	
35	Ms. Suzana Antunović	Researcher, US	WG4	Employed by MZOS budget for the Project

This is the list of personnel the mission was introduced, (and those were met in highlight), as counterparts during the mid-term review.

Annex 10: Result Grid (Progress of the Project)

As of July 2012

Project Purpose: Integrated landslide/flood hazard mapping technology and land-use guidelines formulation methodologies are developed for nation-wide application in Croatia.
Indicator 1 : Number of manual book to develop integrated landslide/flood hazard map (1 manual)
2 : Number of manual book to develop land-use guideline for landslide/flood risk mitigation (1 manual)

Activity	Progress of activities to date	Responsible Researchers	Level of Progress (%)	Way forward for completion
Output 1 : Methodologies for landslide risk assessment, prediction of affecting areas, and early warning systems are developed adapting to hydrological and geological conditions in Croatia. Indicator 1-1: Number of manual book of methodologies for landslide risk assessment (1 manual) 1-2: Number of model sites to develop a simulation for landslide predictions on dynamics (2 model sites; Kostanjek, Grohovo) 1-3: Number of model sites to establish landslide early warning systems (2 model site; Kostanjek, Grohovo)				
1-1 Development of a low-cost undrained shear test apparatus.	• The development of undrained shear test apparatus that can conduct landslide reproduction tests was completed. • Two Croatian researchers were trained in Japan (2 researchers × 2 months × 2 times) for the operation of and the tests with the apparatus. • Croatian researchers are proficient in conducting the tests for themselves. • The shear test apparatus shipped from Japan was at the custom office on 2 July, 2012, and is to be in Rijeka in the same week.	Sassa Arbanas	100%	• The apparatus is currently being shipped to Croatia and will be set up by late July 2012.
1-2 Soil tests using the shear test apparatus.	• Soil samples from model site were sent to Japan and tested with the undrained shear test apparatus.	Sassa Arbanas	70%	• Once the apparatus is set up in Croatia, Croatian researchers will conduct additional soil tests of samples from the model site.
1-3. Field survey and monitoring at landslide risk sites in model sites.	• Field surveys were conducted several times for the model sites. • As for the Grohovo model site (Rijeka), real-time comprehensive monitoring equipment was installed and the monitoring is going on. • As for the Kostanjek landslide model site (Zagreb), extensometer were installed and the monitoring has already began.	Sassa, Marui, Watanabe, Furuya, Nagai Arbanas, Vrkljan, Mihalić	60%	• For Kostanjek landslide, GPS and other monitoring system are currently being procured. The equipment will be set up by this fall, and the monitoring is scheduled to start.
1-4. Development of landslide risk assessment methods based on landslide dynamics, and their application to the model sites.	• The activity 1-4 and 1-5 are linked and to be undertaken concurrently. Methods of landslide risk assessment and the prediction of landslide affecting areas based on landslide dynamics have been basically developed, and there are already some examples of applications in other areas.	Sassa, Nagai Arbanas	40%	• Landslide risks assessment (1-4) and the prediction of affecting areas (1-5) will be carried out at model sites, based on parameters obtained through the soil tests in 1-2.
1-5. Development of methods for the prediction of landslide affecting areas, and their application to the model sites.	• (see activity 1-4)		40%	
1-6. Development of land slide early warning systems, and their application to the model sites.	• At Kostanjek model site (Zagreb), extensometers were installed, largely depending on which an early warning system is to be developed. • The monitoring is going on to accumulate data to feed into the establishment of early warning system.	Sassa, Nagai, Marui, Furuya Arbanas, Mihalić	40%	• Additional extensometers will be introduced to the model site, and their installation suitable for early warning system will be completed by this fall.
Output 2: Flash-flood/debris-flow simulation models and early warning systems are developed adapting to hydrological and geological conditions in Croatia. Indicator 2-1: Number of model sites to formulate a flash-flood/debris-flow simulation model (5 model sites; Rječina River Basin, Dubračina River Basin, Mošćenička Draga, Imotski, Sutina-Karakašica) 2-2: Number of model sites to establish a flash-flood early warning system at Rijeka (2 model sites; Rječina River Basin, Mošćenička Draga)				
2-1. Collection of existing hydro-meteorological data and	• Existing hydro-meteorological data are being collected, and rainfall-discharge characteristics in model sites are being analyzed.	Yamashiki, Kimura	50%	• The analysis will be continued with additional hydro-meteorological data.

analysis of rainfall-discharge characteristics in model sites.		Ožanić, Kisić		
2-2. Installation of rainfall measurement equipment, and collection of rainfall data.	• Rain gauges were installed at model sites in Rijeka and the precipitaion data are being collected.	Yamashiki, Fujiki, Kimura Ožanić, Kisić	40%	• The precipitation data collection will be continued. • Rader rain gauge will be set up at the University of Rijeka in fall this year.
2-3. Development of flashflood and debris flow simulation models in model sites.	• The development of flashflood and debris flow simulation model (Hydro-Debris3D) is completed.	Yamashiki, Fujiki, Kimura, Ožanić, Kisić	50%	• The simulation model will be applied to the model sites in the second half of this year.
2-4. Development of flashflood and debris flow early warning systems, and their application to the model sites.	• The flashflood and debris flow early warning systems are being developed.	Yamashiki, Fujiki, Kimura, Ožanić, Kisić	40%	• The early warning system will be installed at the model sites in the second half of this year.
Output 3: Integrated landslide/flood hazard maps and land-use guidelines for landslide/flood risk mitigation are developed for study areas. Indicator 3-1: Number of study areas to develop an integrated landslide/flood hazard map (3 areas; Rijeka, Split, Zagreb) 3-2: Number of study areas to develop land-use guidelines for landslide/flood risk mitigation (3 areas; Rijeka Split, Zagreb) Note): Indicator 3-1 for Split area means two individual hazard maps for landslide (rock fall) and flashflood. Note): Indicator 3-1 for Zagreb area and Moscenicka Draga (in Rijeka area) means individual hazard maps for landslide and flash flood depending on model site conditions				
3-1. Preparation of digital topography maps of the study areas and the model sites based on the photo interpretation.	• Topography interpretation for model sites and surrounding areas, mainly based on aerial photos, were completed. • Digital maps were prepared for sites as necessary. • For some sites, digital topography maps were created based on LiDAR scanning with airplane.	Sassa, Nagai, Wang,Furuya Arbanas, Mihalić	50%	• Topography interpretation for the study areas based on aerial photos will be completed in 2012.
3-2. Development of wide-area landslide risk assessment methods using the Analytical Hierarchy Process (AHP) method, and their application to the study areas.	• Basic topography and geological survey were conducted several times for the application of AHP to landslide hazard mapping in Croatia. • Evaluation criteria for AHP application were prepared. • The drafts of manuals to develop landslide inventory and risk assessment were prepared.	Hamazaki, Marui, Furuya, Wang Mihalić, Arbanas, Podolszki	50%	• Landslide inventory and risk assessment willbeprepared, by applying the AHP method, for targeted sites in Croatia in the latter half of 2012. • The drafts of manuals will be refined.
3-3. Development of integrated landslide/flood hazard mapping technology, and formulation of integrated hazard maps for the study areas and model sites.	• Integrated hazard map (3-3) will be prepared by synthesizing the wide-area landslide risk assessment using AHP (3-2), results of flashflood and debris flow simulation (2-3), landslide risk assessment on landslide dynamics (1-4), and prediction on landslide affecting areas (1-5). • At present, a work arrangement is under investigation to synthesize the above results.	Marui, Sassa, Yamashiki, Wang, Furuya, Watanabe, Hamasaki, Nagai Ožanić, Arbanas Mihalić, Kisić, Vrkljan	20%	• A work arrangement to synthesize all the results will be elaborated in 2012. • A draft of integrated landslide/flood hazard map for model sites will be developed in the first half of the 2013.
3-4. Development of land-use guidelines formulation methodology, and formulation of land-use guidelines for disaster mitigation in study areas.	• Land-use guidelines (3-4) will be prepared based on the integrated landslide/flood hazard map (3-3). • At present, contents that should be included in the land-use guidelines is under investigation.	Marui, Sassa, Yamashiki, Herath, Wang, Furuya, Watanabe, Hamazaki, Nagai Ožanić, Arbanas, Mihalić, Kisić, Vrkljan	10%	• Drafting of land-use guideline will start in the first half of 2013.
3-5. Preparation of a manual of integrated landslide/flood hazard mapping, and a manual of land-use guidelines formulation that are applicable nation-wide in Croatia.	• Manuals (3-5) will be prepared based on the land-use guidelines (3-4). • At present, contents that should be included in the land-use guidelines is under investigation.	Marui, Sasssa, Yamashiki, Herath, Wang, Furuya, Watanabe, Hamazaki, Nagai Ožanić, Arbanas, Mihalić, Kisić, Vrkljan	10%	• Drafting of manuals will start in the second half of 2013.

Annex 11: Result Grid (Pilot Site)

<table>
<tr><th>Study Area
WG</th><th>Zagreb
City of Zagreb (county) (640km²)</th><th>Rijeka
Primorsko-Goranska County (3,800km²)</th><th>Split
Split-Dalmatian County</th></tr>
<tr><td>WG 1
Detailed Landslide Investigation

Prof. Arbanas (UR)</td><td>Kostanjek Landslide (1.2km²) - Medvednica Hilly area.
1.2 One borehole for soil sampling and inclinometer (100m, Feb 2012)
1.3 (Martin Krkač)<table><tr><th>Equipment to be installed</th><th>Already installed</th></tr><tr><td>15 GPS</td><td>0</td></tr><tr><td>9 extensometers</td><td>5</td></tr><tr><td>3 piezometers</td><td>0</td></tr><tr><td>6 accelerometers</td><td>0</td></tr><tr><td>3 water level sensors in well</td><td>3</td></tr><tr><td>2 water level sensors in weirs</td><td>2</td></tr><tr><td>1 rain gauge</td><td>1</td></tr><tr><td>1 inclinometer casing</td><td>1</td></tr></table>• GPS and extensometers will be set up in one month, currently waiting for the delivery of poles for extensometer.
• Setting up piezometers requires drilling and UZM need to work with suppliers.</td><td>Grohovo Landslide (0.5km²) - Rječina River Basin
1.2 Two boreholes for soil sampling (20m and 25m, May 2011)
1.3<table><tr><th>Equipment in place</th><th>Additional installation</th></tr><tr><td>10 GPS</td><td></td></tr><tr><td>15 extensometers (3 short span)</td><td>1 extensometer</td></tr><tr><td>4 vertical extensometers</td><td></td></tr><tr><td>1 total station</td><td></td></tr><tr><td>25 prisms</td><td></td></tr><tr><td>4 pore pressure gauge</td><td></td></tr><tr><td></td><td>1 water level gauge</td></tr><tr><td></td><td>1 rain gauge</td></tr></table>• Equipment was in place in Aug - Sep 2011.
• 1 extensometer just arrived from Japan on 3 July 2012.
1.6
• Data transmission of GPS was being done with existing system.
• Downloading data from extensometer and pore pressure gauge at sites takes lots of time. It requires for all the data to be automatically transmitted and connected for EWS.</td><td>N/A</td></tr>
<tr><td>WG 2
Flash-floods and debris-flows

Prof. Ožanić (UR)</td><td>N/A
• Zagreb is not likely to have flush flood.
• There is no Hydrologist in UZM.</td><td>Rječina River Basin (22km²)
2.1 - 2.2(60%, Elvis Zic)
• Equipment in place
1 weather station
• Another new meteorological station will be set up in August 2012.

Dubračina River Basin (Salt Creek) (43km²)
• Dominant natural hazard are landslide and erosion, and not flash food
2.1 - 2.2 (90%, Ivana Sušanj)
• Equipment in place
11 mini divers (water level pressure sensor)
2 weather stations

Mošćenička Draga (11km²)
• There are no landslides, but erosion.
2.1 - 2.2 (70%, Igor Ružić)
• Equipment in place
7 rugged TROLL100 (water level pressure sensor
1 rugged TROLL100 (for calibration)
2 weather station

2.3 – 2.4 (45%, Ožanić, Karleuša, Dragičević, Krvavica)
• Flash-flood/debris flow simulation model for Salt Creek (Dubračina River Basin) is completed (Application of solfec program written in Python Cod).
• Radar (Furundo) will be set up and connected to EWS.</td><td>N/A</td></tr>
</table>

WG 3 Regional landslide Investigation Prof. Mihalić (UZM)	**Hilly area of the Medvednica Mountain** (180km^2) 3.1 – 3.2 – 3.3 • Landslide inventory based on aerial photo interpretation and landslide susceptibility analysis using AHP methodology (55%, Podolszki) • Landslide inventory based on LiDAR interpretation and landslide susceptibility analysis using statistical analysis methodology (45%, Ferić) • Landslide causal factor – geological (lithology) based on soil/rock sampling from Kostanjek and mineralogical analysis. (10%, Martinčević) • Landslide causal factor – morphological and land-cover based on spatial analysis of DEM and aerial photos. (40%, Ferić) • Output is to be a landslide susceptibility/hazard map, not including flash-flood analysis. 3.4 • Output is to be a land-use guideline taking into consideration the landslide maps (inventory and susceptibility) (Mihalić, Arbanas) 3.5 • Output is to be a manual for production of landslide inventory and susceptibility maps for use in the system of land-use and emergency management. (Mihalić, Arbanas)	**Rječina River** (22km^2) 3.1 – 3.2 • Landslide inventory based on aerial photo interpretation (Japanese researchers). It is necessary to check additionally. (50%, Đomlija) • Landslide causal factor – geological (lithology) based on compilation of existing data/maps (25%, Đomlija) • Landslide causal factor – morphological and land-cover based on spatial analysis of DEM and aerial photos (25%, Đomlija) • Landslide inventory based on LiDAR interpretation and landslide susceptibility analysis using statistical analysis methodology (20%, Đomlija) 3.3 • Integrated map will be developed when flash-flood map is derived in GIS optionally from WG2. 3.4 – 3.5 • Guideline and manual (Benac, Mihalić, Arbanas) **Dubračina River Basin** (43km^2) 3.1 – 3.2 – 3.3 • Landslide inventory based on aerial photo interpretation (Japanese researchers). Not appropriate methodology due to the scale of photos (100%, Toševski) • Landslide causal factor – geological (lithological) based on soil/rock sampling and geotechnical and mineralogical analysis (10%, Toševski) • Landslide causal factor – morphological and land-cover based on spatial analysis of DEM and aerial photos (40%, Toševski) • Landslide inventory based on LiDAR interpretation and landslide susceptibility analysis using statistical analysis methodology (20%, Toševski) • Output is to be a landslide susceptibility/hazard map, not including flash-flood analysis. 3.4 -3.5 • Same as those of Medvednica Mountain, Zagreb.	N/A
WG 4 Split for all outputs Prof. Miscevic (US)	N/A	N/A	Landslide (Output 1 & Output 3) **Duće** (0.1km^2), **Omiš** '(0.3km^2) • Ground-based scanning of the model sites with portable LiDAR equipment once a month since September 2011. • WG4 plans to buy a software in 2012 to compare the scanned data in a constant way. • Hazard assessment for both sites will be performed with methodology already developed at US. The methodology which couples GIS and MCA has been adapting to the Project's pilot sites&areas and chosen multicirteria method (AHP). • After preliminary results from Omiš and Duće sites, areas affected by rockfalls will be appraised.

			Flash Flood (Output 2) **Imotski** – Blue Lake, Red Lake (0.14km^2), • Mouth of Sutina River located the town of Omiš. • In Red Lake in Imotski an hourly data set is obtained for the whole hydrological year. The analysis of collected data resulted with publication in international scientific journal. **Sutina-Karakašica** (13km^2) • The data record on water level and water temperature in the Sutina Karakašica basin is present since March of 2011 at 5 different stations. • Meteorological data is provided by Meteorological and hydrological institute of Croatia, a governmental service. • Event based measurements on water quality are carried out on different points of studied watershed.

Annex 12: Evaluation Grid based on the 5 Criteria

Evaluation Criteria	Evaluation Question	Source	Findings through Questionnaire, Interview and relevant reports
1. Relevance	1.1 National and development policies/strategies associated with disaster mitigation of landslide and floods in Croatia	MZOS	• Protection and Rescue Plan for Croatia (Official Gazette 96/10) • Evaluation of Endangerment of Croatia from Natural and Technological Disasters, Croatian National Platform for Disaster Risk Reduction, Protection and Rescue Law (Official Gazette 127/10) • Law on Protection from Natural Disasters (Official Gazette 73/97) • Various international agreements on protection and rescue in case of natural disaster
	1.2 Changes of mandate/structure and staff of implementing agencies that may affect the Project implementation	UR	• MZOS issued a letter dated 28 March 2012, announcing the change of Croatian administrative personnel from Annex V of the R/D: • Prof. Nevenka Ožanić, Dean of the Faculty of Civil Engineering, UR, is a new Project Manager, • Assoc. Prof Snjezana Mihalić, Faculty of Mining, Geology and Petroleum Engineering, UZ, is a Deputy Project Manager. • Additional working group 4 was created in order to accelerate the research activities in Split by direct contact between the project manager and the leader of WG4. • Prof. Ognjen Bonacci (former Project Manager) will be retired in Oct. 2012.
	1.3 Alignment of the Project with the needs and expectation of the implementing agencies. (Research plan and priority)	MZOS	• In a social context, the project would fall within a scope of duties performed by National Protection and Rescue Directorate. On the other hand, this is a scientific project and it's under the authority of MZOS • MZOS doesn't have a comprehensive disaster management study.
		EMO	• The Kostanjek is the largest landslide in Croatia. The project initiated the cooperation between the EMO and UZM. • There are many hazard maps prepared, but there is so far only one official landslide inventory map, which is available in the internet. The city, however, hasn't utilized the map. • https://geoportal.zagreb.hr/Karta • According to the one official landslide inventory, there are 770 landslide areas in Zagreb. The Kostanjek is displacing from 1980 over more than 30 years and the city has set some stabilizations. Kostanjek is not a catastrophic landslide, usually very slow, but EMO neither know a proper management nor have standardized operational procedures. EMO doesn't t have data, either. • The physical plan of the City of Zagreb should include a landslide inventory map which is based on more scientific research. • The city doesn't have a land-use guideline taking landslide into consideration. There is one available in Official Gazette, but it is for the construction and not incorporating risk assessment. This guideline should be revised reflecting this project. http://www1.zagreb.hr/SIGlasnik.nsf/VPD/45D18FA1A71D6EB3C1256DDD00491EA1?OpenDocument&19
		CW	• CW is responsible for all the water body in Croatia. The project is receiving necessary data from CW, and will also provide CW with new data from the project.
		City of Rijeka	• City of Rijeka has a land use guideline for construction purpose, but it does not contain a hazard map. There is no rule/regulation on torrential flow. • Spatial Planning Document of the City of Rijeka is available on the open site. http://www3.rijeka.hr/gup1/framesetup.asp
		UR	• Research assistants can get a job, be educated, have a dissertation topic, acquire knowledge through trainings in abroad, work as a teaching assistant, cooperate with other researchers, and publish scientific papers. • The results of the project will be beneficial to local communities, so the faculty has an opportunity to improve the professional cooperation between local authorities and faculty itself.
	1.4 Priority areas of the Government of Japan for the development assistance to Croatia.	JICA	• The Initiative for Disaster Reduction through ODA was announced at the United Nations World Conference on Disaster Reduction held in Kobe, Hyogo prefecture, in January 2005. • JICA's Issue-specific Guideline for Disaster Reduction sets out "building disaster-resilient communities and societies" as one of development strategy goals to be achieved
	1.5 Appropriateness of the selection of model	UZA	• The Kostanjek is the largest landslide in Croatia and also one of primal concerns of EMO.

	sites		・ At present, the physical plan of the City of Zagreb doesn't include the assessment of landslide risk
		UR	・ In the Adriatic Sea catchment area, there are no big rivers. It is all torrent area. ・ The researchers from Croatian side proposed the model site. (pilot areas) ・ At the downstream of Rječina River located the city of Rijeka, and the flood waters can cause significant damage to the city; it could be an even higher hazard in case of concurrent rock avalanche at Grohovo landslide.
		US	・ The model sites in Split are Omiš and Duće where a rock fall is quite frequent, causing damages and posing threats to many houses and population in the towns
2. Effectiveness	2.1 Progress of Output 1 – Methodologies for landslide risk assessment, prediction of affecting areas, and early warning systems are developed adapting to hydrological and geological conditions in Croatia	MZOS	・ Once equipment is in place, then scientist will start putting out various achievements (measurement and publication).
		UR, UZM	・ For early warning system, local government must define procedures. ・ (Activity 1.1).100% (The shear test apparatus shipped from Japan is at the custom office on 2 July, and is to be in Rijeka in that same week) ・ (Activity 1.2) 30% (Soil samples from Kostanjek and Grohovo were sent to Kyoto. Two young researchers were in Japan for short-term training on soil testing. 30%, not in term of the amount to be tested, but in terms of data to help landslide analysis. Soil in Kostanjek is complex) ・ (Activity 1.3: equipment) The installation of equipment has completed more than 90% at Grohovo site. This year, the installation of equipment at Kostanjek will be undertaken, more than 80% of equipment are ready for installation and with Seismographs at the end of September, the installation will be completed. ・ (Activity 1.3: field survey) For Grohovo, many field surveys were conducted in 1998 through 2000. As for Kostanjek, the survey will continue as Kostanjek is wider and more complicated than Grohovo. ・ (Activity 1.4) In Grohovo, basic methodology for flysch formation analysis is completed 80%. Testing by the shear test apparatus is necessary for confirmation. Kostanjek (0～30% progress) is deep sheeted, different geological formation and monitoring results are required. One year from now, enough data may have been obtained. ・ (Activity 1.5) same as (Activity 1.4)
	2.2 Progress of Output 2 – Flash flood/debris-flow simulation models and early warning systems are developed adapting to hydrological and geological conditions in Croatia.	CW	・ Croatian Water is only providing hydrological and meteorological data to the project, and so far having no feedback. ・ CW doesn't have a flood hazard map at present. ・ In Daruvar (dominant agricultural area), the Faculty of Agriculture established an experimental field to measure CO^2 on climate change and has been conducting a research on flood mitigation.
		UR	・ Levels of progress for each activity are: ・ 2.1) 50%, ・ 2.2) 50%, ・ 2.3) -, Flash-flood/debris-flow simulation model for Salt Creek (Slani potok-Dubračina area) is competed (Application of Solfec program written in Python Cod). ・ Formulation of a model requires inputs of data ・ 2.4) – Currently preparing all papers and permits for Rader (Furundo) installation. ・ Three scenario can be considered; 1) flash-flood, 2) flash-flood + landslide, 3) flash-flood + landslide + dam breakdown ・ Activities of WG2 will move faster in the 2nd half as WG2 now fully realizes what need to be done – clear presentation of main objectives, specific objectives, research program and expected results and impacts. At the beginning of the project, WG2 didn't have a clear picture, but now WG2 does. ・ Verification of the developed model requires measurement and data of flashflood and debris flow, which don't happen so often. Model verification is not likely within this project period.
	2.3 Progress of Output 3 – Integrated landslide/flood hazard maps and land-use guidelines for landslide/flood risk mitigation are developed for study areas.	MZOS	・ As far as the City of Zagreb is concerned, due to the involvement of the EMO, the authority is sure to incorporate the handbook and guideline to their policy and regulation. ・ The Minister of MZOS is from Rijeka, and he is aware of this project. Even though MZOS doesn't have interest in interfere with the city, scientists do - they can advise to the city. ・ The handbook and guideline are more important than scientific publication.
		EMO	・ As for the contents of guideline, it is difficult for EMO to make a specific request at present.

			• EMO, established in May 2008, has 21 staff members, responsible for all Zagreb's natural disaster, among which an earthquake is the major disaster. EMO has a plan of operation, but doesn't have a standardized operational procedure. The budget is increasing as EMO is still a new institution. • Before the project, EMO was not very aware of landslide, and EMO's staff doesn't know very much about landslides. • The application of landslide guideline is not at the national level, but local level matter. The City Council needs to approve the landslide assessment and protection plan.
		UZM	• As the 1st promotion for public awareness, we held a press conference at the time of the equipment installed. • We are now planning the 2nd promotion - 2nd press conferences – to announce the system established, not for educational but informative purpose with participants from national level, too.
		UR	• Output 3 of Dubračina River basin is to be the integrated landslide/hydrological condition map – hydrological condition, not as a map but an equation with about 7 parameters such as precipitation, water level, air pressure, etc. • It is now possible to prepare a plan with timeline for the next two years as everything is clear. Rader installation will be a milestone event. • UR held a presentation meeting to the City of Rijeka on 21 March 2011, also on 11 May 2012 on Mošćenička Draga, and on 15 My 2012 on Dubračina (Salt Creek)
		US	• Split-Dalmatian County is supposed to revise the current physical master plan. • Officials of county are also architect and geologist, in the same area of researchers, US. • Two meetings were held with the town of Omiš
	2.4 Prospect of the Project Purpose to be achieved by the end of project period. (Prospect of actual implementation of research results)	MZOS	• The project start-up was delayed, but a major achievement to date is 1) the good cooperation among Croatian universities and good team work, and 2) involvement of local authorities. • Issues are 1) better coordination regarding necessary equipment, and 2) Clearer role of various players on Japanese side.
		UZ, UR, US	• Project is most likely to be able to achieve its purpose.
3. Efficiency	3.1 Clarity of the overall plan of the Project. Master Plan PO	UR, UZM	• Activity of WG1 is very clear from the beginning.
		US,	• Different from the beginning of the Project, now, the activities and goal is very clear. • Plan is necessary to prepare the activities well and conduct monitoring.
	3.2 Inputs of Japanese side – dispatch of experts/researchers.	UZM	• Prof Marui and Furuya, when visiting Croatia, are working on administrative issues. • Dr. Wang is working on spatial analysis all the time.
	3.3 Inputs of Japanese side – trainings.	UZM, US	• Trainings were very useful, narrow and focused. • Trainings for shear test apparatus was very good, • "Portable ring shear apparatus ICL-1 Manual" (Kyoto 2012) was prepared.
	3.4 Inputs of Japanese side – provision of machinery/equipment.	MZOS	• Sometimes wrong amount in donation letters, and until recently no distinction in donation letter whether it's local purchase or purchase in Japan. • Until recently local purchase were not in line with national VAT (25%) regulation, and purchase in Japan were not in line with needs in the field (e.g. need for heavy-duty laptops for field research). • It's unclear who decide on the Japanese side what is needed (JICA, JST, Niigata University?) • We didn't know the administration of implementing an international project. This is a delay of administration, not a delay of procurement. Researchers applied a purchase but we didn't know that tax extensive exemption is required. Regarding local purchase for universities, it requires of invoice, donation letter, and VAT exemption letter. Now it's been settled and the delay will not recur any more. • We still have unsettled payments from the 2nd workshop in December 2011 (travel allowance paid to participants were less than expected amount). It was very embarrassing; yet still don't know who can settle the difference, JICA, JST or Niigata Univ. • For the 1st workshop in November 2010, the project paid travel cost, allowance, and honorarium. MZOS is willing to pay only for accommodation and fee of train 2nd-class for researchers. Project Director should be consulted with these administrative as well as substantial matters of a workshop beforehand, rather than just being invited as a speaker.

		UR	• Equipment for Grohovo was delivered in the summer holiday season, 2011. It was very hot and civil works for installation was off for holidays.
	3.5 Inputs of Croatian side – assignment of counterpart personnel (University researchers and other staff, Officials of municipalities)	UZA	• New WG4 was established in order to speed up research activities in Split. • MZOS supports the salary of 9 young researchers, who are all PhD candidates.
	3.6 Inputs of Croatian side – share of operational costs.	MZOS	• MZOS finances: 1) Lump-sum of 360,000 Kuna / year 2) payment for 9 young researchers (their salaries are paid by MZOS, and they are supposed to get doctors' degree), 3) Traveling of researchers, and 4) payment for equipment installation and maintenance.
		UR	• It is very important to finish the installation of equipment, in particular at Kostanjek. • Shipment and installation of equipment cost money. In 2010, no equipment and budget set aside were not used. In contrast, in 2011, lots of equipment, requiring budget, too. For 2012 and 2013, we don't know and it's not easy to prepare budget on Croatian side. We only know the equipment for the next six month.
	3.7 Communication (periodical and daily) for project coordination – between JICA and implementing agencies.	UZ UR	• 1st JCC was held on 23rd Feb 2012 at the Faculty of Agriculture, UZ. • The Project held two international workshops. 1) 1st WS at Dubrovnik in November 2010 (paid by JICA budget) 2) 2nd WS at Rijeka University in December 2011 (paid by JST budget through Niigata University) 3) 3rd WS is planned in Zagreb in February 2013, inviting more participants from local administration, EMO, more public promotion.
		UR	• It is not clear what a project manager can manage, equipment, budget? The Croatian side should be more informed.
		US	• Sometimes, it takes time to receive response from Japanese researchers via email.
	3.8 Communication (periodical and daily) for project coordination – among Croatian agencies.	MZOS	• The Project has a very good cooperation with the EMO in the City of Zagreb. The project will have two major outputs: 1) guideline and handbook, 2) academic and scientific findings. The guidelines and handbooks will be used by the local authority.
		UZM	• EMO are providing permissions to install monitoring system in city lands (as for private lands, private permission), and may provide financial support to maintain installed equipment. In return, UZM can introduce new data to city's land management. • In Jan 2012, there was a conference in Kyoto, Japan, and ICL and EMO financed researchers travel.
		UZ, UR	• At the 1st JCC, Representative of local communities (City of Rijeka, City of Split, and EMO of City of Zagreb) attended as observers.
	3.9 Methods and contents of technology transfer from JICA experts to Croatian researchers.	UR	• Training in Japan has been very important for young researchers, who were introduced to landslide issues and exposed to a new apparatus. • There are no similar apparatus in Croatia.
	3.10 Promoting/hindering factors that may have affected the Project implementation.	MZOS	• Complete lack and understanding of what is needed at the start of project. Project started on a wrong premise that no funds or involvement from MZOS are necessary. • Croatian side is to need an agency which could appoint project director and do extra work for the project. • Project Director (Croatian Side) and Project Coordinator (Project Coordinator) had to fill in the gap between the preliminary study and actual implementation. Because of the gap, a year was lost at the project start-up, but the job was done and the Croatian sides are satisfied, expecting now to make it up.
		UR	• All researchers can attend the once-a-year workshop, but probably meeting at every six-month, not only among WG leaders but all researchers, can facilitate the cooperation among WG2 and other WGs.
4. Impact	4.1 Any positive/negative impact brought about by the Project (Policy and research development, Poverty reduction, environmental protection, and gender equality.)	MZOS	• Positive impact is the research development of young researchers. Also, raised awareness of the public as well as the commitment of municipalities.
		UZA	• 9 PhD students being trained in Japan is one of best effects in Project.
		Japanese researchers	• Through international conference organized by the Project, research results and findings on landslides and flash-floods/debris-flow are shared among researchers from neighboring countries such as Serbia,

			Bosnia-Herzegovina, Kosovo, Macedonia, and Slovenia, where studies on disaster risk management are important and required for societies.
	4.2 Activities beyond the scope of Master Plan.	US	• The town of Omiš prepared a project document to contain potential rock falls in the town. • The leader of WG4 of the Project is a reviewer of the project document, and expects that the RiDAR scanning conducted in the Project will also help identify critical points of potential rock falls, and will contribute to the implantation of the town's project. • The Ministry of Finance of Croatian Government will finance the project once the project document is signed.
	4.3 Ongoing/possible collaborations, if any, with multi/bi-lateral development partners (UN, NGO, civil society, and private sector).	US	• Project of rockfall protection in Omiš city (Conex-st, Split) • Collecting of meteorological data (Meteorological and Hydrological Service, Croatia) • Maintenance and meteorological station (CROMETEO, NGO)
5. Sustainability	5.1 Prospect from institutional viewpoint (Legislation and policies Rule and regulation, standard operational procedures Responsible organization and division, Participation of stakeholders)	MZOS	• As far as MZOS is concerned, problems are now solved and the project is going well. • Dissemination seminars for local communities are required.
	5.2 Prospect from technical viewpoint (Technology/knowledge and its update Equipment and its maintenance Educational materials Training opportunities)	UZM	• Follow-on maintenance of equipment after the end of the Project is currently being explored by the implementing universities. • The maintenance of installed equipment is also discussed among EMO and UZM. An idea is that at the end of the Project UZM could hand over the equipment to the City of Zagreb, which could bear the costs for its maintenance while UZM could provide constant inspection of the equipment and provide the City with monitoring data collected thereof.
		UR	• Equipment installed in model sites is currently well maintained; a container of inclinometer casing, pore pressure gauge and GPS, a fence around solar panels, concrete base of a pole for the prism, and insurance policy for equipment. MZOS bears the costs of these protective and maintenance measures. • Possibility of follow-on maintenance could be: New proposal to EU, MZOS Local authority, City of Rijeka Croatian Water
	5.3 Prospect from Human Resource viewpoint (Number of staff, Assignment of responsible personnel, His/her qualification and motivation, New recruitment and volunteer)	UZOS	• Currently, nine young researchers, doctoral students, are sponsored by MZOS to work for the Project. It will lead to a significant human resource capacity when they obtain doctorates.
	5.4 Prospect from Funding viewpoint (Budget allocation for the activities, External financing from donor/private sector)	MZOS	• At present, MZOS has prepared a counter-budget, financing a part of project operation. • The prospect of sustainability is more than medium, except for its financial aspect considering the current economic situation. Croatian economy growth recording negative and resulting budget constraints. • There are funds available from Croatian Science Foundation (HRZZ)