Handbook: 1. Structural Upgrading - Version 0.0

Process step: 2. RVS

Engineering Inspection Protocol RVS

2a

Building type: CC1b

NAM ref: EP201311204131

Groningen Earthquakes - Structural Upgrading

Process Management Model CENTRE SAFE HOUSING (CVW)

HANDBOOKS LARGE SCALE IMPLEMENTATION

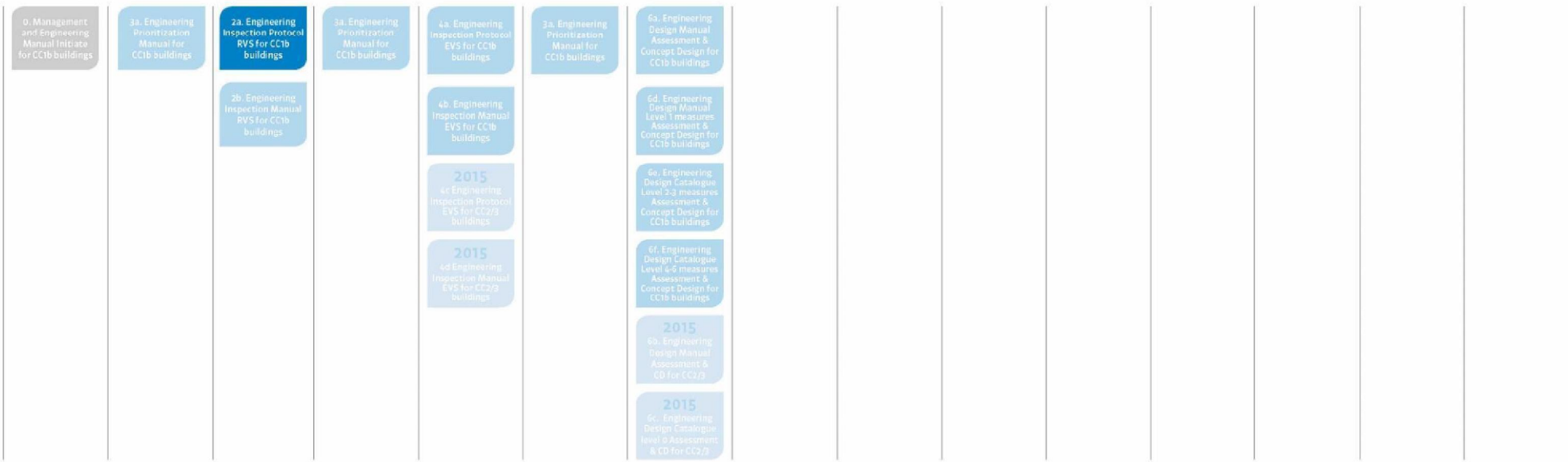
VERSION 0.0

Handbook 0 Introduction Handbook 1 and 2

Handbook 1 Structural Upgrading - Version 0.0

Management Protocols

Engineering Protocols



Handbook 2 Damage Handling

Contents

Preface

Handbook 1 Structural Upgrading is prepared by Arup for the Nederlandse Aardolie Maatschappij (NAM).

Handbook 1 is a collection of protocols, manuals and catalogues that underpin the process of large scale implementation of structural upgrading of existing buildings.

Users of Handbook 1 will be third parties responsible for large scale implementation of structural upgrading of existing buildings.

Any methodology or guidance prepared by Arup for Handbook 1 takes into account the particular instructions and requirements of NAM and addresses their priorities at the time. Priorities are likely to change over time and this guidance will need to be updated accordingly.

The protocols, manuals and catalogues in Handbook 1 Version 0.0 are indicative only and they represent the preliminary knowledge developed at the date of issue for the assessment and structural upgrading of Consequence Class 1b (CC1b) buildings in the Groningen Region.

The protocols, manuals and catalogues have been produced in the absence of Dutch national regulations and design codes relating to seismic issues.

Due to the parallel execution of activities required by the compressed programme, the guidelines in this Handbook will be updated on a 6 monthly basis until Q1 2017 and must be read as incomplete and /or containing inaccuracies until that date. After that date they will need to be further reviewed and updated on a periodic basis to reflect developments in knowledge, methods and the regulatory regime.

Handbook 1 is to be read in conjunction with the other related documents outlined in paragraph 1.2.1 and, in case of any discrepancy, in the order of priority stated. The other related documents are also in the process of development and so may impact future developments of Handbook 1.

Handbook 1 is only to be used by those with suitable training and experience.

Comprehensive, site-specific assessments must be independently developed and cannot rely on the protocols, manuals and catalogues of Handbook1 alone. Full responsibility for the assessment and structural upgrading of buildings shall remain solely with the third party.

1 Introduction

1.1 Intention of Use and intended Users

1.1.1 Intention of Use

There are two separate Handbooks available: one for the large scale implementation of structural upgrading of the existing buildings in the Groningen region and one for the handling of earthquake-related damage.

These Handbooks are referred to as follows:

- Handbook 1: Structural Upgrading;
- Handbook 2: Damage Handling;

This document is part of Handbook 1 SU and outlines the process of the Rapid Visual Screening (RVS) of existing CC1b buildings (houses). It is used in Process Steps 2 – RVS, in conjunction with Parts 2 of the Management Protocols ("Red Book"). It follows the procedures described in the NAM Basis for Design chapter 2.

The detailed guidance on the implementation, backgrounds and interpretation of the Rapid Visual Screening (RVS) of CC1b buildings (houses) can be found in the report "RVS manual CC1b".

1.1.2 Intended Users

Generally, users of Handbook 1 will be third parties responsible for large scale implementation of structural upgrading of existing buildings.

More specifically, this document has been written with a defined purpose and application in mind. For the reader of this report to use it to its intended purpose a specific level of expertise and professional background is required. The minimum required skill level to read/use the book is a Structural engineer with at least 5 years of relevant experience and knowledge in the Dutch building construction.

It is further assumed that the person using this document will have received an introduction and training by an experienced professional on how the methods, procedures and guidelines described in this report are applied to a specific case.

1.2 Related Documents & Developments

1.2.1 Related Documents

This report is part of the Structural Upgrading Handbook which shall be used in consideration of other documents that may have a higher legal status or relevance to the structural upgrading process. If contradictions occur between different reference documents and this document, the following order of precedence of documents needs to be considered:

1. Nationwide legislation (e.g. Woningwet, Bouwbesluit)

2. Local regulations
3. International normative references (e.g. Eurocodes + National annexes)
4. Nationwide normative references (e.g. NEN-codes)
5. Nationwide specific references (e.g. NPRs)
6. Project specific references (e.g. NAM Basis for Design)
7. **Project specific guidance (Handbook 1: Structural Upgrading); and**
8. International references (e.g. ASCE, FEMA, Eurocode 8)

2 Goal and Scope of RVS

2.1 Goal

This protocol is specifically applicable to the RVS process for existing Class CC1b buildings (houses).

The RVS has two main goals:

1. To identify buildings or elements of buildings that pose a high risk to people in case of a seismic event; and
2. To obtain building information for prioritisation of the subsequent Extended Visual Screening (EVS).

2.2 Scope

The RVS is a screening with a visual inspection of the building from the public realm only. The specific objectives of the screening are:

- Identify external High Risk Building Elements (HRBEs), defined here as elements, such as chimney and parapets, which could pose a life safety risk during a seismic event;
- Gathering information that will enable definition of a building performance expressed through the use of a scoring system (calculated for unreinforced masonry buildings " URM" only). This scoring system is referred to as a Structural Hazard Score or "S-score", and is calculated for each building. The S-score provides information of the relative vulnerability of the structural lateral-load-resisting system;
- Validation and (initial) improvement of GIS data in order to improve risk assessment studies data; and
- Collection of additional information of interest at the request of stakeholders, e.g. possibility to fit solar panels.

Only the primary residential building for a given address is assessed during the RVS. The result of the RVS will prioritise the follow up, consisting of either measures on HRBEs or an Extended Visual Screening.

This second level screening and evaluation will be carried out based on the recommendations from the RVS and prioritised on S-scores and vulnerability, including identification of HRBE's.

3 Rapid Visual Screening (RVS)

The Rapid Visual Screening is a four step process:

- Planning; planning and communication,
- Gather Information; gathering information to prepare for the inspection,
- Inspection; the procedure to inspect the building,
- Close out; communication and follow up.

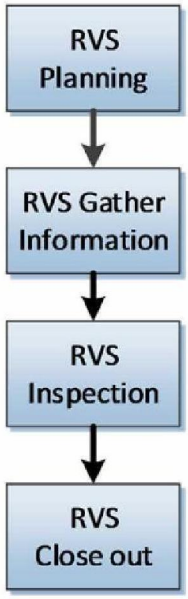


Figure 1 Rapid Visual Screening Process.

3.1 RVS - Responsibilities

The responsibilities set out below is the general set of responsibilities for the project, within this context the operation of the RVS process is executed.

Table 1 Rapid Visual Screening Responsibilities.

Role		**Responsibilities**
Steering Committee		The Steering Committee has overall responsibility for the delivery of the large scale implementation of structural upgrading measures for the GESU project.
CVW (Centrum Veilig Wonen)	Communication Team	Communication team is responsible for communicating with the Stakeholder for the Project.
	Management Team	The Management Team has responsibility for the management and delivery of all activities defined by the CVW scope of service as agreed with NAM. The Management Team is also the primary point of contact for NAM on the GESU project.
	Inspection Support Team	Inspection Support team is responsible to provide assistance to the inspectors in the execution of their responsibilities. The duties may include, for example, gathering data in advance of, and to support, an on-site inspection. It should be noted that the Inspector is responsible to ensure that any such information gathered by Inspection Support is robust and reliable.
	Inspectors Team	The Inspectors are responsible for carrying out on-site inspection activities (RVS and EVS) and reporting. All Inspectors should therefore comprise professionals suitably qualified and experienced in disciplines relevant for this role e.g. structural, seismic, geotechnical etc.
	Engineering Team	The Engineering Team is responsible for ensuring that all information produced in the course of the execution of the CVW scope of service is robust and reliable from an engineering perspective. The Engineering Team should therefore comprise engineering professionals suitably qualified and experienced in disciplines relevant for this role e.g. structural, seismic, geotechnical etc.
	Quality Team	The Quality Team is responsible to ensure that all work on the GESU project

		achieves the quality objectives as defined by NAM.
	Design Team	The Design Team is responsible for all design activities on the GESU project. The Design Team should therefore comprise engineering professionals suitably qualified and experienced in disciplines relevant for this role e.g. structural, seismic, geotechnical etc.
Contractor		The Contractor is responsible for the execution of all construction activities for the GESU project. The Contractor must have, and be able to demonstrate, suitable expertise and prior experience of projects of a similar scale and complexity to the works being executed for the GESU project.
Owner/Occupier Building	Owner	Owner of the building. The owner of the building is the legal entity for the building, but does not necessarily mean the resident of the building.
	Occupier	Resident of the building. The resident does not necessarily mean the owner of the building, but is concerned with the logistics of inspection and/or structural upgrading of the building.

3.2 RVS process

The RVS process is illustrated in the following paragraphs. In the first paragraph the flowcharts of the main process steps provided. The input and output are stated for each step.

In the following two paragraphs detailed process flowcharts for gathering information and the inspection is presented. Within the flowcharts which set up with vertical 'lanes' each 'lane' represents a responsibility area. All process steps in an area are executed by the owner of the area as indicated on the top row.

3.2.1 RVS main process

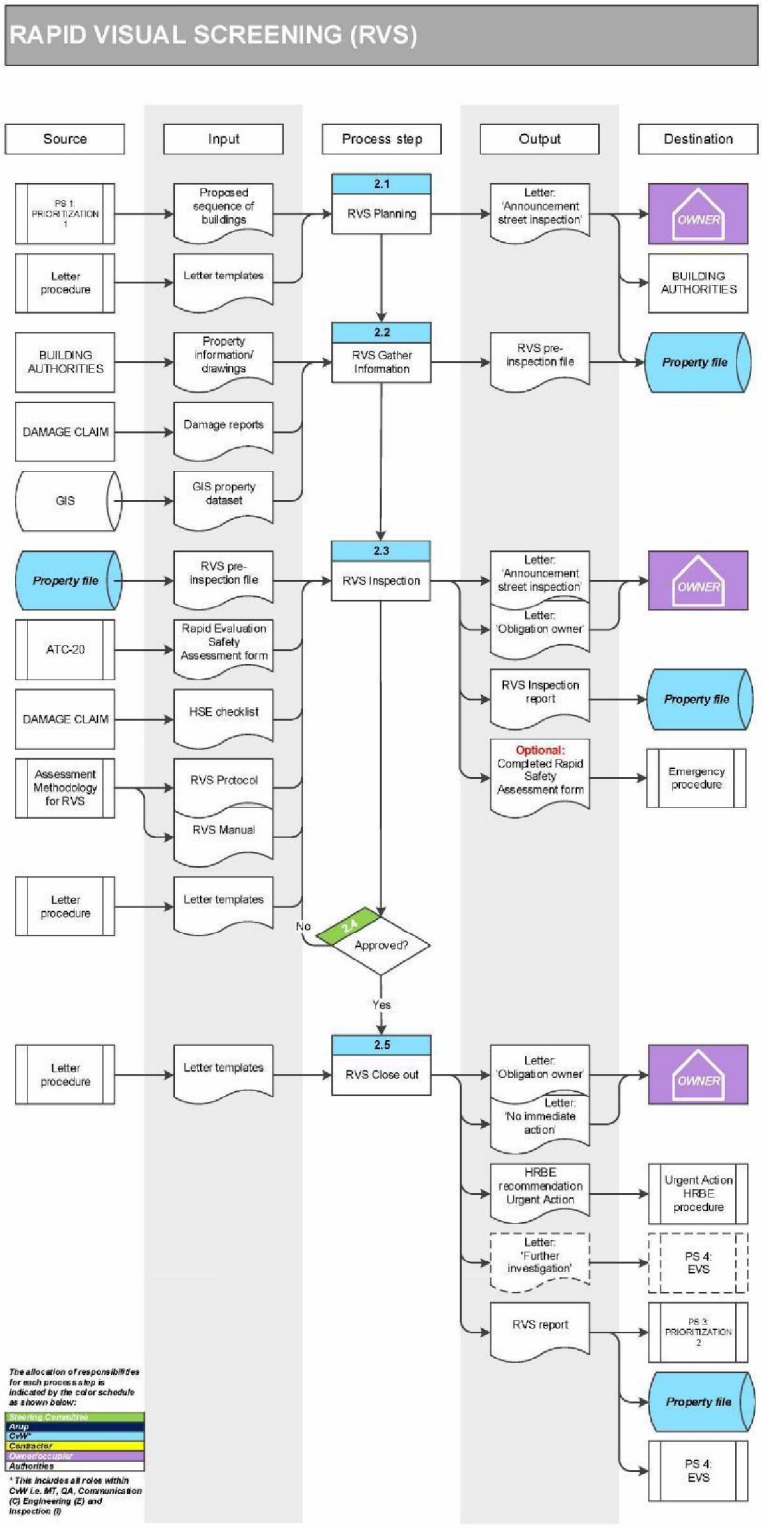


Figure 2 Rapid Visual Screening (RVS) main process.

3.2.2 RVS Information Gathering

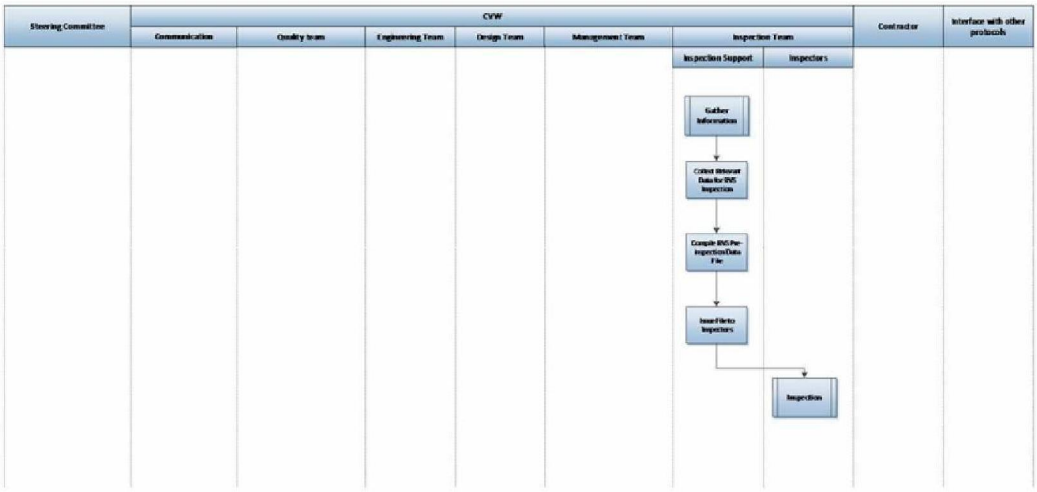


Figure 3 Rapid Visual Screening (RVS) information gathering process

3.2.3 RVS Inspection

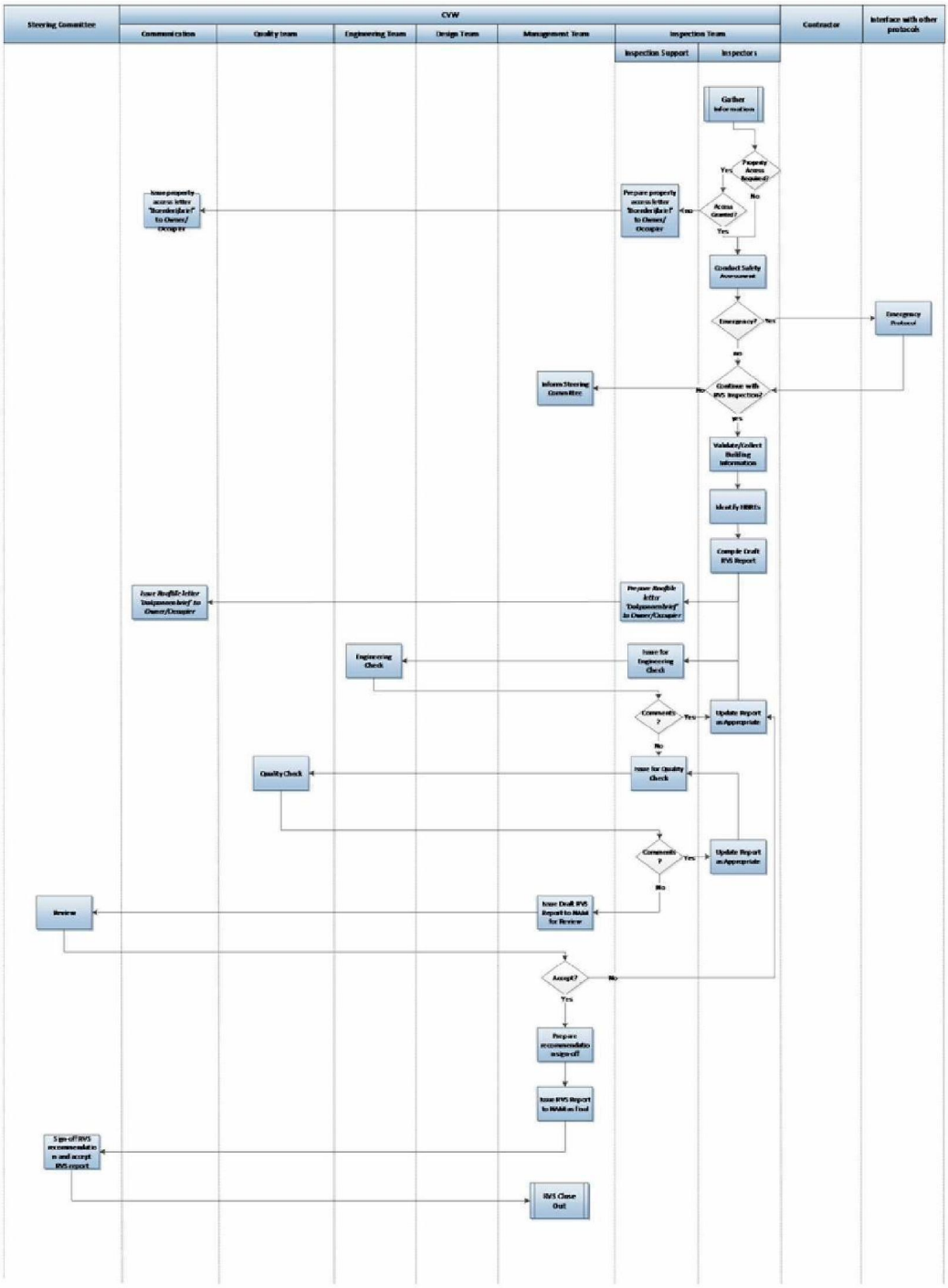


Figure 4 Rapid Visual Screening (RVS) inspection process

4 Process description

4.1 Gather information

Prior to the inspection the available building data will be collected. This will contain building data from the Geographic Information System (GIS), available building drawings and available damage reports. For a detailed description of the data to be collected refer to the Engineering Inspection Manual RVS for CC1b building v0.3.

4.2 Inspection

The RVS inspection is aimed to realise the prioritisation of the buildings for follow up inspections and or dealing with HRBE's. The RVS inspections consist of four parts.

- Safety Assessment;
- Collect Building information;
- High Risk Building Elements; and
- Collection of other information.

4.2.1 Safety Assessment

The Safety Assessment procedure has two goals. One is to assess the safety for the residents of the building and secondly to ensure a safe situation for the inspectors to execute the RVS screening.

The Safety Assessment procedure is based on the ATC-20 procedure. That survey was originally intended for post-earthquake safety assessment (i.e. assessing buildings with earthquake damage), to assess whether the structure is safe to use.

As part of the Health, Safety and Environment (HSE) plan, the inspectors need to assess the situation in order to ensure a safe working environment. The HSE Form is given in Appendix A. The do's and don'ts during and after an earthquake are summarised in Appendix C.

The safety of the building is evaluated according to the Rapid Evaluation Safety Assessment and classified as 'Green' / 'Yellow' / 'Red'. The Assessment Form is given in Appendix B.

- If, after the assessment, the building is tagged as 'Green', it indicates that the safety of the building has not been significantly changed compared to the undamaged state of the building and is likely to be able to resist static design loads. It does not mean that it is safe or secure against future / design seismic loads.
- If the building is tagged as 'Yellow' it indicates that occupancy or entry is restricted to a part of the building while other areas remain usable or, in particular situations, the use of the whole building may be restricted. With only a restricted part it does not mean that the remaining usable areas are safe or secure against future / design seismic loads.

- If the building is tagged as 'Red' this indicates it is unsafe to occupy or enter the building for any reason in the current situation. It is very important to understand that this does not automatically mean that the property has been condemned or will require demolition.

It must be noted that where a "Safety Assessment" has not been deemed necessary or a green or yellow tag have been assigned, this does not mean the building is safe in relation to future seismic action. Such a situation means there is no clear and pre-existing damage in the building; nevertheless, structural strengthening may still be required.

The Emergency Protocol describes the follow up in cases where the building is tagged as 'Yellow' or 'Red'.

4.2.2 Collect Building information

The inspection team will only inspect the building from the public realm. For a detailed description of the data to be collected refer to the Engineering Inspection Manual RVS for CC1b building v0.3.

4.2.3 High Risk Building Elements (HRBE)

Identification of HRBEs is one of the key targets of the RVS process. The inspectors have to identify these elements during the inspection. A short overview of these HRBEs is given below:

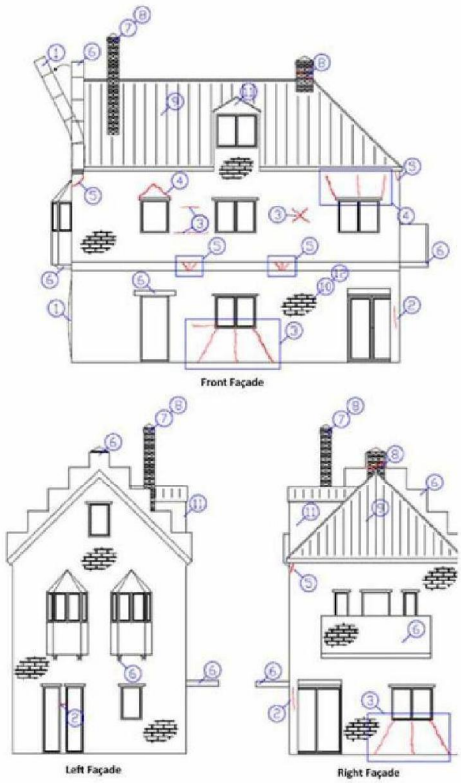


Figure 5 overview of High Risk Building Elements and associated crack patterns (fictitious building)

Index of the HBRE's shown in Figure 5:

Item	HRBE	section
1	Walls out of plane (bulging walls, out of plumb) Gables	3.4.1
2	Slender columns, cracked columns	3.4.2
3	Cracked or deformed walls	3.4.3
4	Cracked lintels/ spandrels	3.4.4
5	Lack of ties, punching elements	3.4.5
6	Parapets, balcony, etc.	3.4.6
7	Slender chimneys	3.4.7
8	Deformed or damaged chimneys	3.4.8
9	Missing roof cladding or loose bricks	3.4.9
10	Lack of mortar between bricks	3.4.10
11	Dormers of brick work	3.4.11
12	Lack of cavity ties	3.4.12
13	Other	3.4.13

For a detailed description of the HRBEs refer to the Engineering Inspection Manual RVS for CC1b building v0.3.

4.3 Quality procedure

In order to reach the correct level of quality the documents created will have several checks. The following checks are preformed:

1. *Engineering check*; validating the data, conclusion and recommendations made in the report.
2. *Seismic check*; validating the conclusion and recommendations on a seismic level.
3. *Final Quality check*; This is a total check of the report, before the report will be externally issued.

These checks are mandatory to reach the quality level before the document is sent to the client.

5 Communication and Privacy

5.1 Communication

When talking to owners/occupants, team members must be aware of the sensitivity of certain aspects of the project and act as professionals at all time. The inspectors should be reactive to owners/occupier, but they should not, on their own initiative make contact with residents.

5.2 Privacy

By gathering personal data from occupants, privacy regulations must be taken into account. In practice the Dutch privacy legislation ("Wet Bescherming Persoonsgegevens") describes that:

- Personal data obtained from occupants shall only be used for the intended purpose it was obtained for.
- Personal data should be stored at a safe, protected digital environment.
- Personal data should not be distributed to third parties.

There are different stages in the process where personal data will be gathered:

- Addresses and contact information of occupants is used to send letters and make appointments with building occupants.
- Data may be obtained from occupants prior to the inspection such as drawings.
- Photographs are taken during the inspection.

Inspectors should be aware of the regulations and take into account the following rules:

- Avoid taking photographs of people, (also consider the image of people in mirrors or people passing by the house).
- Avoid taking photographs of license plates.
- Keep filled in forms out of sight for third parties.
- Never leave a bag with personal data unprotected.

6 Follow up

The principal requirement of the RVS is to identify buildings that have priority for reducing the seismic risk. The result of the RVS is the RVS report, which contains the identified HRBEs and a S-score based on the collected and verified data. Refer to the Prioritisation Strategy for the priority of the follow up.

An explanation on the S-score can be found in the Appendix of the RVS Manual.

7 Reference documents

- ASCE 41-13 (American Society of Civil Engineers) "Seismic evaluation and retrofit of existing buildings";
- ATC 20 (Applied Technology Council) "Rapid Evaluation Safety Assessment";
- FEMA 154 (Federal Emergency Management Agency) "Rapid Visual Screening of Buildings for Potential Seismic Hazards";
- Eurocode 8; "Design of structures for earthquake resistance";
- Basis for Design, NAM Report Number EP201403208456, Rev 2 16 October 2014.
- GESU Report; Engineering Inspection Manual RVS for CC1b building v0.3

Appendix A– Do's and Don'ts Earthquake

DO'S

OFFICE	FIELD
PREVENTION AND PRO-ACTIVE	
Make sure repressive aids, such as fire extinguisher, first-aid kit etc. are in place.	
Know who is local emergency response (BHV) or first aid (EHBO).	
Know where and how to turn off gas, electricity or water.	
Know the numbers of the fault-clearing service of the local utility companies (gas, electricity and water).	
Know where the local muster point is.	
Anchor cupboards .	
Know what to do during an earthquake.	
DURING ACTUAL QUAKE	
	
STAY CALM!!!	
If you're indoors, stay inside / If you're outside, stay outside.	
Indoors: stand in the corner or crawl under heavy furniture (a desk or table). Stay away from windows and outside doors.	Outdoors: stay in the open away from power lines or anything that might fall and protect your head.
If the above is not possible than crouch down, protect your head with your hands or a hard hat.	If you're in a car, stop the car if that's possible and stay inside the car until the earthquake stops.
AFTER THE QUAKE	
Check yourself and others for injuries. Provide first aid for anyone who needs it.	
Check water, gas and electric lines for damage. If any are damaged, shut off the valves.	
Check for the smell of gas. If you smell it, open all the windows and doors, leave immediately, and report it to the fault-clearing service of the local utility company.	
Turn on the radio (local station RTV Noord).	
	Stay out of damaged buildings.
Be careful around broken glass and debris.	
Follow the instructions of the person in charge.	Be careful of chimneys (they may fall on you).
Stay away from damaged areas.	
Expect aftershocks.	
National number of the fault-clearing service Gas and Electricity: 0800 - 9009 (Essent and Enexis)	
Number of the fault-clearing service Water: 0800 - 020 20 13 (Waterbedrijf Groningen)	

OFFICE	FIELD
PREVENTION AND PRO-ACTIVE	
Do not leave loose materials on cupboards.	
DURING ACTUAL QUAKE	
DON'T PANIC!!!	
Don't use matches, candles, or any flame. And don't light up a cigarette. Broken gas lines and fire don't	
Don't use elevators.	Don't go near windows, glass dividers, shelves and filing cabinets.
Don't go near windows, glass dividers, shelves and filing cabinets.	Avoid stopping the car near or under buildings, trees, bridges or overhead services.
AFTER THE QUAKE	
Don't use the phone unless it's an emergency.	
On no account use open flame, smoke, use switches, cell phones, flashlights, etc. In short avoid sparks	
	Don't go near or into a building. Stuff might fall off the building or the building could fall on you.
Don't go to damaged areas.	
Don't inhale dust, but use your clothing as a mask to avoid dust inhalation.	

Appendix B – ATC-20 Rapid Evaluation Safety Assessment Form

ATC-20 Rapid Evaluation Safety Assessment Form

Inspection

Inspector ID:

Affiliation:

Inspection date and time:

Areas inspected: ☐Exterior only ☐Exterior and interior

Building Description

Building name:

Address:

Building contact/phone:

Number of stories above ground: below ground:

Approx. "Footprint area" (square meter):

Number of residential units:

Number of residential units not habitable:

Type of Construction

☐ Wood frame ☐ Concrete shear wall

☐ Steel frame ☐ Unreinforced masonry

☐ Tilt-up concrete ☐ Reinforced masonry

☐ Concrete frame ☐ Other:

Primary Occupancy

☐ Dwelling ☐ Commercial ☐ Government

☐ Other residential ☐ Offices ☐ Historic

☐ Public assembly ☐ Industrial ☐ School

☐ Emergency services ☐ Other:

Evaluation

Investigate the building for the conditions below and check the appropriate column.

Observed Conditions:	**Minor/None**	**Moderate**	**Severe**	**Estimated Building Damage (excluding contents)** ☐ None
Collapse, partial collapse, or building off foundation	☐	☐	☐	☐ 0-1%
Building or story leaning	☐	☐	☐	☐ 1-10%
Racking damage to walls, other structural damage	☐	☐	☐	☐ 10-30%
Chimney, parapet, or other falling hazard	☐	☐	☐	☐ 30-60%
Ground slope movement or cracking	☐	☐	☐	☐ 60-100%
Other (specify)	☐	☐	☐	☐ 100%

Comments:

Posting

Choose a posting based on the evaluation and team judgment. Severe conditions endangering the overall building are grounds for an Unsafe posting. Localized Severe and overall Moderate conditions may allow a Restricted Use posting. Post INSPECTED placard at main entrance. Post RESTRICTED USE and UNSAFE placards at all entrances.

☐ **INSPECTED** (Green placard) | ☐ **RESTRICTED USE** (Yellow placard) | ☐ **UNSAFE** (Red placard)

Record any use and entry restrictions exactly as written on placard:

Further Actions Check the boxes below only if further actions are needed.

☐ Barricades needed in the following areas:

☐ Detailed Evaluation recommended: | ☐ Structural | ☐ Geotechnical | ☐ Other:

☐ Other recommendations:

Comments: