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EUROPEAN ORGANISATION FOR EXPERIMENTAL PHOTOGRAMMETRIC RESEARCH

OEEPE

OFFICIAL PUBLICATION

N° 17

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Influences of Reproduction Techniques on the Identification of Topographic Details on Orthophotomaps

Commission E of the OEEPE

(with 51 Figures, 25 Tables and 6 appendices)

Table of Contents

page

Preface 13

Summary, Zusammenfassung 15

A PROJECT DESCRIPTION AND ORGANIZATION 24

1 Aim of the Project 24

2 Structure of the Project 25

3 Participating Centres 25
3.1 Pilot Centre 25
3.2 Preparatory operations 25
3.3 Production of the reproductions to be evaluated 25
3.4 Organization of sub-project "Evaluation of selected reproductions by orthophoto users" 26
3.5 Evaluation of all products made within the scope of the project . . . 26
3.6 Registration of the evaluation data 26

4 Preparatory Operations 26
4.1 Selection of test areas and photographic material 26
4.2 Production of airphoto diapositives 27
4.3 Production of orthophoto negatives 27

5 Production of the Reproductions to be Evaluated 27

6 Evaluation of the Selected Reproductions by Orthophoto Users (User Poll) 28
6.1 Aim and objective of classification 28
6.2 Execution 28

7 Evaluation of All Reproductions Made Within the Scope of the Project 29
7.1 Preparatory operations of the Pilot Centre 29
7.1.1 Codification of the reproduction results 29
7.1.2 Selection of the questions and identification of the details to be appraised 29
7.1.3 Execution instruction for the evaluating centres 30
7.1.3.1 Additional conditions 30
7.1.3.2 Evaluation tables, evaluation scales 30
7.2 Execution and results 31

page

B ANALYSIS OF THE RESULTS 32

8 Analysis of the Evaluation Results of Selected Reproductions (User Poll) 32

8.1 Evaluation results 32

8.2 Comparison of the evaluation results of the user poll with the results of the total evaluation 32

9 Analysis of the Evaluation of All Reproductions 33

9.1 Average evaluation levels 33

9.2 Average evaluation of questions, resp. question groups 33

9.3 Varying evaluation within the production groups, sensitivity of details to changes of production technique 33

9.4 Comparison of evaluation results 34

9.4.1 General overview 34

9.4.2 Influence of the screening technique 35

9.4.2.1 Contact screening in the vacuum frame 35

9.4.2.2 Screening in the process camera 36

9.4.3 Influence of the paper type used on the evaluation of diazo images and offset prints 36

9.4.4 Influence of the density range of the orthophoto negatives . . 37

After page 138:
List of OEEPE publications

Preface

The proposal to study the influences of reproduction techniques on the quality of orthophotos and orthophoto maps was first made by Professor Ir. *L. van Zuylen,* Delft, at the meeting of Commission E in April 1974 in Vienna. That had been the first meeting of the Commission under its new President, Hofrat Dr. *J. Bernhard.* The Commission attached a high degree of topicality and relevance for practice to this project; under the internal short title of "Reprotest" it therefore was included in the Commission's working programme. On the proposal of the President of the Commission, the Steering Committee of OEEPE approved the realization of this project at the Vienna meeting of May 1974.

The Bundesamt für Eich- und Vermessungswesen, Gruppe Landesaufnahme (Federal Bureau of Standards and Surveying, Sect. National Surveys) in Vienna acted as Pilot Centre under the direction of Oberrat Dipl.-Ing. *H. Nowakowski.* A first working programme was sent to the Commission members in August 1974; the second version, of January 1975, was discussed at the Commission meeting in Frankfurt on Main in April 1975. The final working programme of June 1975 reflects the modifications made. The source material, orthophoto negatives of the test area, was on hand in July 1976. Making the reproductions took the participating centres until October 1979. Already before that, the Commission had adopted evaluation standards based on suggestions from the Pilot Centre, which were distributed to the 6 evaluating centres together with the reproductions. The complete evaluation results were at the disposal of the Pilot Centre by May 1981.

In autumn of 1981, the presidency of Commission E devolved on the undersigned, while Hofrat *Dr. J. Bernhard* continued to supervise the the Reprotest until its conclusion as the head of a working group.

Evaluation of the extensive material was carried out at the Pilot Centre in Vienna on the basis of standards the Commission had worked out and adopted in May 1981; it was finished in 1982. At the Commission meeting in April 1983 in Munich, Oberrat *H. Nowakowski* presented a first draft of the final report in German which was given its definite form by an editorial committee during 1983. Translation into English was undertaken by Professor Ir. *L. van Zuylen,* Delft, and was finished in April 1984. On request of the Commission, *van Zuylen* also prepared a comprehensive English summary which *W. Hofmann* translated into German. The final editing and reproduction took another 2 years, so that the fair copies of the English and German manuscripts could not be delivered to IfAG, Frankfurt on Main, before April 25, 1986.

The total duration of the Reprotest, from its first conception in 1974 to the publication of this final report, thus amounts to more than 12 years. Taking into account only the time since the completion of the reproductions to be evaluated still leaves 7 years. Even if one bears in mind that the extensive work on the Reprotest was largely done as an (unpaid) side job, this duration is much too long. The Reprotest has undoubtedly produced valuable results and insights, yet some of these are of merely historical relevance as the orthophoto and reproduction techniques — like many others — have changed and advanced significantly in recent years. Today, an international study such as the Reprotest would have to take into consideration, above all, the methods of digital image processing and draw a comparison with the others.

The Commission E hopes that this report will meet with much interest notwithstanding its limited topicality, and that it could provide specialists in all fields of productive and interpretive photogrammetry with ideas for their professional work. The report comes with a comprehensive summary meant to give a quick overview of the goals, the course, and the outcome of the test. Careful study of the extensive data material and tables may lead to well-grounded suggestions for further investigation.

Finally, this is the right place to thank all institutions and persons involved in this ambitious project, first of all, of course, the members of the Gruppe Landesaufnahme at the Österreichische Bundesamt für Eich- und Vermessungswesen, who had to bear the main burden of management and proper evaluation, but be it not forgotten to mention the many individuals involved in the evaluation procedure, among them student helpers, who contributed to the collection of correct primary data. The Commission E hopes to have achieved a result, through the joint effort of all who participated, that is in keeping with the tasks and goals of OEEPE.

Walther Hofmann
President of Commission E of OEEPE

Influences of Reproduction Techniques on the Identification of Topographic Details on Orthophotomaps

SUMMARY: The objective of this investigation was to study the identification of detailed specified topographic elements on orthophotos at the scale 1 : 5000, 1 : 10,000 and 1 : 25,000 reproduced on continuous tone bromide paper, on diazo material in continuous and in half-tone and printed in offset.

The results were evaluated by users of orthophotomaps.

The producing agencies had to give a detailed description of the production methods used and the time needed.

The three photomap scales were chosen because in Europe these three scales are predominantly used for photomaps and also because they are expected to show considerable influence of the repromethods on the identification of topographic elements.

The phases of the study were

- the selection of the test area and the production of the orthophoto negatives,
- production of the orthophoto reproductions,
- classification and evaluation of the selected topographic elements,
- analysis of the evaluation results.

The "Bundesamt für Eich- und Vermessungswesen, Gruppe Landesaufnahme" in Vienna (Austria) acted as Pilot Centre.

As test area, a part of the "flat area" of the "Ternitz-Schneeberg" terrain in Austria was chosen (see OEEPE Publication No. 6) that has already been photographed at many scales. In the area concerned three types of terrain were selected i. e.

- a densely built-up area,
- an open area,
- a forest area.

The aerial photos used are wide angle pictures taken with a Wild RC 8 camera with a 15 cm focal-length lens on panchromatic Du Pont Cronar Pan 30 film.

The photos taken at the 1 : 12,500 scale were used for the orthophoto production at scale 1 : 5000 and the 1 : 25,000 original negatives were used to make the orthophotos at the 1 : 10,000 and the 1 : 25,000 scale.

The control points were supplied by the Pilot Centre.

From the original negatives a series of diapositives were made, with a density range of 0.7 and another series with a density range of 1.1. For this production a Logetronic Mark IV dodging device was applied.

The orthophoto negatives were all made in a right-reading and a mirror-reversed version in the orthophoto projectors;

- the 1 : 5000 and the 1 : 10,000 orthophoto negatives on the Zeiss GZ 1 at the IfAG,
- and the 1 : 25,000 orthophoto negatives on the Wild OR 1 by the manufacturer.

In total 11 centres participated in the production of the orthophoto reproductions. Reproduction technique, scales of the orthophotos to be reproduced and the choise of materials was free. The final result, however, had to permit unambiguous identification.

Table 2 shows the number of reproductions made.

A total of 298 reproductions were made and had to be evaluated.

During the preparation phase it was decided to include the opinions of a wide circle of users of photomaps in the total project.

For this purpose the Topographic Service of the Netherlands made four contact prints of each of the three scales 1 : 5000, 1 : 10,000 and 1 : 25,000 on Kodak Veribrom paper with different density ranges.

So 10 series of 12 images each were made and evaluated by orthophotomap users in various disciplines and in various countries. The evaluators (156 in total) completed 225 questionnaires.

Most of them had professional training in

geodesy (69)
geography (37)
cartography (13)
geology (8)
agriculture (8).

They were active mostly in

topography (73)
cartography (43)
planning (29)
reallotment (11).

They were asked the following questions:

a) Select the best, second best, third best and worst orthophoto with regard to your field of application when viewing them from a distance of 30 cm.
b) Give the same rating, now viewing the orthophotos from a distance of 1 meter.
c) Give the same rating but now using an optical device, for instance a magnifying glass.

The results of the evaluations were classified according to:

- the professional training of the evaluator,
- the scales of the orthophotos,
- the field of application,
- the intensity of the use of orthophotos,
- the age groups of the evaluators.

In table 11 the total result of the investigation is shown.

For each image marks (0—10) were given and for question a) the average of all marks for all photos on each scale (Ø) was calculated.

This value was subtracted from the marks per photo.

For question b) the number of persons that classified the best and the worst photo are indicated and the same is done with the answers to question c).

Analysis of the results showed that

- at all three scales 1 : 5000, 1 : 10,000 and 1 : 25,000 and at all three viewing distances the worst orthophoto was readily dentified by all evaluators, whereas
- the best orthophoto was not so unambiguously determined at all three scales by the evaluators. Two copies were rated as almost equally useful.
- These statements also hold good, more or less, if one divides the evaluators into such fields of application as: topography, cartography, . . . regional-planning- . . . geography . . . The ratings are almost identical in the various fields of application.
- Differentiation of the user groups as to the extend of their activity in the field of photo-interpretation: A = predominantly, B = occasionally employed, showed that the opinions of A and B on the usefulnes of orthophoto copies are nearly identical.
- Subdividing the judges into age groups produced roughly the same results as to their opinion on the usefulness of the orthophoto copies.
- The questionnaire shows that independent of the criteria: professional training of the interpreters, scale of orthophotos, fields of application, intensity of activit in photo-interpretation and age of the interpreters, **high-contrast orthophotos were preferred.**

Apart from this investigation 6 institutes collaborated in the main evaluation concerning the identification of topographic details marked on the orthophotos reproduced. Per orthophoto 33 resp. 34 elements were selected for each of the three scales. These elements had to be identified on each of the 298 reproductions. The elements selected in the various types of terrain had a bright-dark or a dark-bright contrast and were selected as point elements (such as vent-traps, chimney-hoods, pylons, single trees), line elements (such as shadow stripes, goal-lines, tracks) and area elements (such as shrubs, sand banks etc.).

The circumstances under which one had to work were prescribed in detail and ratings were given with the marks from 0 to 10.

The outcome of this work was:

- 8 series with 3230 evaluations of the 1 : 5000 photos,
- 10 series with 4107 evaluations of the 1 : 10,000 photos,
- 9 series with 3774 evaluations of the 1 : 25,000 photos.

This was a total of 100,876 evaluations.

To be able to handle that amount of data the evaluation results were transferred on magnetic tape and used for the calculation of the final evaluation results.

The results of the evaluations are summarized in the figures A, B and C. They are divided into the three main types of reproductions i. e. photobromide, diazo, and offset prints, and these are subdivided into continuous tone and halftone groups. In each column the average (A) of all evaluations in that group is shown as well as the maximum evaluation (M) of the same group.

Analysing the results of the evaluations the following conclusions can be drawn:

1. In most cases the total imagery rated higher than the details on the same images. The reason for this may be the fact that details are scrutinized more closely.
2. As expected, the continuous-tone photobromides were rated best. Here, the glossy paper surface was selected as being the best.
3. At the scale 1 : 5000, the diazo copies rated higher than at the scales 1 : 10,000 and 1 : 25,000. At the 1 : 5000 scale the diazo copies on contrast paper came close to the evaluation of the photobromide copies. This was not the case for the diazo copies 1 : 10,000 and 1 : 25,000.
4. For the images at scale 1 : 5000 the mean evaluation results were
   - for the photobromides . . . 9,
   - for the diazo copies . . . 6, with extremes to 8.5.

   These extremes were obtained with diazo copies on contrast paper and screened with a 60 l/cm magenta screen with elliptical dot (density range 1.1),
   - for the offset prints . . . 4.5.
5. For the images at scale 1 : 10,000 the mean evaluation results were
   - for the photobromides . . . 7.5,
   - for the diazo copies . . . 5.5, with extremes to 7.5.

   These extremes were also obtained with copies on contrast paper and screened with a 60 l/cm magenta screen with elliptical dot (density range 1.1),
   - for the offset prints . . . 4, with extremes to 7.

   These best offset prints were made on glossy art paper with an image screened with a 70 l/cm magenta screen, elliptical dot (density range 1.1).
6. For the images at scale 1 : 25,000 the mean evaluation results were
   - for the photobromides . . . 9,
   - for the diazo copies . . . 5, with extremes to 7.

   These extremes were also obtained with copies on contrast paper and screened with a 60 l/cm magenta screen with elliptical dot (density range 1.1),
   - for the offset prints . . . 4.5, with extremes to 7.

   These offset prints were made on glossy art paper with a half-tone image screened with a 70 l/cm magenta screen with elliptical dot (density range 1.1).
7. In general, the offset prints received the highest ratings for the forest area.
8. The random dot images rated very low (maximum 4.5), relatively the highest marks for the forest features.
9. The diazo images were rated somewhat higher than the offset printed images. As mentioned already, at the scale 1 : 5000 the diazo images were rated higher than at the scales 1 : 10,000 and 1 : 25,000.
10. The images screened with a grey or a magenta screen obtained about the same evaluation. Only the extreme best results were obtained with a magenta screen (60/70 l/cm) and an elliptical dot.

11. The magenta screen produced a much better result on the 1 : 25,000 scale; there was not much difference apart for the extreme bests.
12. Going from 60 l/cm to 80 l/cm the magenta screen with elliptical dot gave a constant result but the magenta screen with a square dot was evaluated much lower with the denser screen ruling, especially for the larger scales.
13. For the scale 1 : 25,000 a very high screen density (100 l/cm) in offset printed images produced a highly appreciated result.
14. Screening in the repro camera using a contact screen gave the best result for the larger scale. Using a glass screen in the camera gave only for the very best evaluated reproductions an evaluation as high as the average evaluation of the contact screened pictures.
15. The glossy art paper showed a considerable better result with the offset printed images when produced with a magenta screen (70 l/cm) with elliptical dot in particular for the scales 1 : 5000 and 1 : 10,000.
16. With the evaluation of the diazo copies and the offset prints there exists a clear correlation with the reproduction centres. The reason can be the difference in paper quality but also the printing technique used by the centres.
17. Concerning the density ranges used (0.7 and 1.1) the following can be stated:
   - 0.7 density range gives the best results with the photobromide reproductions;
   - 1.1 density range gives the best result with the screened diazo copies;
   - for the offset prints no difference was shown.

ZUSAMMENFASSUNG: Das Ziel der vorliegenden Untersuchung war es, den Einfluß des Reproduktionsverfahrens auf die Erkennbarkeit bestimmter topographischer Elemente in Orthophotos der Maßstäbe 1 : 5000, 1 : 10 000 und 1 : 25 000 festzustellen; die Vorlagen waren auf photographisches Halbtonpapier, auf Lichtpausmaterial und im Offsetdruck reproduziert.

Die Auswertung wurde durch Benutzer von Orthophotokarten vorgenommen.

Die Hersteller hatten genaue Angaben über das angewandte Reproduktionsverfahren und über den Zeitaufwand mitzuteilen.

Die drei genannten Maßstäbe wurden gewählt, weil sie in Europa bei Luftbildkarten am häufigsten zu finden sind und weil man in ihnen einen beträchtlichen Einfluß der Reproduktionsverfahren auf die Erkennbarkeit topographischer Details erwarten konnte.

Die Untersuchung gliederte sich in folgende Abschnitte:

- Auswahl des Testgebietes und Herstellung von Orthophotonegativen,
- Herstellung der Orthophotoreproduktionen,
- Klassifizierung und Bewertung der ausgewählten topographischen Elemente,
- Analyse der Bewertungsergebnisse.

Centre Pilote für den Test war das Bundesamt für Eich- und Vermessungswesen, Gruppe Landesaufnahme, in Wien.

Als Testgebiet wurde ein Teil des Flachlandes im Bereich „Ternitz-Schneeberg", Österreich, gewählt, für den bereits Befliegungen in mehreren Maßstäben vorlagen (siehe OEEPE-Publikation Nr. 6). In diesem Gebiet wurden drei Landschaftstypen ausgesucht, nämlich

- ein dicht bebautes Gebiet,
- ein offenes Gebiet,
- ein Waldgebiet.

Die verwendeten Luftbilder sind Weitwinkelaufnahmen mit einer Wild-RC-8-Kammer (c = 15 cm) auf panchromatischem Cronar-Pan-30-Film von Du Pont.

Die Luftbilder im Maßstab 1 : 12 500 wurden zur Herstellung der Orthophotos 1 : 5000 herangezogen, aus den Luftbildern 1 : 25 000 wurden die Orthophotos 1 : 10 000 und 1 : 25 000 gewonnen.

Paßpunktunterlagen lieferte das Centre Pilote.

Von den Originalnegativen wurde eine Serie von Diapositiven mit dem Dichteumfang 0,7, eine zweite mit dem Dichteumfang 1,1 hergestellt; dabei wurde ein Logetronic-Mark-IV-Abtastgerät verwendet.

Die Orthophotonegative wurden im Orthoprojektor durchwegs sowohl seitenrichtig wie seitenverkehrt angefertigt, und zwar

- im Maßstab 1 : 5000 und 1 : 10 000 mit dem Zeiss-GZ-1-Projektor beim Institut für Angewandte Geodäsie in Frankfurt am Main;
- im Maßstab 1 : 25 000 mit dem Wild OR 1 bei der Herstellerfirma.

Bei der Herstellung der Orthophotoreproduktionen waren insgesamt 11 Zentren beteiligt. Das Reproduktionsverfahren, der Maßstab der reproduzierten Orthophotos und die Auswahl des Materials waren freigestellt; doch mußte das Endergebnis eindeutig identifizierbar sein.

Tabelle 2 enthält die Anzahl der angefertigten Reproduktionen.

Insgesamt wurden 298 Reproduktionen hergestellt, die auszuwerten waren.

In der Vorbereitungsphase wurde beschlossen, die Meinungen eines großen Kreises von Photokartenbenutzern in das Gesamtprojekt aufzunehmen. Zu diesem Zweck fertigte der Topographische Dienst der Niederlande von jedem der drei Bildmaßstäbe 1 : 5000, 1 : 10 000 und 1 : 25 000 vier Kontaktkopien auf Kodak-Veribrom-Papier mit unterschiedlichem Dichteumfang an. 10 Serien von je 12 Bildern wurden von Photokartenbenutzern aus verschiedenen Fachbereichen und in verschiedenen Ländern ausgewertet. Die insgesamt 156 Auswerter sandten 225 Fragebogen ein.

Beteiligt waren Fachleute aus folgenden Gebieten:

Geodäsie	(69)
Geographie	(37)
Kartographie	(13)
Geologie	(8)
Landwirtschaft	(8);

ihre Haupttätigkeitsfelder waren:

Topographie	(73)
Kartographie	(43)
Planung	(29)
Flurbereinigung	(11).

Die Fragestellung lautete:

a) Geben Sie mit Rücksicht auf Ihren Anwendungsbereich bei Betrachtung der Bilder aus 30 cm Abstand das beste, zweitbeste, drittbeste und schlechteste Orthophoto an.

b) Dieselbe Angabe bei Betrachtung aus 1 m Abstand.

c) Dieselbe Angabe bei Betrachtung mit optischen Hilfsmitteln, z. B. Lupen.

Die Ergebnisse der Auswertung wurden nach folgenden Gesichtspunkten klassifiziert:

- Fachgebiet des Auswerters,
- Maßstab der Orthophotos,
- Anwendungsbereich,
- Intensität des Gebrauchs von Orthophotos,
- Altersklassen der Auswerter.

Tabelle 11 enthält das Gesamtergebnis der Umfrage. Für Frage a) wurde das Mittel (Ø) aller Bewertungen für alle Bilder in jedem Maßstab berechnet und von den Einzelbewertungen abgezogen. Für Frage b) und ebenso für c) wurde die Zahl der Personen, die jeweils ein Bild als bestes oder schlechtestes bewerteten, angegeben.

Die Analyse der Ergebnisse zeigt, daß

- in allen drei Maßstäben 1 : 5000, 1 : 10 000 und 1 : 25 000 und bei allen drei Fragestellungen das schlechteste Orthophoto ohne weiteres von allen Auswertern angegeben werden konnte,
- sich hingegen das beste Orthophoto nicht eindeutig in den drei Maßstäben bestimmen ließ; zwei Kopien schnitten jeweils annähernd gleich gut ab.
- Diese Feststellungen gelten mehr oder weniger auch bei einer Aufteilung der Auswerter auf Anwendungsbereiche wie Topographie, Kartographie, Landesplanung, Geographie, usw. Die Bewertungen in den verschiedenen Bereichen sind fast identisch.
- Bei einer Unterscheidung hinsichtlich des Beschäftigungsgrades in der Luftbildnutzung: A = vorwiegend; B = gelegentlich, ergibt sich die Bewertung der Brauchbarkeit von Orthophotokopien bei A und B fast identisch.
- Eine Unterteilung der Bewerter in Altersgruppen liefert ebenfalls annähernd identische Ergebnisse.
- Die Fragebogen zeigen, daß unabhängig von den Kriterien Fachgebiet des Bewerters, Bildmaßstab, Anwendungsbereich, Beschäftigungsgrad mit Photointerpretation und Alter des Bewerters, **Orthophotos mit starkem Kontrast** bevorzugt werden.

An der Hauptauswertung hinsichtlich der Erkennbarkeit topographischer Einzelheiten, die in den Orthophotoreproduktionen gekennzeichnet waren, beteiligten sich 6 Institute. In jedem Bildmaßstab wurden 33 bzw. 34 Elemente markiert, die auf jeder der 298 Reproduktionen aufzusuchen waren. Die Einzelheiten in den verschiedenen Landschaftstypen wiesen entweder einen hell-dunkel oder dunkel-hell Kontrast gegenüber ihrer Umgebung auf; sie waren punktförmig (Dachluken, Kamine, Pfeiler, Einzelbäume), linienförmig (Schattengrenzen, Torlinien, Fahrspuren) und flächenhaft (Büsche, Sandbänke, usw.).

Die Arbeitsbedingungen waren detailliert vorgeschrieben; die Bewertung erfolgte mit der Werteskala 0 bis 10.

Nach dieser Auswertung lagen vor:

- 8 Serien mit 3230 Bewertungen für den Maßstab 1 : 5000,
- 10 Serien mit 4107 Bewertungen für den Maßstab 1 : 10 000,
- 9 Serien mit 3774 Bewertungen für den Maßstab 1 : 25 000,

insgesamt also 100 876 Bewertungen.

Um diese Datenmenge bearbeiten zu können, wurden die Bewertungsergebnisse auf Magnetband übertragen und so zur Ermittlung des endgültigen Auswerteergebnisses benutzt.

Die Ergebnisse der Auswertung sind in den Abbildungen A, B und C zusammengefaßt; sie enthalten eine Aufgliederung in die Hauptreproduktionsarten, nämlich Photokopie, Lichtpause und Offsetdrucke, wobei die letzteren wiederum in Halbton- und Rastergruppen unterteilt sind. In jeder Spalte erscheint das Mittel A aller Bewertungen in dieser Gruppe sowie die Höchstbewertung M in derselben Gruppe.

Die Analyse der Ergebnisse führt zu folgenden Schlüssen:

1. Die Bewertung des Gesamtbildes lag in den meisten Fällen höher als die von Einzelheiten im selben Bild. Der Grund hierfür mag die Tatsache sein, daß Einzelheiten sorgfältiger bewertet wurden.

2. Erwartungsgemäß erhielten photographische Halbtonreproduktionen die höchsten Bewertungen; dabei schnitt Hochglanzpapier am besten ab.

3. Im Maßstab 1 : 5000 war die Bewertung der Lichtpausen höher als in den Maßstäben 1 : 10 000 und 1 : 25 000. Bei 1 : 5000 kamen die Lichtpausen auf Kontrastpapier nahe an die Bewertung der Photokopien heran. Dies gilt nicht für Lichtpausen 1 : 10 000 und 1 : 25 000.

4. Für Bilder im Maßstab 1 : 5000 waren die mittleren Bewertungen
   - bei Photokopien . . . 9,
   - bei Lichtpausen . . . 6, mit Spitzenwerten bis 8,5.

     Diese Extreme wurden mit Lichtpausen auf Kontrastpapier und bei Rasterung mit einem Magentaraster von 50 L/cm Weite und mit elliptischem Punkt (Dichtebereich 1,1) erreicht.
   - Für Offsetdrucke . . . 4,5.

5. Für Bilder im Maßstab 1 : 10 000 waren die mittleren Bewertungen
   - bei Photokopien . . . 7,5,
   - bei Lichtpausen . . . 5,5, mit Spitzenwerten bis 7,5.

     Diese Extreme wurden ebenfalls mit Kopien auf Kontrastpapier und bei Rasterung mit einem Magentaraster von 60 L/cm und mit elliptischem Punkt (Dichtebereich 1,1) erzielt.
   - Bei Offsetdrucken . . . 4, mit Spitzenwerten bis 7.

     Diese besten Offsetdrucke wurden auf Kunstdruckpapier und mit einem Magentaraster von 70 L/cm und mit elliptischem Punkt (Dichtebereich 1,1) erzielt.

6. Für Bilder im Maßstab 1 : 25 000 waren die mittleren Bewertungen
   - bei Photokopien . . . 9,
   - bei Lichtpausen . . . 5, mit Spitzenwerten bis 7.

     Diese Höchstwerte wurden ebenfalls mit Kopien auf Kontrastpapier und bei Rasterung mit einem Magentaraster von 60 L/cm und mit elliptischem Punkt (Dichtebereich 1,1) erzielt.
   - Bei Offsetdrucken . . . 4,5, mit Spitzenwerten bis 7.

     Diese Offsetdrucke wurden auf Kunstdruckpapier mit einem Magentaraster von 70 L/cm mit elliptischem Punkt (Dichtebereich 1,1) hergestellt.

7. Im allgemeinen wurden die Offsetdrucke für Waldgebiete am höchsten bewertet.

8. Die „Random-dot"-Bilder wurden sehr niedrig bewertet (maximal mit 4,5), relativ am höchsten noch bei forstlichen Objekten.

9. Die Lichtpausen wurden etwas höher bewertet als die Offsetdrucke. Wie bereits erwähnt, lagen die Bewertungen im Maßstab 1 : 5000 höher als in den Maßstäben 1 : 10 000 und 1 : 25 000.

10. Rasterung mit einem Grau- bzw. mit einem Magentaraster führte fast zur gleichen Bewertung. Jedoch wurden die allerhöchsten Bewertungen mit einem Magentaraster von 60/70 L/cm und mit elliptischem Punkt erzielt.

11. Der Magentaraster lieferte ein weit besseres Ergebnis im Maßstab 1 : 25 000; abgesehen von den Spitzenwerten ergaben sich keine großen Unterschiede.

12. Beim Wechsel von 60 auf 80 L/cm Rasterweite erzielte der Magentaraster mit elliptischem Punkt gleichbleibende Ergebnisse; der Magentaraster mit quadratischem Punkt wurde jedoch bei dichterer Rasterweite weit niedriger bewertet, besonders in den größeren Maßstäben.

13. Im Maßstab 1 : 25 000 erzielte eine sehr dichte Rasterweite (100 L/cm) in Offsetdrucken ein hohes Resultat.

14. Aufrasterung in der Reprokammer mit einem Kontaktraster führte im größeren Maßstab zu den besten Ergebnissen. Die Benutzung eines Glasrasters in der Kamera erreichte nur bei den bestbewerteten Reproduktionen eine Einschätzung auf der mittleren Höhe der Bilder von Kontaktrastern.

15. Das Kunstdruckpapier erhielt eine beträchtlich bessere Bewertung bei Offsetdrucken mit einem Magentaraster (70 L/cm) mit elliptischem Punkt, besonders in den Maßstäben 1 : 5000 und 1 : 10 000.

16. Bei Lichtpausen und Offsetdrucken zeigt sich eine deutliche Korrelation mit den Herstellungszentren. Der Grund hierfür kann in Qualitätsunterschieden des Papiers, aber auch in der von den Zentren verwendeten Drucktechnik vermutet werden.

17. Der Unterschied im Dichteumfang der Originaldiapositive führte beim Vergleich der höchstbewerteten Reproduktionen zu folgenden Ergebnissen:
    - 0,7 wurde bei photographischen Halbtonbildern am höchsten bewertet;
    - 1,1 wurde bei gerasterten Lichtpausen am höchsten bewertet;
    - bei Offsetdrucken zeigt sich kein Unterschied zwischen beiden Werten.

A PROJECT DESCRIPTION AND ORGANIZATION

1 Aim of the Project

The techniques used in the reproduction of aerial photographs, orthophotographs and orthophotomaps are, almost exclusively:

- bromide copy,
- diazo copy,
- offset printing.

Within the techniques the course of procedure and the requirement on the original material can be markedly different.

Notwithstanding that, the beginner in the field would not take long in attaining a clear concept of the work needed for the respective reproduction technique and the resulting cost per copy.

If, however, the efficiency of the individual techniques and their variants are to be assessed as to general impression and reproduction of details, the opinions even of experienced reproduction specialists often differ considerably. A circumstance which is certainly due to the great number of factors taking effect in the reproduction process and the differences in the evaluation of the results, but which is most unsatisfactory.

Therefore, the aim of the present investigation should be to classify within each of the three examined orthophoto scales 1 : 5000, 1 : 10,000 and 1 : 25,000 the identification of separate photo details and the general impression of the photographs comparatively, thus demonstrating the influence of the reproduction techniques applied in the scope of the experiment, and finally to draw first conclusions for practice.

Further, the obtained

- evaluation tables,
- procedure descriptions, and
- intermediate and final results of the reproduction

should provide material for future detail studies of individual influences.

The scale range used was chosen, because

- in Europe these three scales are mainly used, both for geometrical (distortion) and physiological (identification of relevant photo details) reasons and
- within this scale range significant differences in efficiency of the individual reproduction techniques can be expected.

2 Structure of the Project

Due to the volume of the project it had to be divided into several phases:

- Preparatory operations:
  - selection of experimental zones and of photographic material,
  - production of orthophoto negatives;
- production of orthophoto reproductions;
- evaluation of the selected reproductions by the orthophoto users;
- evaluation of identification of details of all reproductions;
- analysis of evaluation results.

3 Participating Centres

3.1 Pilot Centre

- Bundesamt für Eich- und Vermessungswesen, Gruppe Landesaufnahme, Wien.

3.2 Preparatory operations

- Bundesamt für Eich- und Vermessungswesen, Gruppe Landesaufnahme, Wien;
- Institut für Angewandte Geodäsie, Frankfurt am Main;
- Topografische Dienst, Delft;
- Wild Heerbrugg AG.

3.3 Production of the reproductions to be evaluated

- Bayerisches Landesvermessungsamt, München (Reproduction centre (HZ) 9);
- Bezirksregierung Rheinhessen-Pfalz, Forstdirektion, Neustadt a. d. Weinstrasse (HZ 11);
- Bundesamt für Eich- und Vermessungswesen, Gruppe Landesaufnahme, Wien (HZ 10);
- Hessisches Landesvermessungsamt, Wiesbaden (HZ 5);
- Institut für Angewandte Geodäsie, Frankfurt am Main (HZ 1);
- Institut für Kartographie und Topographie, Universität Bonn (HZ 4);
- Istituto Geografico Militare, Firenze (HZ 7);

— International Institute for Aerial Survey and Earth Sciences (ITC), Enschede (HZ 3);
— Landesanstalt für Ökologie, Landschaftsentwicklung und Forschung, Nordrhein-Westfalen, Recklinghausen (HZ 12);
— Landesvermessungsamt Nordrhein-Westfalen, Bonn-Bad Godesberg (HZ 6);
— Topografische Dienst, Delft (HZ 2, HZ 13).

3.4 *Organization of sub-project "Evaluation of selected reproductions by orthophoto users"*

— Institut für Angewandte Geodäsie, Frankfurt am Main.

3.5 *Evaluation of all products made within the scope of the project*

— Istituto Geografico Militare, Firenze (Evaluation Centre (BWZ) 5);
— International Institute for Aerial Survey and Earth Sciences (ITC), Enschede (BWZ 2.2);
— Staten Landmäteriverket, Gävle (BWZ 1);
— Topografische Dienst, Delft (BWZ 2.1);
— Universität Freiburg (BWZ 4);
— Universität Karlsruhe (BWZ 3).

3.6 *Registration of the evaluation data*

— International Institute for Aerial Survey and Earth Sciences (ITC), Enschede.

4 Preparatory Operations

4.1 *Selection of test areas and photographic material*

As test area a part of the region "Flachland" of the interpretation project "Ternitz-Schneeberg" of Commission E was chosen (see Official Publication No. 6 of OEEPE) to save the cost of flying and to be able to start work quickly (figures 1 and 2).

At scale 1 : 10,000 and 1 : 25,000 a well-balanced division of a densely populated urban area and an industrial area, an open area and a forest area could be obtained, whereas at scale 1 : 5000 (southern half of the test area scale 1 : 25,000) unfortunately no larger part of the forest could be included.

Wide angle photographs were used as follows:
— $M_b = 1 : 12{,}500$ for orthophoto scale 1 : 5000,
— $M_b = 1 : 25{,}000$ for orthophoto scale 1 : 10,000,
— $M_b = 1 : 25{,}000$ for orthophoto scale 1 : 25,000.

The necessary control points for the production of reproductions are obtained by transfer of points at the Bundesamt für Eich- und Vermessungswesen in Wien.

Their accuracy can be given with $m_x = m_y = m_z = \pm 1$ m, which seems to be enough for the aim of the experiment, because the correctness of position was not to be assessed.

4.2 *Production of airphoto diapositives*

After the marking of the control points in the original negatives by the "Institut für Angewandte Geodäsie" (IfAG), two series of dodged diapositives were made by the "Topografische Dienst", Delft, for each of the two photo scales — the first with the density range of 0.7, the other with the density range of 1.1.

Subsequently, a transparent Agfa-step wedge (wedge constant 0.15) as well as a resolution test target figure was mounted in every diapositive at IfAG. (see appendices 1—3)

4.3 *Production of orthophoto negatives*

A right-reading as well as a mirror reversed orthophoto negative was made for each of the three orthophoto scales with density ranges 0.7 and 1.1 (figure 3).

In order to provide the production centres with copies of the same quality, both the right-reading orthophoto negatives and the mirror reversed orthophoto negatives were made through direct projection, of which those at the scales 1 : 5000 and 1 : 10,000 were produced by the "Institut für Angewandte Geodäsie" on instruments of Zeiss/Oberkochen (Planimat and Ortho projector GZ 1), whereas those at 1 : 25,000 were made by Wild Heerbrugg AG (Avioplan OR 1).

Boundary marks were copied into the orthophotos of the scales 1 : 5000 and 1 : 10,000, the neutral wedge and the test target were projected at all three scales. In addition, the test target and the line sequence taken from the "UGRA-GRETAG-Test-wedge" were exposed by means of the contact printer before development. Examination of the density range was done on 12 points by means of a densitometer "Densitron" by "Hoh & Hahne" with a measuring point diameter of 0.4 mm. It should be noted that the densities measured by various centres at identical points or steps on the grey wedge show considerable differences (up to 0.07 density units). Apart from varying measuring-point-diameters, differences in the measuring systems could also be the cause. The technical developments of the last years should have brought improvement here. For the objective of the project, viz. the comparative evaluation of the reproductions produced from the same original material, it would have been sufficient to make enlargements of the airphoto negatives at approximatly the selected scales. Nevertheless, the commission chose the method described in order to follow a practice-oriented reproduction procedure.

5 Production of the Reproductions to be Evaluated

11 centres participated in the production (see 3.3). The choise of the production procedure, the methods and the material used, was left to the centres, however, methods were to be used, which were expected to give the best possible homogeneous interpretability of the entire picture content.

The following results of all production varieties had to be handed over to the Pilot Centre:

- 2 copies of reproduction results,
- the intermediate products (masks, diazo copies, contacts on film etc.),
- exact descriptions of the procedures followed.

Table 2 shows a survey of the number of reproductions made and table 3 shows the choise of the various methods by the participating reproduction centres.

The reproduction methods for the various results are shown in figures 4—28 (for the identification of the reproduction centres see 3.3 and for the identification of the reproduction results, see 7.1.1).

6 Evaluation of the Selected Reproductions by Orthophoto Users (User Poll)

6.1 Aim and objective of classification

During the discussions of Commission E it was pointed out that because of the great number of reproductions to be evaluated, only a small group of evaluators could be involved in the evaluation of the reproduction results. From the structure of the participating centres follows that these users are closely connected with photogrammetry, resp. the production of orthophotos, whereas orthophotos are chiefly being interpreted by experts of other disciplines. Consequently, it appeared most important to include the opinions of these wide and varied user groups in the study.

Hence it was decided to copy for each of the three scales 1 : 5000, 1 : 10,000 and 1 : 25,000, resp. four contact copies with significantly differing density ranges on Kodak Veribrom paper (performance Topographic Service, Delft). After the approval of the sub-project by the Steering Committee, the total of the 10 series of 12 photos each were handed over for evaluation by members of the Steering Committee in their native countries to orthophoto users of various disciplines. The enclosed questionnaire (figure 29) conceived by Prof. *Schmidt-Falkenberg* aimed in the first place at determining the usefulness of the orthophoto reproductions for the specied fields if application (questions 1 and 3). Besides that, it also asked for the general impression of the photos when viewed from a distance of 1 m (question 2).

It was explicitly permitted, that a user gave classifications for several fields of applications, resp. that several users of an adressed Instituts classifications for the same field of application.

6.2 Execution

After termination of the evaluation, 225 questionnaires of 156 users were considered, as well as the ranges of application, for which the questionnaires were provided (see tables 4 and 5).

7 Evaluation of All Reproductions Made Within the Scope of the Project

7.1 Preparatory operations of the Pilot Centre

7.1.1 Codification of the reproduction results

For evaluation of the reproductions and further classification of the evaluation results the individual reproductions were given code numbers. These code numbers consist of 4 digit groups:

$$\underbrace{..5}_{1}\ \underbrace{272}_{2}\ \underbrace{.611}_{3}\ \underbrace{6..}_{4}$$

The digit groups mean:

1: the scale of orthophotos (5, 10 or 25);

2: production group, resp. production technique (see table 6 and figures 4—28);

3: first digit: statement of screen ruling (in the above mentioned example 6 for 60 l/cm). 2nd and 3rd digit: serial number of production centre:

1 Institut für Angewandte Geodäsie, Frankfurt am Main;
2 Topografische Dienst, Delft;
3 International Institute for Aerial Survey and Earth Sciences (ITC) Enschede;
4 Institut für Kartographie und Topographie, Universität Bonn;
5 Hessisches Landesvermessungsamt, Wiesbaden;
6 Landesvermessungsamt Nordrhein-Westfalen, Bonn-Bad Godesberg;
7 Istituto Geografico, Firence;
8 not applicable;
9 Bayerisches Landesvermessungsamt, München;
10 Bundesamt für Eich- und Vermessungswesen, Wien;
11 Bezirksregierung Rheinhessen-Pfalz, Forstdirektion, Neustadt a. d. Weinstrasse;
12 Landesanstalt für Ökologie, Landschaftsentwicklung und Forstplanung, Nordrhein-Westfalen, Recklinghausen;
13 Topografische Dienst, Delft.

4: Subdivision number: at the issue of several reproductions of a centre within a production group (e. g. two copies made with the same screen, resp. on various types of paper or with different exposure times).

The code for the production groups, as well as the number of reproductions in the single production groups are shown in table 6.

7.1.2 Selection of the questions and identification of the details to be appraised

In order to compare the visual impression with the recognizibility of details the following questions were taken as a basis for further evaluation:

- Visual impression as to:
  - overall image (indicated by "A"),

- urban areas and industrial areas (B),
- forest areas (C),
- open areas (D).

- Detail rendering

  In selecting the details to be evaluated, the following aspects had to be considered:
  - the majority of the details was to be close to the limits of identification in order that the effect of the reproduction technique became evident regardless of the inevitably different interpretation by the evaluators,
  - identical image details at two different scales,
  - regular distribution of the details in the orthophotos,
  - details in open, forest, and agricultural areas,
  - as many density combinations as possible between object and surroundings,
  - both linear and surface objects.

The details chosen under the above-mentioned aspects were described shortly (figures 30—32) and indicated on transparent films (appendices 4—6: combined copy of orthophotos and films). The details 1—11 are located in urban areas, 12—22 in open land, 23—24 in forest areas.

Because of the condition to select details close to the identification limit, only 5 identical details could be found for scales 1 : 5000 and 1 : 10,000 and only 12 for scales 1 : 10,000 and 1 : 25,000. In selecting forest area points the suggestions of Prof. *Hildebrandt* were largely taken into consideration. See also tables 7—9 and figure 44.

7.1.3 Execution instruction for the evaluating centres

7.1.3.1 Additional conditions

The evaluation had to be done at clear visual distance with the naked eye, provided that emmetropia was within ± 2 diopters. Illuminance of at least 100 Lux was to be kept over the total viewing field. In order to ascertain uniform measurement of the intensity of illuminance the centres were provided with luxmeters of the type "Gossen Panlux Electronic", calibrated by the pilot centre. Illuminance was to be measured in the four corners as well as the centre of the viewing field.

The necessary lighting was provided either through daylight, incandescent lamps or neon tubes "neutral white" or "warm white" with a colour fidelity index Ra ≥ 85. The light sources had to be arranged in such a way, that they were invisible to the observer, and no lighting reflexes could occur.

7.1.3.2 Evaluation tables, evaluation scales

The evaluation of the visual impression of the entire image (resp. parts of it) and the quality of identification of the details was rated by allocating 0 to 10 points.

The visual impression resp. the quality of detail rendition were to be rated as follows:

excellent	10 points,
very good	8 points,

good	6 points,
fair	4 points,
bad	2 points,
useless	0 points.

Within each question and each detail studied this evaluation scale should be equidistant, e. g. with reproductions rated in a range of 0 to 4 points the results given 2 points should, in the evaluator's opinion, be in the middle between the best and worst reproduction of this detail type.

In the evaluation it had to be assessed how well the image detail could be identified and how well it could be interpreted, but not wether the object designation given in the description (figures 7—9) could actually be identified as such (the description only served to facilitate finding the detail).

The results of the evaluation were to be surveyed for each evaluator and each evaluation arrangement separately in evaluation tables (figure 33).

Every evaluation centre should provide for each scale at least one evaluation table.

The evaluations of the visual impression are indicated in the evaluation table as follows:
- "A" stands for the overall image,
- "B" for the urban and industrial area,
- "C" for the forest area,
- "D" for the open area.

7.2 *Execution and results*

The evaluation was carried out by 5 centres (see 3.5), which in many cases completed one or two evaluation series.

Available were:
- 1 : 5000 : 8 series with 3230 evaluations each,
- 1 : 10,000 : 10 series with 4107 evaluations each,
- 1 : 25,000 : 9 series with 3774 evaluations each,

i. e. 100,876 in total.

For further processing of the dataset on a computer, the evaluations were transferred to magnetic tape by ITC, Enschede.

B ANALYSIS OF THE RESULTS

8 Analysis of the Evaluation Results of Selected Reproductions (User Poll)

8.1 Evaluation results

The analysis of the 156 questionnaire results was based on (corresponding to the arrangement of the questionnaire):

a) the main training of the evaluator,

b) the scales of the orthophotos,

c) the fields of application,

d) the intensity of the activities (in the field of the interpretation),

e) the age groups.

The analysis results have been arranged in overviews (tables 10—16). According to these it can be stated:

1. Of the 156 evaluators, 69 persons had their main professional training in geodesy, 37 in geography, and 13 in cartography,
   the rest in various disciplines. All the following statements are particularly valid for these three groups of evaluators.

2. At all three scales 1 : 5000, 1 : 10,000 and 1 : 25,000 and at all the three viewing distances the "worst" orthophoto was readily determined by all the evaluators.

3. The "best" orthophoto, however, was not so unambiguously determined at all three scales, at all three viewing distances and by all evaluators. Two copies were evaluated as almost equally useful.

4. Statements 2 and 3 also hold good, more or less, if one divides the evaluators into such fields of application as: topography, cartography, . . . regional-planning, . . . geography . . .. The opinions in the various fields of application are (almost) identical.

5. Differentiation of the user groups as to the extend of their activity in the field of photo-interpretation: A = predominantly, B = occasionally employed, showed that the opinions of A and B on the usefulness of orthophoto copies are nearly identical.

6. Subdividing the judges into age groups showed that their respective interpretation of the usefulness of the orthophoto copies are (almost) identical too.

7. The questionnaire shows, that independent of the criteria: professional training of the interpreters, scale of orthophotos, fields of application, intensity of the activities in photo-interpretation and age of the interpreters, high-contrast orthophotos were preferred.

8.2 Comparison of the evaluation results of the user poll with the results of the total evaluation

In table 17 the denotations of the orthophoto for the users and for the total evaluation are compared.

If one compares, in table 18, the differences of the average of the evaluations of the total judgement with the evaluation by the orthophoto users, a difference in the order of both evaluations is shown only in a single case (AS, 1 : 25,000).

Question A (overall impression) of the total evaluation was compared with question 2 (1 m viewing-distance) and the value AS (average of evaluations of all detail points), with question 3 (viewing through magnifying glass) of the user poll. In table 18 the best and second best of the three scales were underlined twice resp. once. A comparison of the ratings of the various user groups was considered irrelevant because of the small size of the groups, no significant differences were shown.

9 Analysis of the Evaluation of All Reproductions

9.1 Average evaluation levels

In the first computation for each evaluation series the average evaluation level was determined (average of all questions and evaluations). These evaluation levels are shown in figure 34. The correction of the individual evaluation was dispensed with because the average of the individual questions remain unchanged and the average error of the means of evaluation became only slightly smaller, as was shown in a trial computation. In the following investigations the averages of the evaluations of the individual reproductions were therefore employed.

9.2 Average evaluation of questions, resp. question groups

The mean values (XM), mean errors of the mean values (MXM), and also the mean errors of an evaluation (MX) were computed.

In order to compare the evaluations of the visual impressions with the evaluations of identification of detail forms (question A, B, C, D), for every individual reproduction the evaluation average values were additionally computed.

AS	all points	(total image),
BS	points 1 . . . 11	(urban image),
CS	points 23 . . . 33, resp. 34	(forest area),
DS	points 12 . . . 22	(open area).

Table 19 shows, as an example, results for the scale 1 : 10,000. Tables 20/1—20/14 show for the individual reproductions the average values of the evaluations XM and the average errors MXM for A—D and AS—DS. In figures 35—42 the average values for the reproduction groups are shown.

9.3 Varying evaluation within the production groups, sensitivity of details to changes of production technique

In view of the in some cases strikingly different ratings given some reproductions from the various production groups the question arises whether the reproductions forming one group can be evaluated together. It is worth finding out if the opinions of the

evaluators or the reproduction methods cause the variation in the evaluations. To answer this question the F-test (level of significance 1 %) *) was applied to the questions A—D and 1—33, resp. 34.

As an example table 21 shows for the reproduction group 10212 as well as for the compilation of the reproduction groups 10012—10212 the calculated F-values, emphasizing such values that exceeded the tabulated fractiles.

On evaluating the F-test the percentage of the questions was determined for each reproduction group for which grouping was rejected (figure 43).

High percentages indicate inhomogeneous reproduction groups. For scale 1 : 25,000, for instance, grouping is rejected for almost all questions concerning reproduction groups 266 and 268 (offset printing on map paper resp. art paper, magenta screen 70 and 100 l/cm). Here significant quality differences seem to be evident.

The number of reproduction groups where the F-test shows a stronger influence of the reproduction methods is relatively large. Therefore the evaluation averages of the individual reproductions were used in the following investigations. The percentage of these reproduction groups was determined — for each question — that received significantly different ratings (figure 44).

High percentages indicate that the respective details react sensitively to variations in the reproduction method. As expected, this is mostly the case with low-contrast details.

9.4 Comparison of evaluation results

9.4.1 General overview (see figures 35—42)

First of all it is remarkable that the overall visual impression was clearly rated higher in most cases than the reproduction of detail forms. Psychological influences, such as large-scale view of image surfaces and critical examination of details, but also questions of the luminance of viewing field could play a role here.

As expected, the **photobromides in continuous tone** received the highest ratings. The group of continuous tone prints on glossy photo paper (group 003) also includes those pictures that were classified as less satisfying in the user poll.

Concerning the density range of the original negatives, the density range of 0.7 (groups 001, 003, 005) show better results than the density range of 1.1 (groups 203, 205).

Essential differences based on paper surface are not recognizable. However, the photo paper with glossy surface always received highest ratings.

Diazo images on continuous tone diazo paper (group 210) and well-screened diazo pictures show nearly the same quality. An evaluation reduction of the picture details with the application of contrast paper is not shown clearly (group 214: only one reproduction available). Remarkable, however, is the reduction in quality when diazo line tone paper is used.

*) *Wolf, H.:* Ausgleichungsrechnung nach der Methode der kleinsten Quadrate. — Bonn, Hannover, München 1968, S. 514 ff.

Also surprising is the evaluation of the **screened diazo copies** and **prints** in comparison with the photobromide images. It is clear that there is a loss in rendering of detail, but as to the overall impression the best diazo results have a quality that comes quite close to that of the photobromides. Comparing the **offset prints with the diazo copies** one can state that there is not so much difference in quality for the scales 1 : 10,000 and 1 : 25,000. However, for the scale 1 : 5000 the offset prints were rated much lower than the diazo images.

9.4.2 Influence of the screening technique

In figures 45—46 the evaluations A and AS are shown for the diazo images and for the offset prints in dependence on the screen ruling. Table 22 gives for the diazo copies and for the offset prints with a screen ruling of 60 l/cm a compilation of the evaluation averages A—D and AS—DS. In the tables 23—24 the evaluation averages in dependence on the screen rulings for magenta screens with square and elliptical dots are shown. In all three tables those reproduction groups are indicated for the evaluation averages of the questions A—D which, in accordance with the F-test (significance level 1 %), could be taken together.

Apart from this, film material with latent screen dot and the random dot technique were also investigated.

Remarkable is to see that screens with latent screen dots give good usable results with diazo image as well as with offset prints. When one has to produce screened images only in incidentical cases such latent screen dot films can be used efficiently and the purchase of the expensive contact screens can be avoided. The results of the random dot technique are rather disappointing. At the scale 1 : 5000 the diazo images and the offset prints rated even lower than 3 1/2. At the scale 1 : 25,000 the ratings were a little higher as compared to the other techniques.

9.4.2.1 Contact screening in the vacuum frame

— Final result of the diazo method (see figure 45)

Concerning the colour of the contact screen, the grey screen — rarely used in this test, and only with the 60 l/cm ruling (which reflects common practice) — proved to results that are comparable to the magenta screen for the scale 1 : 5000 and 1 : 10,000. However, the rating of the grey-screened images was considerably lower for the scale 1 : 25,000.

An advantage of the elliptical dot over the square dot could not be found.

The influence of the screen ruling is very small if one disregards the low quality of the image at the scale 1 : 25,000 with a 48 l/cm screen. It is remarkable that the screen ruling of 60 l/cm shows small advantages over the other screens at all scales. Because of the fact that with the production of diazo copies, there is no increase of the screen dot, it could have been expected that denser rulings would have given better results.

— Final result of the offset prints (see figure 46)

As with the diazo images, one can state that concerning the colour of the contact screen the grey screen has almost the same result at the scales 1 : 5000 and 1 : 10,000 as the magenta one. However, for the 1 : 25,000 scale production the results of the grey contact screen are clearly lower.

The influence of the shape of the screen dot of the magenta screen is strong, as was to be expected, with the offset printing using screens with 70 l/cm or 80 l/cm.

Here the elliptical dot is superior to the square dot. However, it is surprising that with the screen ruling of 60 l/cm there is no difference shown between the elliptical and the square dot.

When the screen ruling is increased from 60 l/cm to 80 l/cm the reproduction quality stays constant with the magenta screens with elliptical dot, but with the square dot there is a decrease in quality.

It is worth mentioning the good results of the 6 prints made by reproduction centre no. 1 with a magenta screen 100 l/cm and square dot.

Because of the lack of comparable prints for the scale 1 : 5000 and 1 : 10,000 is it not possible to answer the question whether an increase of the screen ruling higher than 80 l/cm for larger scales and elliptical dots would have enhanced the quality.

9.4.2.2 Screening in the process camera (figures 36, 38)

Here the good results achieved with contact screening the 1 : 5000 scale must be pointed out. Using the glass screen in the process camera produced results of which only the best received average ratings.

9.4.3 Influence of the paper type used on the evaluation of diazo images and offset prints

Quite a number of the reproduction results show a difference in quality even with the same reproduction techniques applied, including the making of the printing plate resp. the diapositive for the diazo copies. The reason for this is the influence of the paper type used.

Through a comparison of image pairs made on line tone and on contrast paper with the diazo technique, respectively on map printing paper and on glossy art type paper with the offset printing technique, it became possible to draw conclusions on the influence of the paper types uses.

Table 25 shows the average rating differences of this comparison classified as to reproduction centres and scales.

— For the **offset prints** the rating differences between art type paper and normal map printing paper for A and AS are shown graphically in figure 47 (classified as to screentype) and in figure 48 (classified as to reproduction centres).

Figure 48 shows remarkably that the improvement in quality with the use of art type paper depends on the reproduction centre. The reason for this may be the differences in quality of the various papers but is it also possible that it is due to the adaptation of the printing technique to the paper quality.

Based on the reproductions made it is possible to draw the conclusion that for all scales the offset prints of magenta screened images with the elliptical dot on art type clossy paper give the best evaluation results, as shown in figure 47 and table 25. However, prints screened with the square dot at the scale 1 : 25,000 show no difference in quality.

— For the **diazo images** the evaluation differences between the various paper types also appear correlated to the various reproduction centres (table 25).

9.4.4 Influence of the density range of the orthophoto negatives

The reproduction centres could choose between orthophoto negatives with a density range of 0.7 resp. 1.1.

Although a number of reproductions were made in exactly the same way, starting from both orthophoto negatives, it was not possible to come to a clear conclusion because of the very few pairs of comparable images.

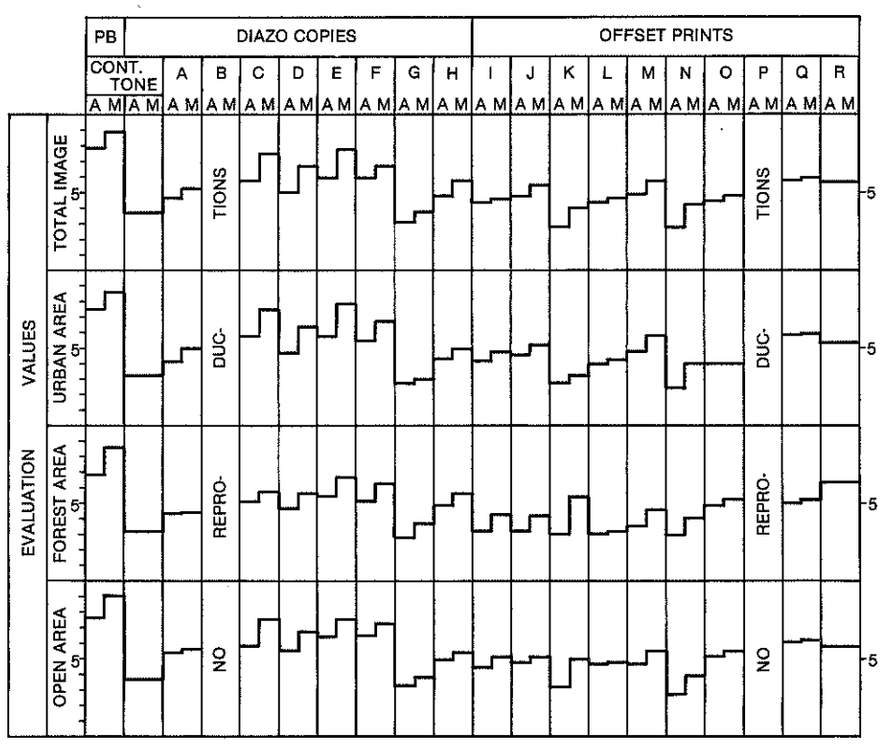
However, when the best reproduction results in the various reproduction groups are compared it became clear that

— as already said under par. 4.4.1 the **photobromides** made from the softer orthophoto negative (so with the density range of 0.7) rated highest;

— with the **screened diazo images** the harder orthophoto negative (i. e. with the density range of 1.1) used as original gave the better result;

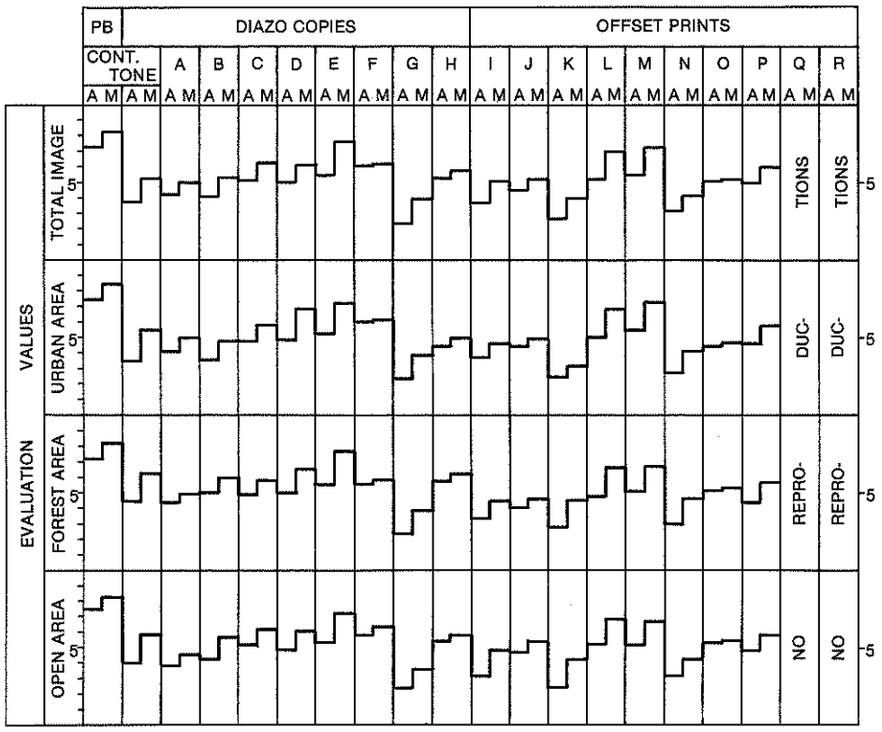
— with the **offset prints** the evaluation results are quite close to each other and do not allow drawing clear conclusions in this matter.

EVALUATION DIAGRAM FOR 1 : 5 000 ORTHOPHOTOS FIGURE A



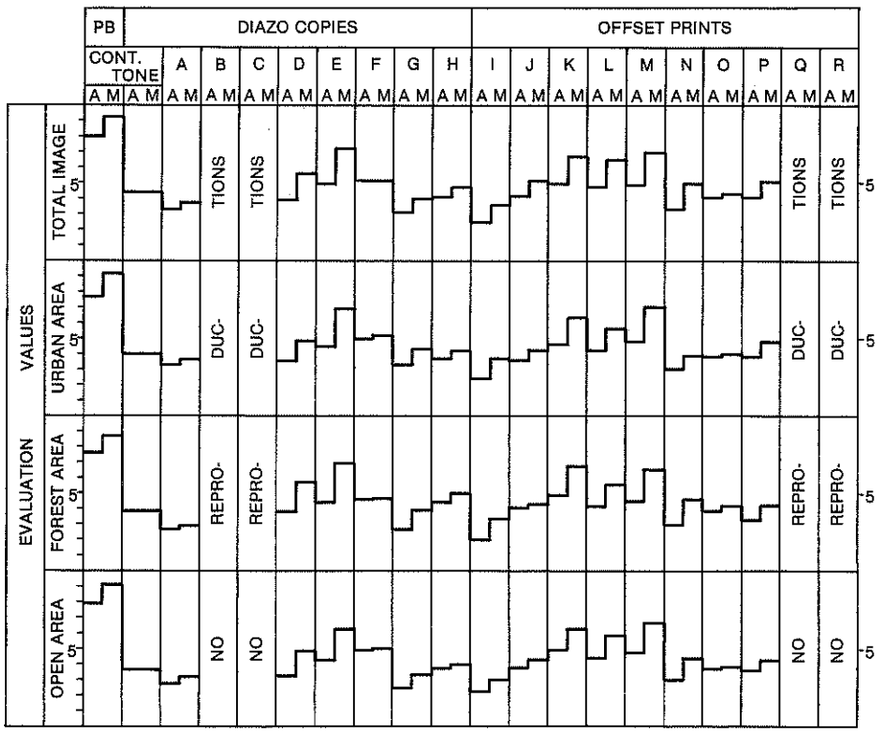
LEGEND
A = average evaluation
M = maximum evaluation
PB = photo bromide
A = grey screen 60l/cm, quadr. d.
B = grey screen 70l/cm, quadr. d.
C = mag. screen 54-60l/cm, quadr. d.
D = mag. screen 70-80l/cm, quadr. d.
E = mag. screen 48-60l/cm, ell. d.
F = mag. screen 70-80l/cm, ell. d.
G = random dot
H = latent screen dot
I = grey screen 60l/cm, quadr. d.
J = mag. screen 60l/cm, quadr. d.
K = mag. screen 70-100l/cm, quadr. d.
L = mag. screen 60l/cm, ell. d.
M = mag. screen 70-80l/cm, ell. d.
N = random dot
O = latent screen d. 54l/cm
P = screen in camera 60l/cm
Q = grey screen in camera 60l/cm, quadr. d.
R = mag. screen in camera 60l/cm, quadr. d.

EVALUATION DIAGRAM FOR 1 : 10 000 ORTHOPHOTOS FIGURE B



LEGEND
A = average evaluation
M = maximum evaluation
PB = photo bromide
A = grey screen 60l/cm, quadr. d.
B = grey screen 70l/cm, quadr. d.
C = mag. screen 54-60l/cm, quadr. d.
D = mag. screen 70-80l/cm, quadr. d.
E = mag. screen 48-60l/cm, ell. d.
F = mag. screen 70-80l/cm, ell. d.
G = random dot
H = latent screen dot
I = grey screen 60l/cm, quadr. d.
J = mag. screen 60l/cm, quadr. d.
K = mag. screen 70-100l/cm, quadr. d.
L = mag. screen 60l/cm, ell. d.
M = mag. screen 70-80l/cm, ell. d.
N = random dot
O = latent screen d. 54l/cm
P = screen in camera 60l/cm
Q = grey screen in camera 60l/cm, quadr. d.
R = mag. screen in camera 60l/cm, quadr. d.

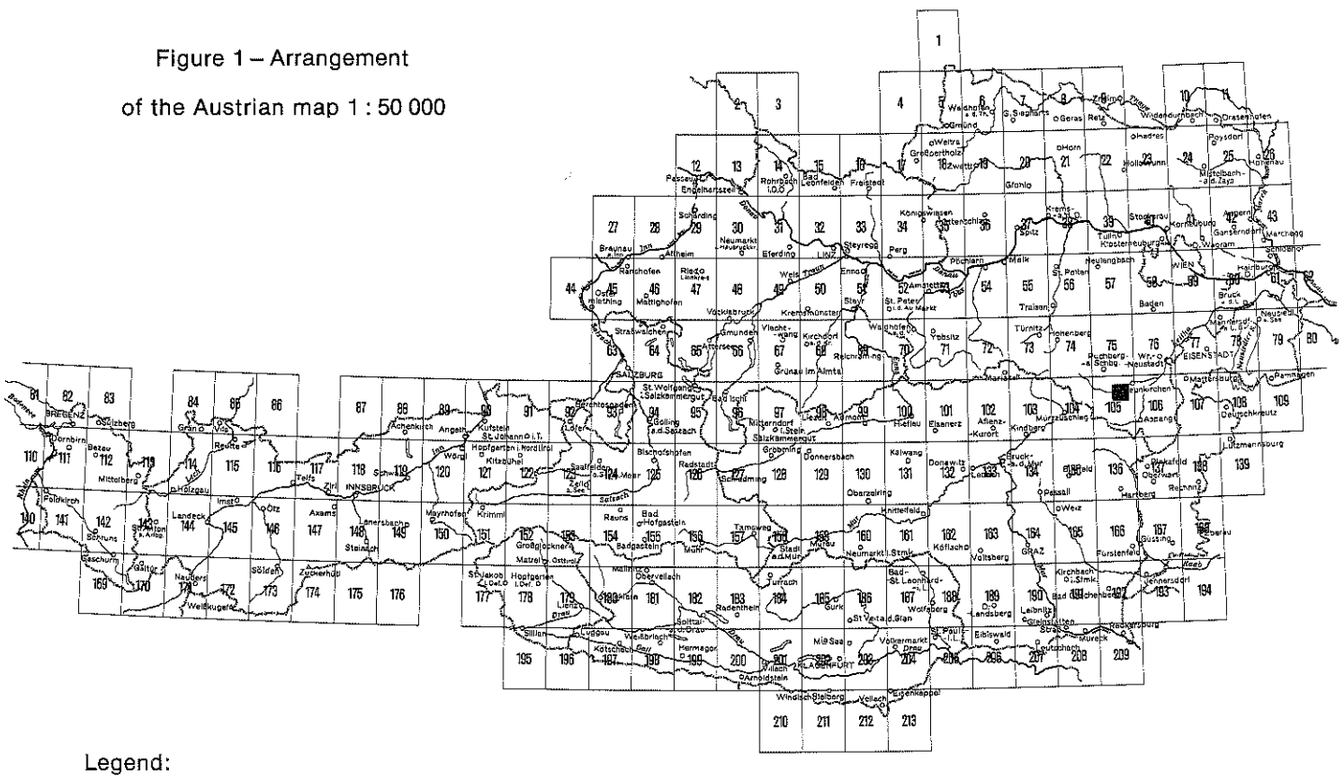
EVALUATION DIAGRAM FOR 1 : 25 000 ORTHOPHOTOS FIGURE C



LEGEND
A = average evaluation
M = maximum evaluation
PB = photo bromide
A = grey screen 60l/cm, quadr. d.
B = grey screen 70l/cm, quadr. d.
C = mag. screen 54-60l/cm, quadr. d.
D = mag. screen 70-80l/cm, quadr. d.
E = mag. screen 48-60l/cm, ell. d.
F = mag. screen 70-80l/cm, ell. d.
G = random dot
H = latent screen dot
I = grey screen 60l/cm, quadr. d.
J = mag. screen 60l/cm, quadr. d.
K = mag. screen 70-100l/cm, quadr. d.
L = mag. screen 60l/cm, ell. d.
M = mag. screen 70-80l/cm, ell. d.
N = random dot
O = latent screen d. 54l/cm
P = screen in camera 60l/cm
Q = grey screen in camera 60l/cm, quadr. d.
R = mag. screen in camera 60l/cm, quadr. d.

Figure 1 – Arrangement

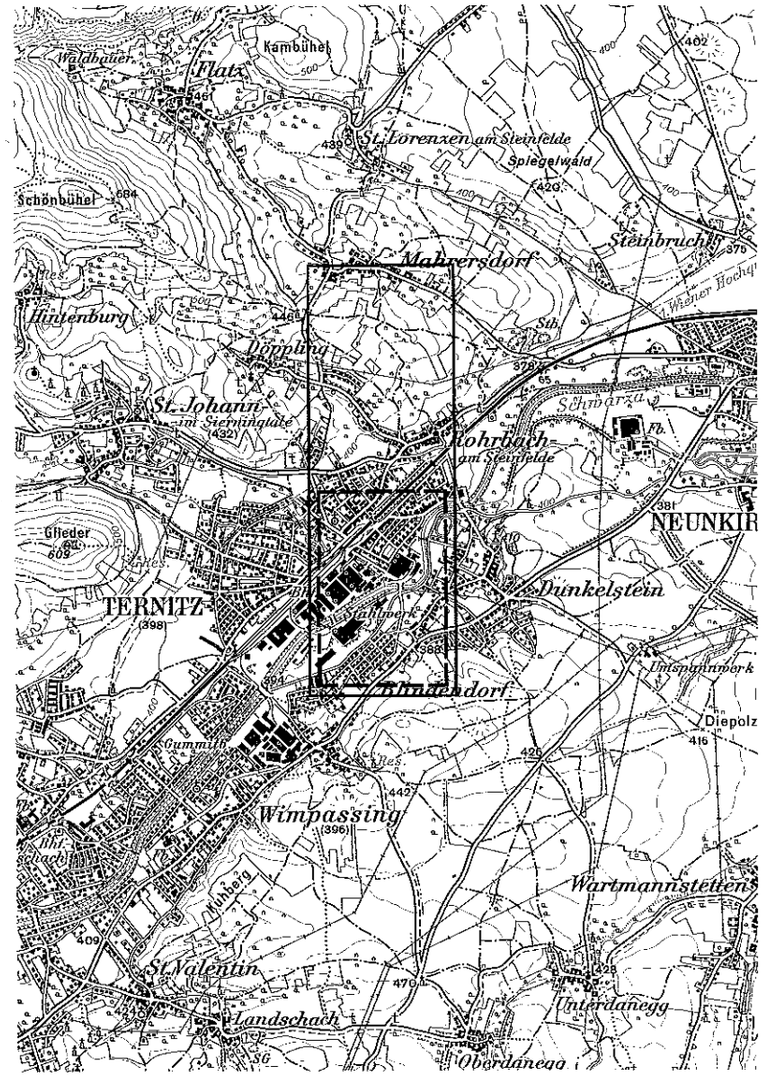
of the Austrian map 1 : 50 000



Legend:

■ site of the test area on map 105-Neunkirchen

Figure 2 – Site of the test-area



Map extract of the Austrian map series 1 : 50 000
Sheet 105 – Neunkirchen (only the most important elements)

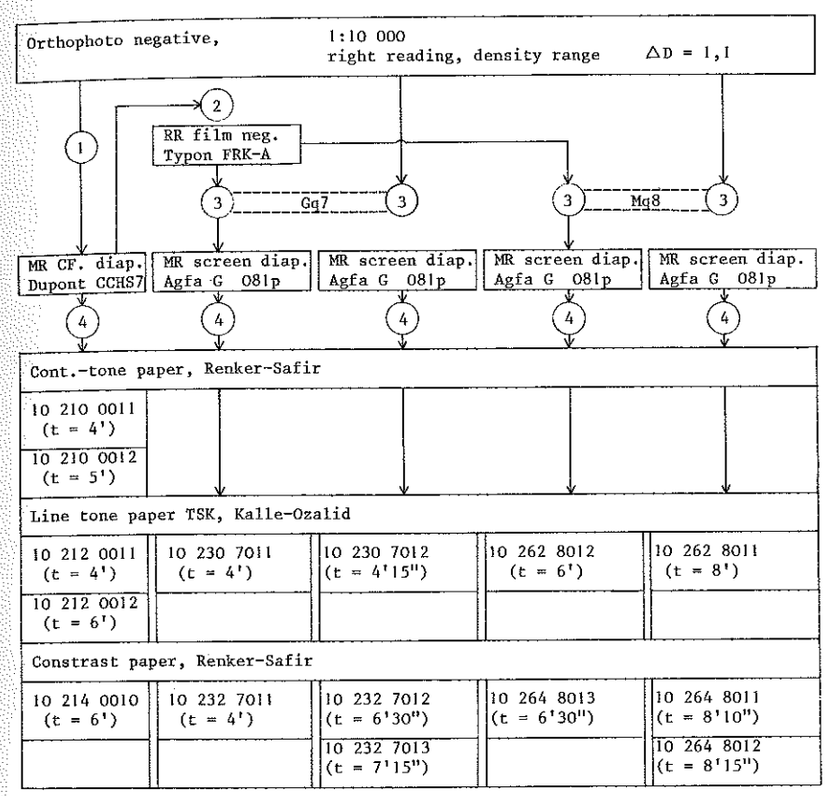
— — — orthophoto 1 : 5000

——— orthophotos 1 : 10 000 and 1 : 25 000

Figure 3 – Method of production of the orthophoto negatives

	Dodged diapositives											
Scale	approx 1 : 12 500				approx 1 : 25 000							
Density range	depending on the density ranges of the orthophoto negatives 0,7 or 1,1											
	by orthoprojection											
Scale	1 : 5000				1 : 10 000				1 : 25 000			
Orthophoto negative	RR		MR		RR		MR		RR		MR	
Density range	0,7	1,1	0,7	1,1	0,7	1,1	0,7	1,1	0,7	1,1	0,7	1,1

Figure 4 – Methods of production
Reproduction centre 1
Diazo copies



1: Contact copy: hand development in Cronafin 1:10 CFLD

2: Contact copy: hand development in Agfa Gevaert G 5p

3: Screening in contact: film-processor Lüth LD 120 EDS,
Developer Agfa Gevaert G 9c

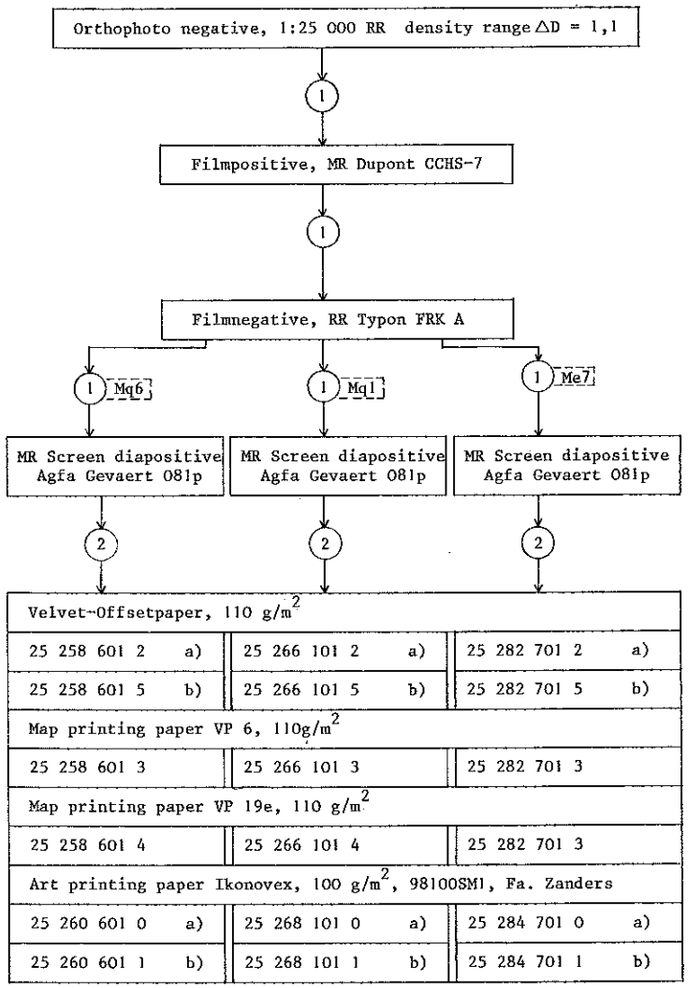
Gq 7: contact screening, type GKD with chain point effect
PAWO, Nottaris and Wagner, Oberburg, Switzerland

Mq 8: Positive contact screen, type MPUS, Policrom Respi, Italy

4: Diazo machine "METEM 61" with vacuum frame, Xenon lamp 8000 W,
exposure distance contant.
development step: 4, exposure time:t

RR = Right reading
MR = Mirror Reversed
CI = Continuous Tone

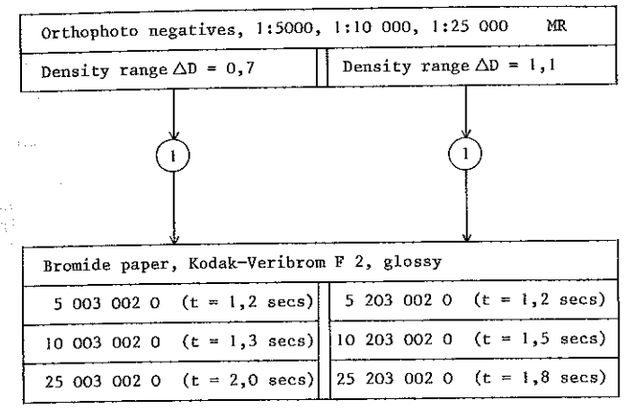
Figure 5 – Methods of production
Reproduction centre 1
Offset prints



1: Contact copy, film-processor Lüth LT 120 EDS
Developer: Agfa Gevaert G 9 c.
Mq 6: Positive Contact screen, Type PS with chessboard construction Raster-Union, EFHA-Kohinoor, Frankfurt, München
Mq 1: Positive Contact screen, 100 dots/cm, Type MPUS, Policrom, Respi-Italy.
Me 7: Positive Contact screen, 70 dots/cm, Type MPUE, Policrom

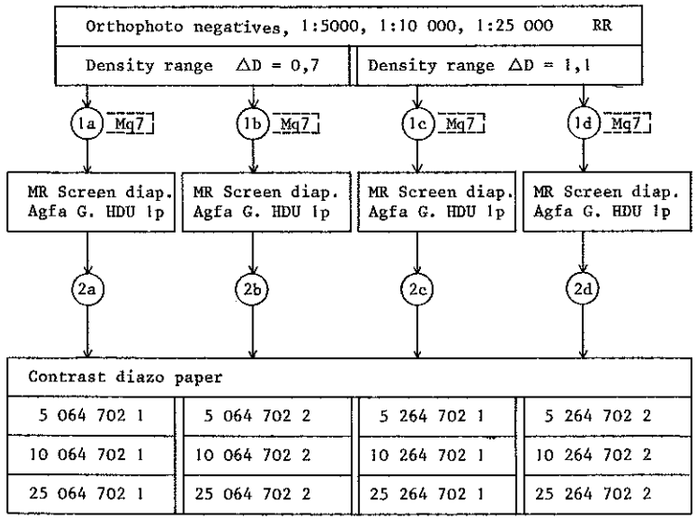
2: Monochromatic-Offset printing machine "Roland Ultra", Fa. Faber und Schleicher, Offenbach, Type RU 4, Nr. 11366, year of construction 1957. Colour: 70 % MSL black S 5500, Fa. Schmidt, 30 % Super-Set-Euro-Blue, 1077 Offset, Fa. Epple. Alteration of colourprint a) colour weak b) colour strong.

Figure 6 – Methods of production
Reproduction centre 2
Continuous tone photos



1: Contact copy in vacuum frame, spotlight 40 W, distance 2 m.
Development in Pakotone, developer G 5c, speed 45 inch/min, temperature 27°C.
Fixation in G 333c, 34°C. drying temperature 38°C, exposure time: t

Figure 7 – Methods of production
Reproduction centre 2
Diazo copies



1: Screening in contact:

Exposures: pre-exposure without negative and with screen
main-exposure with negative and screen
post-exposure with negative and without screen

Exposure-time: a): pre-exp. 0.75", main-exp. 50", post-exp. 1"
b-d): pre-exp. 0.75", main-exp. 50", post-exp. o.50"

Spotlight 15 W, distance 2m.
Development in dish with G 8c at 20°C. Duration 3 min.

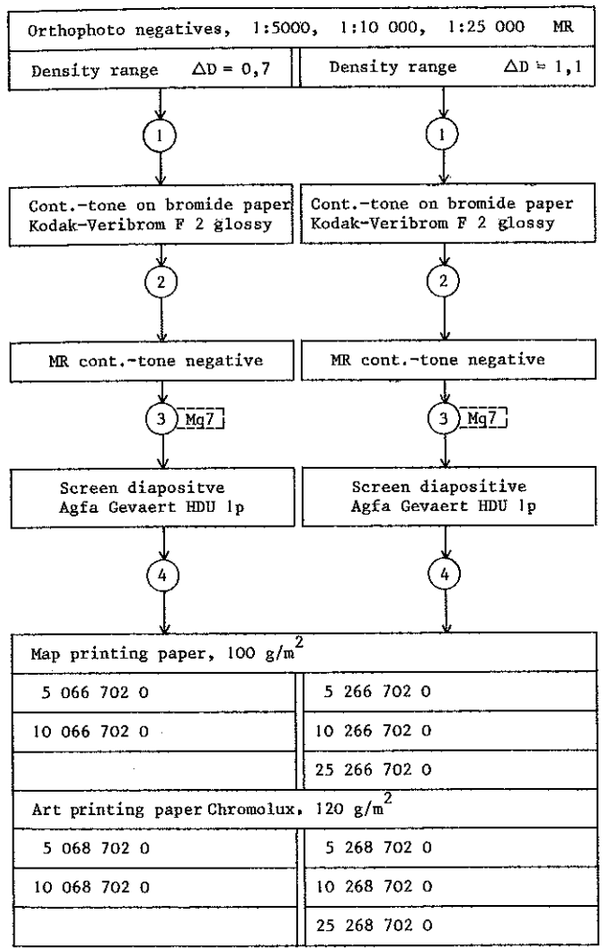
2: Diazo-copying in vacuum frame
Xenon lamp 5000 W, distance 1.25 m.

Exposure-time	1:5000	1:10 000	1:25 000
a)	27,5"	27,5"	20"
b)	22.5"	22.5"	15"
c)	35"	35"	25"
d)	20"	20"	20"

Development in "Commodore Regma", Speed 5.

Mq 7: Magenta screen Policrom, 70l/cm.

Figure 8 – Methods of production
Reproduction centre 2
Offset prints



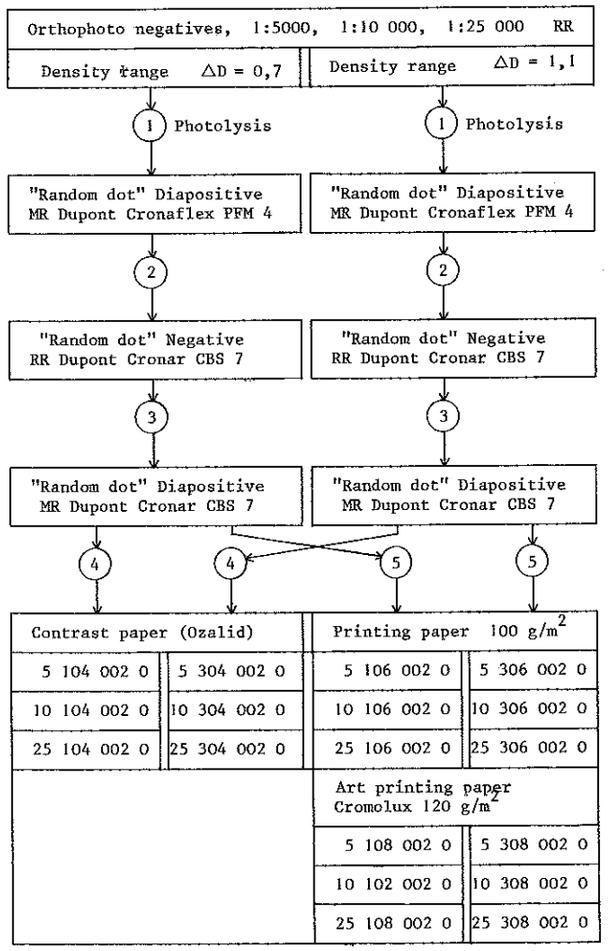
1.: Contact copy see "continuous-tone photographs"

2: Production of continuous-tone negatives with "Klimsch Commodore"

3: Screening in contact:
Main exposure 120", post exposure without screen 6".
Spotlight 15 W, distance 2 m.
Development in dish with G 8c at 20°C. Duration 3 min.
Mq 7: magenta screen Policrom, 70L/cm, rotation 45°.

4.: Production of printingplates:
The "Eggen" copy emulsion was brought up in the whirler. Drying time 10 min.
Exposure in vacuum frame 1 min. Etching with "69 Eggen". Copying-lacquer "stabil" and protecting-paint "S". Cover with "AGUN-Z".
Production of offset-prints on "MANN-IIIA Nr. 35433, Blanket: Cow, Ink: Van Son Gloss Kote 421 Offset. Water: PH ± 6,7.

Figure 9/1 – Methods of production
Reproduction centre 2
Random dot
Diazo copies, offset prints



1: Photolysis: Exposure in vacuum frame, xenon lamp Violux 5000 W, distance 1.25 m, exposure time 3 min. The result has a density between 0.24 and 0.34.

2: Contact copy in vacuum frame, spotlight 5 W, distance 2 m, exposure time 9 sec.
Development in dish with G 8c, development duration 4 min., temperature 20°C.

Figure 9/2

3: Contact copy in vacuum frame, spotlight 15 W, distance 2 m.
Exposure time:

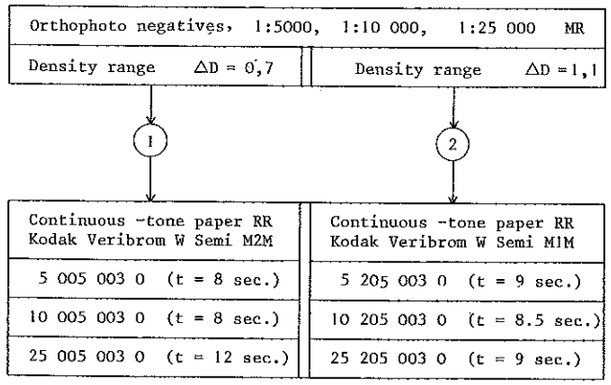
ΔD = 0,7:	1.25 sec.	ΔD = 1,1:	1.0 sec.	(5000)
	1.5 sec.		1.25 sec.	(10.000)
	2.0 sec.		1.75 sec.	(25.000)

Development in Pakotone, speed 150, developer G 5c.

4: Diazo-copy in vacuum frame, xenon lamp 5000 W., distance 1.25 m.
Development in Commodore regma, speed 5.

5: Production of printing plates and print as with Mq 7 (see figure 8/2).

Figure 10 – Methods of production
Reproduction centre 3
Continuous tone photos



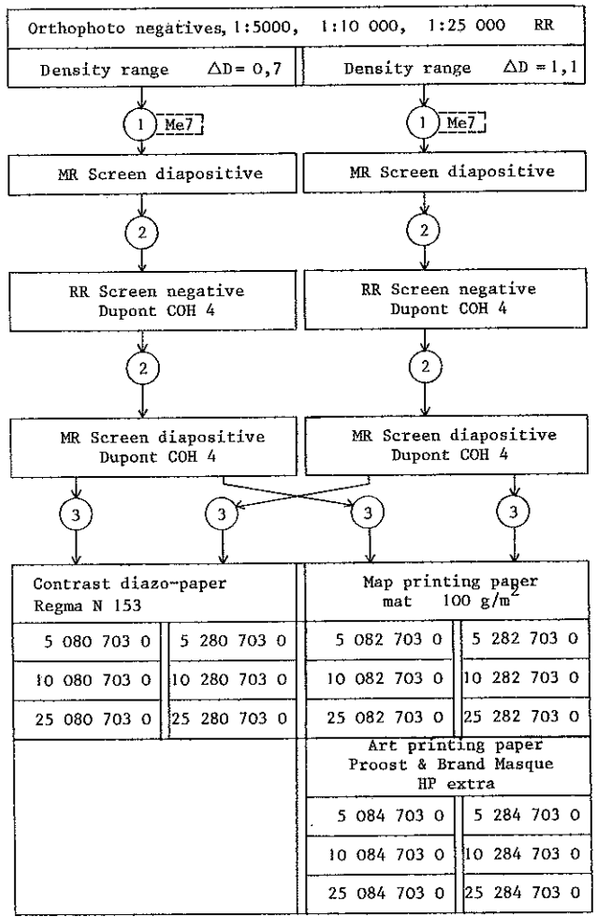
1: Contact copy:

Klimsch Vakuprint, spotlight 40 %
Exposure time: t
Developer G 5c. dilution 1:10, developing time 2 min.
Fixation in 5 min., wash 30 min.

2: Exposure time: t
Developer G 2c, dilution 1:10
Develop time: 2 min. 30 sec. - (5000)
2 min. 30 sec. - (10 000)
3 min. - (25 000)

further as 1.

Figure 11/1 – Methods of production
Reproduction centre 3
Diazo copies, offset prints



1: Screening in contact:
Exposure: spotlight, lamp: Osram 7468 12 V, 35 W.
Distance 1.80 m.

Exposure time	D = 0,7:	45 sec.	- 5000
		53 sec. with magenta filter	- 10 000
		84 sec. Kodak Nr. 30	- 25 000
	D = 1,1:	17+10 sec. (yellow filter)	- 5000
		11+20 sec. (magenta filter)	- 10 000
		12+40 sec. (magenta filter)	- 25 000

Figure 11/2

Filmprocessor Dupont 24 L, speed number 15.5
Gradation value 7.1, temperature 27°C, speed 100 cm/min.
Developer: Dupont CLCD
Me 7: magenta screen, elliptical point, 70 l:cm, Policrom MPUE

2: Contact copy in Klimsch Vakuprint 65,
Exposure 3.5 sec. with intensity of 40 %.
Automatic filmprocessor 24L,
speed 100 cm/min.

3: Diazo-copying Mark-Regma, type Commodore S751.
Exposure in vacuum frame: 1 min. 6 sec.
Lamp Violux 3000 W, distance 1.30 m.
Temperature of the development 100°C. Speed: 3.

4: Printing plate exposure in vacuum frame.
Lamp Violux 3000 W, distance 1.35 m, exposure time 4 min.
Development 2 min., developer Poseidon-Howson.
Printing plate: Howson Olympic Gold
Printing press: Color Metal Perle 127.
Ink: van Son Superior Black Offset Nr. 2675 with 5 % lazulite 1075; water: P_H 5.7
Speed of the press: 3000 prints/hour
Offset rubber fabric Reeves Vulkan 714 GW.

Figure 12/1 – Methods of production
Reproduction centre 3
Random dot
Diazo copies, offset prints

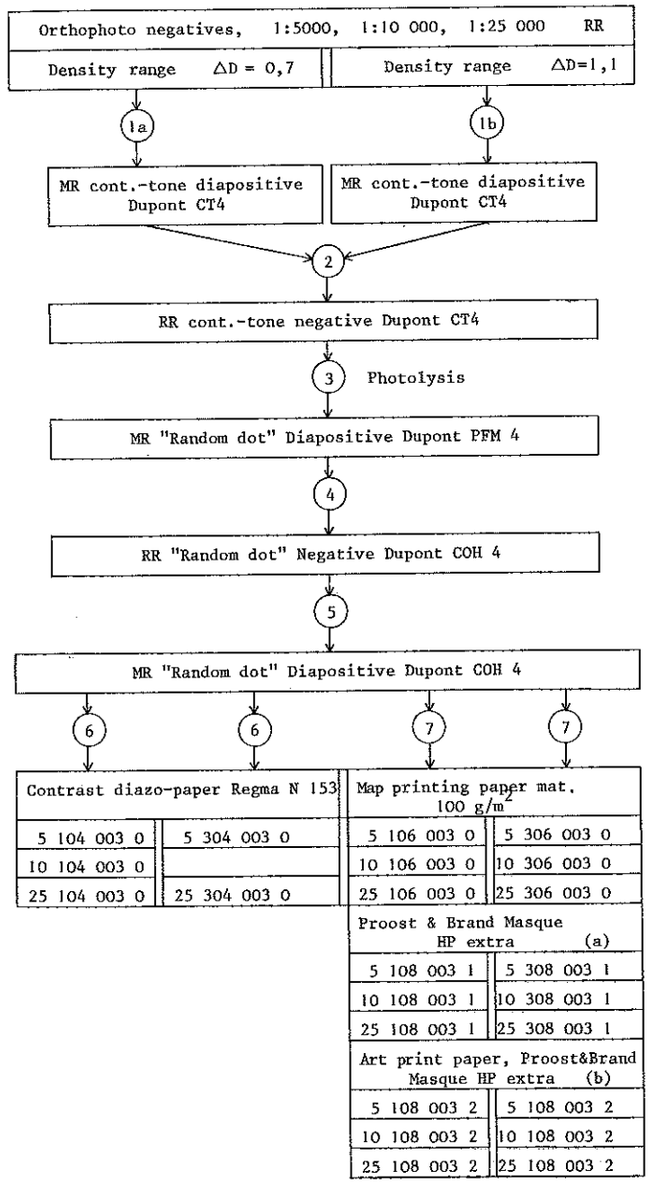


Figure 12/2

1: Contact copying with Klimsch Vakuprint 65.
Exposure with spotlight, intensity 35 %: a) 2 sec.
b) 4 sec.
Developer: Agfa Gevaert G 2c. dissolution 1:7;
Developing time: a) 2,5 min
b) 2,25 min. (5000)
2,5 min. (10 000) and 25 000)
Fixation 5 min., and wash 30 min., drying naturally.

2: All films assembled. Contact copying in Klimsch Vakuprint 65.
Exposure 1 sec. with intensity 40 %. Developing time 2.5 min.
in developer G 2c, dissolution 1:7. Stopbath 30 sec.,
fixation 5 min., wash 30 min., drying naturally.

3: Photolysis:
Exposure 10 min., source of illumination 3000 W, distance
1.30 m, fixation 10 min., dissolution 30 min., drying naturally.

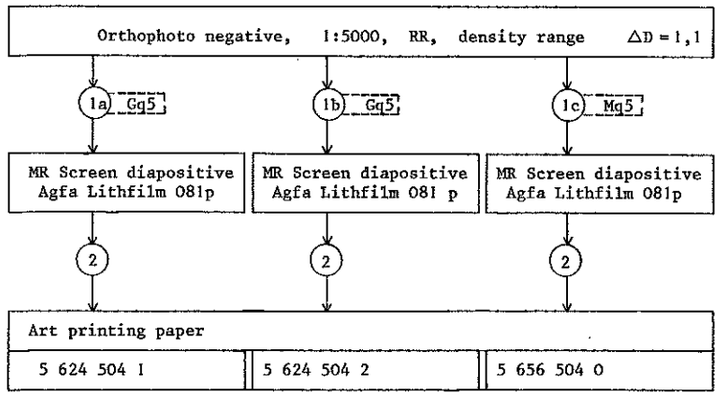
4: Copying: spotlight, intensity 55 %, distance 1.80 m.
Exposure time 35 sec., development in automatic filmprocessor Dupont
24 L, Speed 100 cm/min..

5: Copying in Klimsch Vakuprint 65. Exposure time 3 sec. with
intensity 40 %. Development as 4.

6: Diazo-copying: Regma type Commodore S 751. Lamp Violux 3000 W,
distance 1.30 m.
Exposure time: 50 sec. (5000, 10 000), 70 sec. (25 000)
Developing speed 3.

7: Printing-press: Color Metal 127.
Ink: van Son Superior Black Offset Nr. 2675 with 5 % lazulite 1075.
Further information as 4 mentioned above.
Map printing paper: normal colouring.
Art printing paper: a) version grease, density 1.70
b) version lean, density 1.05

Figure 13 – Methods of production
Reproduction centre 4
Offset prints

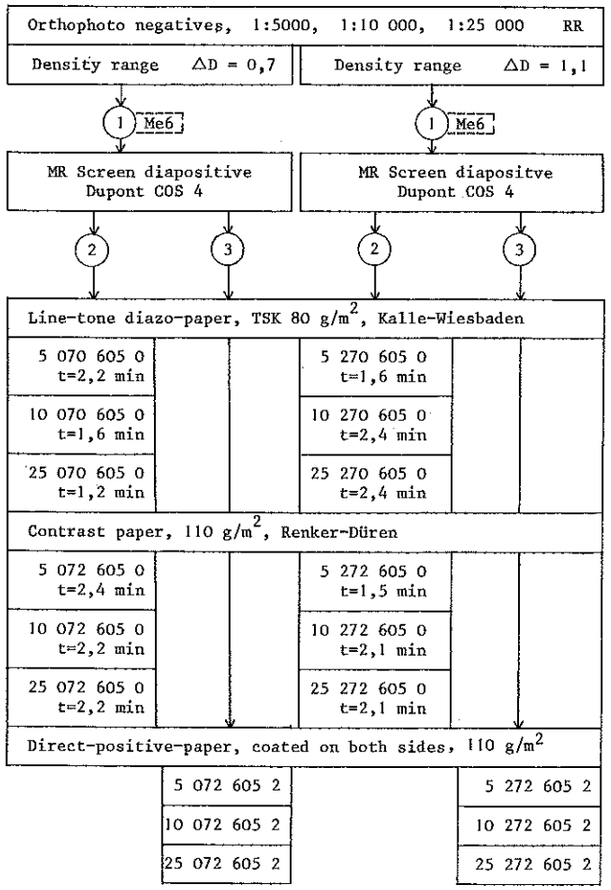


1: Screening: Repro-camera Klimsch Ultra DKT;
Exposure in transmitted light filament lamp 8 x 500 W.
The productional density extent of the screen in the repro-camera
was not sufficient for the screening of the copy. The density
surplus of the copy was bridged over by pre-exposure.
Exposure: 1a: main exposure 100 E, pre-exposure 3 sec.
1b: main exposure 80 E, diaphragm 11, pre-exposure 3 sec.
post exposure 5 E, diaphragm 22,
1c: main exposure 80 E, pre-exposure 15 sec.
Development in G 8c, 2 min., moved slightly.
Gq 5: EFHA-Kohinoor- gry-contact screen, 54 1/cm,
positive characteristic 45°, chess-board dot end

Mq 5: Agfa Gevaert Magenta-contact screen, 54 1/cm
positive characteristic 45°, chess-board dot end

2: Printing plate copy in vacuum frame with Metal-Halogen-lamp 5000 W,
exposure 200 E
Printing plate: Kalle Ozasol P 4.
Printing on offset press, type Heidelberger KOR,
Max. printing-format 39 x 56.
Ink: Litho-set-black of Siegwerk-Farbenfabrik, Siegen.

Figure 14 – Methods of production
Reproduction centre 5
Diazo copies

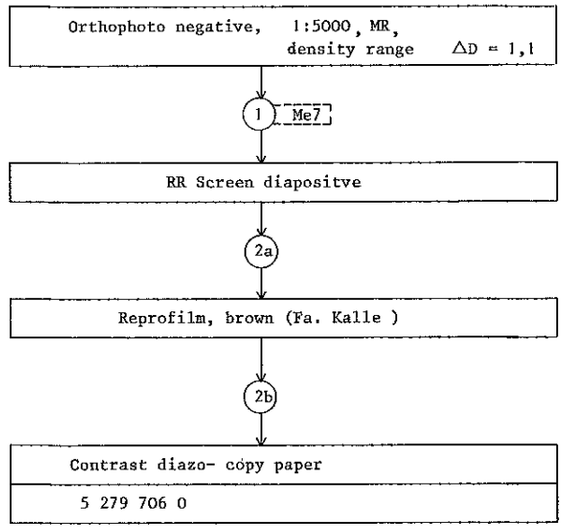


1: Screening in contact:
Apparatus: Vakuprint P, Fa. Klimsch, with automatic exposure control Gevarex, Agfa-Gevaert; spotlight 150 W, 24 V; filter: blue 98 %, yellow 2 %. Development in dish, developer Dupont CLPD, dissolution part A 1:4, part B 1:1, temperature 20°C. Developing time 2 min. 35 sec., fixation 3 - 4 min. at 20°C. Machinable drying at 38°C.
Me 6: magenta-positive-contact screen, elliptical point, extent 1,4, 60 L/cm, Fa. Kohinoor.

2: Diazo-copying in horizontal apparatus Brillant, Fa. Staub-Neu Isenburg, lamp 5000 W., 380 V. type MH 5000 E, Fa. Waldhäuser, Fanrkfurt, lamp distance 1,35 m, exposure times see A5. film processor Ozaprimus, Fa. Kalle-Wiesbaden.

3: Exposure time 14 sec. at 100 % light, development, fixation drying machinable in T 65, Fa. Chemico, developer-fixation-bath Powermatic, Fa. Chemico, at 21°C. Further as 1.

Figure 15 – Methods of production
Reproduction centre 6
Diazo copy



1: Screening in contact with Hoh + Hahne contact copying apparatus type 384; exposure Gevarex with lamp- house, blue yellow rate 80:20.
Film- processor Dupont Cronalith 24 L, speed 43 inch/min., temperature 26°C. Drying temperature 50°C.

Developer: CLCD A + B, as well as CLCE regenerator CLCR A + B (dazzling- system)

Fixation bath: CLLF with hardening addition, after-treatment with farmer's reducer.

Me 7: magenta screen with elliptical point, Agfa-Gevaert MPE 1, 70 L/cm

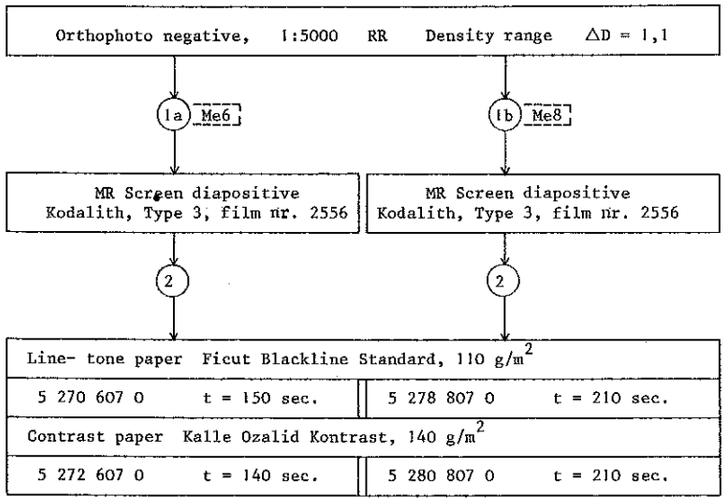
2: Diazo- copy procedure:

Apparatus: Vacuum frame, lighting source Violight 5000 S, distance 2 m horizontal.
Exposure: emulsion on emulsion.
Light dosing apparatus Brillant 2a: 28 impulses
2b: 18 impulses

Filmprocessor Renker RT 154, speed 3 m/min., temperature 40°C.

Developer: ammonia.

Figure 16 – Methods of production
Reproduction centre 7
Diazo copies



1: Screening in contact:
Apparatus: Reprobromografo PRT Type RB2, halogen- lamp, spotlight 100 W. 12 V, potentiometer adjustment on 45 %.

Exposure time: 1a: 2.5 sec. + 15 sec. with yellow filter (Kodak Wratten 8)
1b: 7 sec. + 1,3 sec. without screen (pot 9 %).

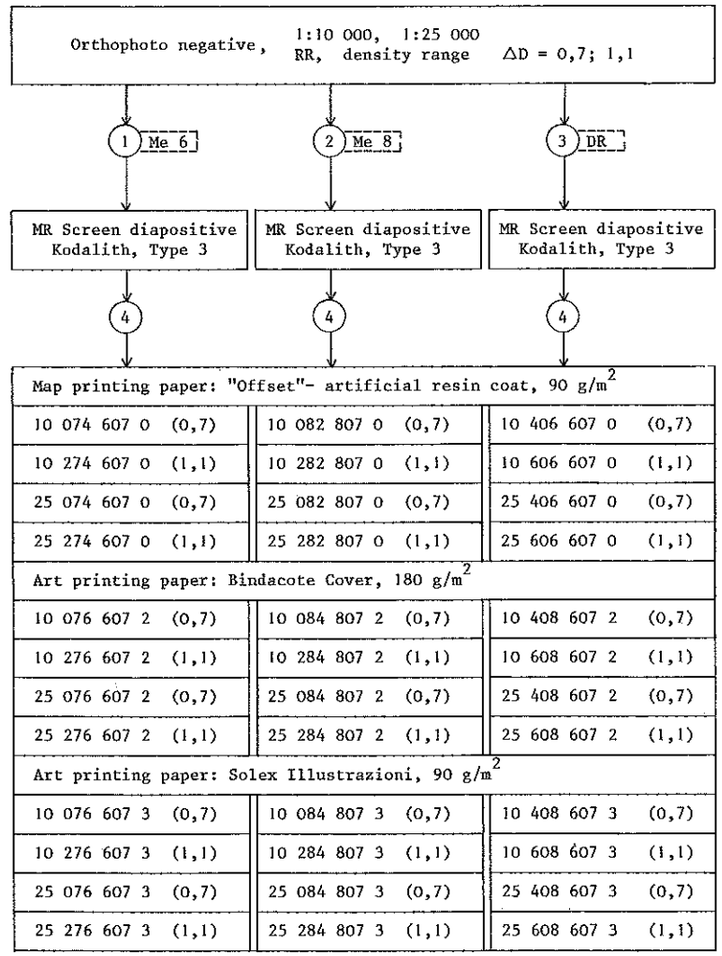
Development in dish under constant movement, developer Kodalith Liquid dissolution 1:3, temperature 20°C, developing time 3 min..
Stop-bath: acetic acid-bath dissolution 1:20, duration 15 sec., 20°C.
Fixation-bath: Agfa 303, duration 4-5 min., 20°C. Drying at 45°C.

Me 6: magenta screen, elliptical dot, 60 l/cm, Policrom magenta MNUE

Me 8: magenta screen, elliptical dot, 80 l/cm, Policrom magenta MNUE

2: Diazo-copying:
Apparatus: Fotoespositore DVIT, type K/30,
Ultra-violet lamp 2000 W with black grid filter.
Exposure times see A5.
Development: "Rigoli" film processor with ammonia.

Figure 17/1 – Methods of production
Reproduction centre 7
Offset prints



Screen: Me 6: Magenta screen, elliptical point, 60 l/cm
Policrom Magenta MNUE

Me 8: Magenta screen, elliptical point, 80 l/cm
Policrom Magenta MNUE

DR : Distance screen, Policrom 60 l/cm

Figure 17/2

1: Screening in contact:
Apparatus: Reprobromografo PRT type RB2, halogen lamp, spotlight 100 W, 12 V, potentiometer adjustment on 45 %.

Exposure times:

1:10 000, ΔD = 0,7: 5 sec.
ΔD = 1,1: 3 sec. + 10 sec. with yellow filter Kodak Wratten 8

1:25 000, ΔD = 0,7: 3,5 sec.
ΔD = 1,1: 5,5 sec.

Development in dish under constant movement,
Developer Kodalith liquid dissolution 1:3, temperature 20°C.
Developing time 3 min.
Stop-bath: acetic acid bath dissolution 1:20, duration 15 sec., 20°C.
Fixation-bath: Agfa 303, duration 4-5 min., 20°C. Drying at 45°C.

2: Exposure times:

1:10 000, ΔD = 0,7: 4,5 sec. + 0,7 sec. without screen
ΔD = 1,1: 5,5 sec. + 0,5 sec. without screen

1:25 000, ΔD = 0,7: 4,5 sec. + 0,8 sec. without screen
ΔD = 1,1: 4,5 sec. + 0,5 sec. without screen

other data see 1.

3: Screening with distance screen:
Apparatus: Klimsch Super Autovertikal 60 with objective Rodenstock Apo-Ronar 1:9 - 360 and screen DR.

Exposure with Klimsch Summalum:

1:10 000, ΔD = 0,7: diaphragm 32, potentiometer pos. 42, screen distance 7,9 mm, diaphr. 90, pos. 17
ΔD = 1,1: diaphragm 32, potentiometer pos. 43, screen distance 7,0 mm, diaphr. 90, pos. 20

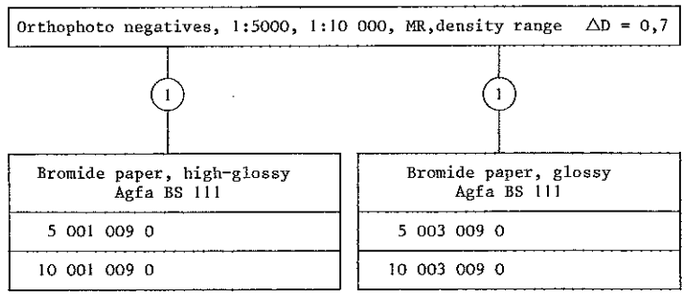
1:25 000 ΔD = 0,7: diaphragm 32, potentiometer pos. 43, screen distance 7,7 mm, diaphr. 90, pos. 20
ΔD = 1,1: diaphragm 32, potentiometer pos. 45, screen distance 7,6 mm, diaphr. 90, pos. 22

Development as under 1.

4: Printing plate production with pneumatic press Biarcio. Xenon lamp 8000 W, distance 86 cm, exposure duration 4 min.
Development with Ozasol at 20°C. Coat with tampon till thickness less than 0,40, wash and coat with body-colour Kalle RC 43.
Fixation with Kalle FC 11, with tampon coat, drying in whirler at 50°C., 3-4 min. Coat of the protection solution "Rotaprint".

Drying in whirler during 2-3 min. at 50°C.
Printing plate "Ozasol P 3".
Printing: automatic press "Mailander", format 80 x 110
Ink: "Icifis noir-froid JK 71".
Water-bath: PH-value 4,50.

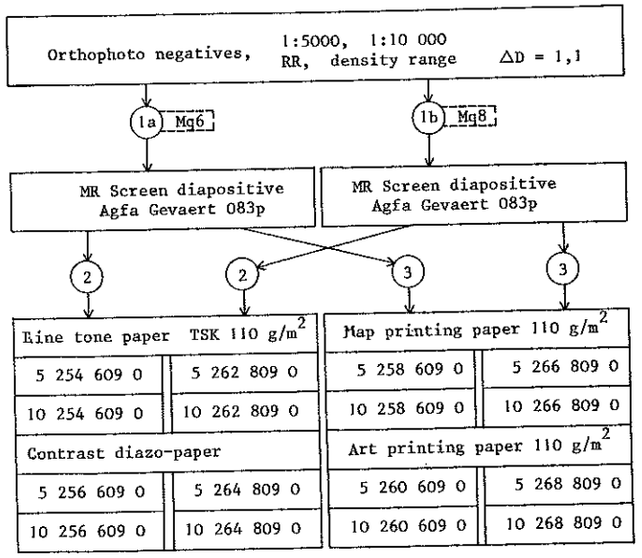
Figure 18 – Methods of production
Reproduction centre 9
Continuous tone photos



1: Contact copying by means of sack-vacuum frame, spotlight, halogen lamp 100 W, 12 V, voltage-adjuster 70 %, exposure time 1,3 sec.

Development: standard development in dish, developer: Agfa-Neufal, dissolution 1:15, temperature 20°C. Development time 1,5 min., fixation-bath 10 min. at 20°C.
Drying in drying press Standard-H Meteor, Siegen.

Figure 19 – Methods of production
Reproduction centre 9
Diazo copies, offset prints



1: Screen by means of contact screen.
Apparatus: Hausleitner-contact copying apparatus, spotlight 50 W, 6 V, voltage adjuster 0%, illumination 150 lux.

exposure time: a: 35 sec. (yellow) + 50 sec. (blue) - 5000
20 sec. (yellow) + 20 sec. (blue) - 10000
b: 27 sec. (yellow) + 12 sec. (blue) - 5000
18 sec. (yellow) + 20 sec. (blue) - 10000

Film processor Lüth ED 5
Developer Agfa G 9, temperature 26°C., speed 120 sec.

Mq 6: magenta screen with quadratic dot, 60 1/cm
Mq 8: magenta screen with quadratic dot, 80 1/cm

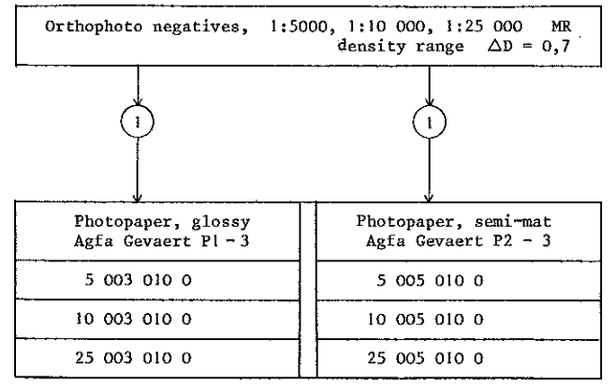
2: Contact diazo-copy in Paus-Sack horizontal copy frame 130 x 160, halogen lamp 3000 W, distance 95 cm.

Exposure time on line-tone paper: 1,7 min.
on contrast paper: 3,0 min. (5000)
3,5 min. (10000)

Development in filmprocessor Kalle TK 100, speed 25 sec.

3: Printing plate copy in horizontal copying frame, halogen lamp 5000 W, distance 1,5 m, exposure time 4,5 min., pre-coated Polichrom-printing plates.
Development in printing development apparatus Kalle Brillant, speed 2 min., developer Ozasol, and Kalle fixation.
Blackening with Kalle's protection paint, rubber coating PC 963 Polichrome. Printing on small offset-press Rotaprint with hydro-colour paintwork R 305, Ink: Rotaprint artprint ink black.

Figure 20 – Methods of production
Reproduction centre 10
Random dot
Continuous tone photos



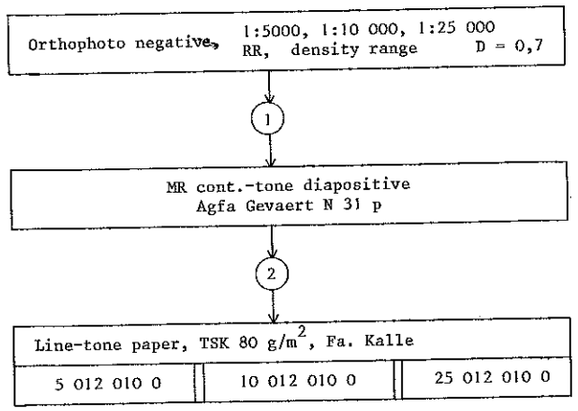
1: Contact copying in Klimsch Vakuprint, halogen lamp 150 W, 24 V, potentiometer adjuster on 40 %.

Film processor Pakotone.

Development speed 35 inch/min., temperature 25°C.
Developer Agfa Gevaert G 7c, dissolution 1:10,
Quick fixation and hardening bath Fa. Adefo.

Exposure times: 2,8 sec. (5 003 010 0)
2,8 sec. (10 003 010 0)
6,0 sec. (25 003 010 0)
2,4 sec. (5 005 010 0)
2,4 sec. (10 005 010 0)
5,0 sec. (25 005 010 0)

Figure 21 – Methods of production
Reproduction centre 10
Continuous tone diazo copies



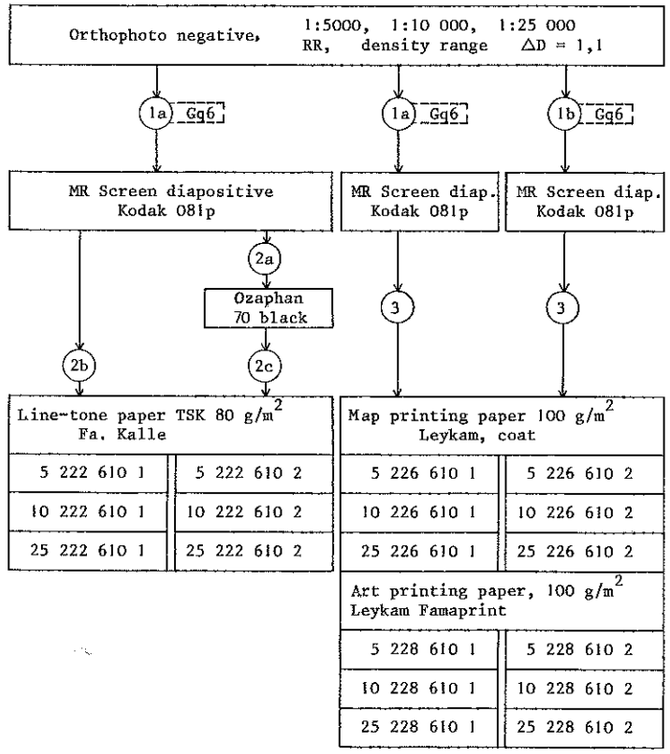
1: Contact copying in Klimsch-Vakuprint, halogen lamp 150 W, 24 V, potentiometer adjuster on 35 %.

Exposure times: 2,2 sec. (5000)
2,0 sec. (10000)
3,0 sec. (25000)

Film processor Pakotone
Development speed 30 inch/min., temperature 25°C.
Developer Agfa Gevaert G 7c, dissolution 1:10.
Quick fixation and hardening bath Fa. Adefo.

2: Diazo-copying in contact procedure in vacuum frame.
Carbon arc lamp. Exposure duration approx. 8 min.
Development in ammonia. Duration approx. 1 min..

Figure 22 – Methods of production
Reproduction centre 10
Diazo copies, offset prints
Grey screen, quadratical dot



1: Contact copying in Klimsch Vakuprint, halogen lamp 150 W, 24 V.
Supplementary lighting Progalum S.

Exposure time: a) approx. 10 sec.
b) approx. 10 sec. and post-exposure without screen
Film processor Pakotone. Development speed: a) 25 inch/min. (5000)
15 inch/min. (10000, 25000)
b) 25 inch/min.
Developer Agfa Gevaert G 7c, temperature 25°C., dissolution 1:10, quick fixation and hardening-bath Fa. Adefo.

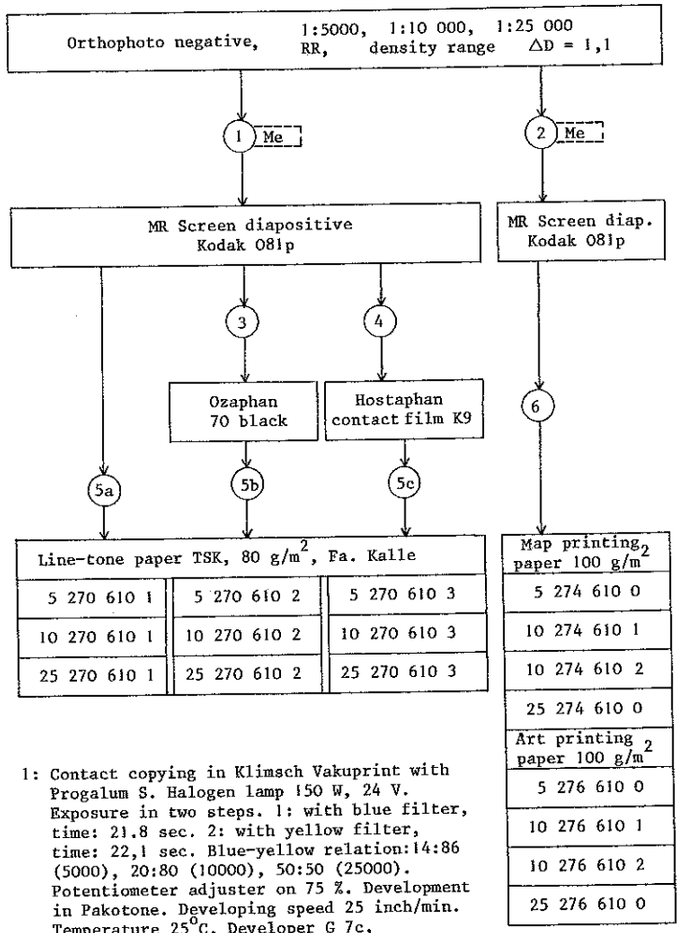
2: Diazo-copying in contact vacuum frame. Carbon arc lamp.

Exposure time: 2a, 2b: 7,5 min.(5000)
9,5 min.(10 000, 25 000)
2c: 6,5 min.

Exposure time: 2a: 3 min. 2b, 2c: 1 min.

3: Printing palte production: Exposure of aluminium plates in vacuum frame. Metal halogen lamp 3000 W, exposure time 4,5 min., development time 2,5 min. Kalle Ozasol processing installation VA 540 - Brillant. Heated at 230°C. in Dicopa-Ozasol-stove OTV IV, approx 10 min., printing machine RU 5, Fa. Roland, type Ultra 5, speed 5000 prints/hour, winding key: middle hard.

Figure 23 – Methods of production
Reproduction centre 10
Diazo copies, offset prints
Magenta screen, elliptical dot



1: Contact copying in Klimsch Vakuprint with Progalum S. Halogen lamp 150 W, 24 V. Exposure in two steps. 1: with blue filter, time: 21.8 sec. 2: with yellow filter, time: 22,1 sec. Blue-yellow relation:14:86 (5000), 20:80 (10000), 50:50 (25000). Potentiometer adjuster on 75 %. Development in Pakotone. Developing speed 25 inch/min. Temperature 25°C. Developer G 7c, dissolution 1:10

2: As in 1., only additional with blue-yellow relation 30:70 (10000)

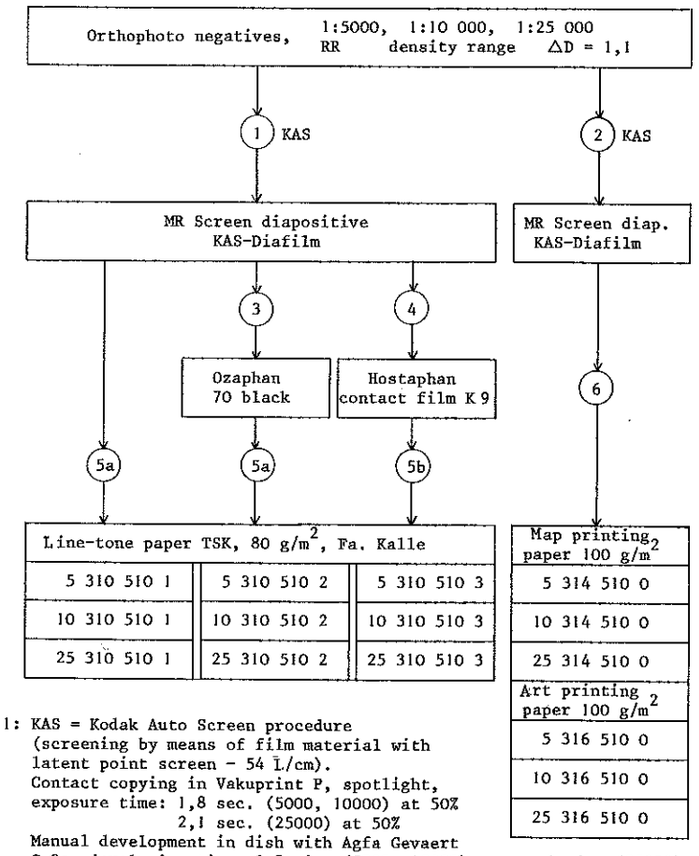
3: Contact copying: exposure 8 min. (5000, 25000), resp. 9,5 min. (10000). Development in drying procedure approx. 3 min.

4: Contact copying. Development in wet procedure.

5: Diazo-copying in contact procedure in vacuum frame, carbon arc lighting. Exposure time: a) 8 min. (5000, 25000), resp. 9,5 min (10000), b) 6,5 min. Development in ammonia, speed 1 min.

6: Printing plate production and prints as in Gq 6.

Figure 24 – Methods of production
Reproduction centre 10
Diazo copies, offset prints
Kodak auto screen procedure



1: KAS = Kodak Auto Screen procedure (screening by means of film material with latent point screen – 54 L/cm).
Contact copying in Vakuprint P, spotlight, exposure time: 1,8 sec. (5000, 10000) at 50%
2,1 sec. (25000) at 50%
Manual development in dish with Agfa Gevaert G 9c, developing time: 2,7 min. (5000, 10000), resp. 3 min. (25000), temperature 20 – 25°C.

2: As in 1., however, exposure time: 5000 pre-exposure 2,3 sec. (30%), main-exposure 1,4 sec. (50%)
10000 pre-exposure 2,3 sec. (30%), main-exposure 1,5 sec. (50%)
25000 pre-exposure 2,0 sec. (30%), main-exposure 1,8 se. (50%)
Development: 2,75 min. (5000, 10000), resp. 3 min. (25000).

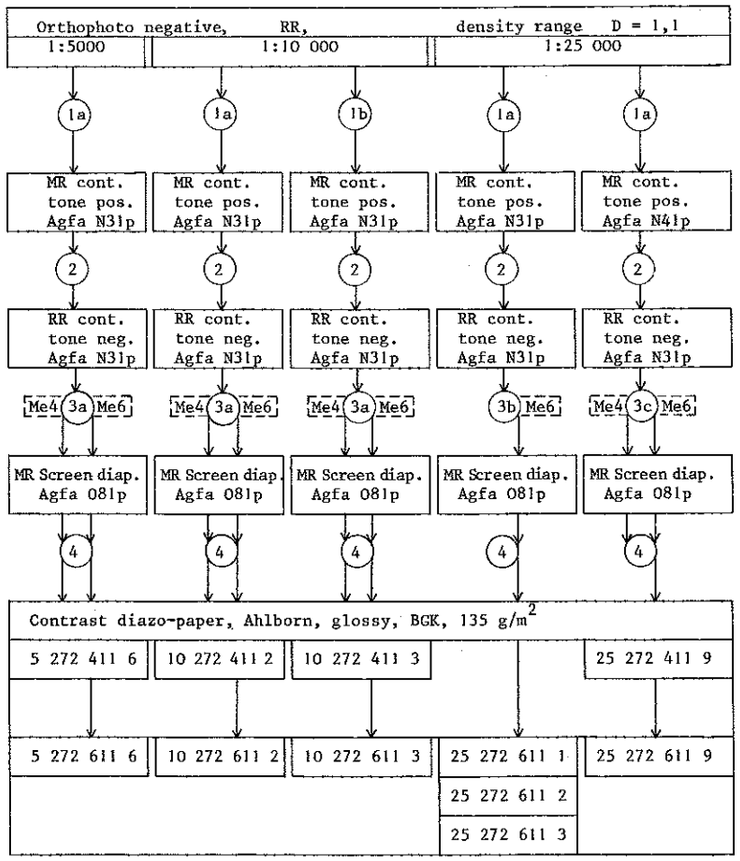
3: Contact copying: exposure 5 min. (5000), resp. 8 min. (10000, 25000). Development in drying procedure approx. 3 min.

4: Contact copying. Development in wet procedure.

5: Diazo-copying in contact procedure in vacuum frame, carbon arc lighting.
Exposure time: a) 4,5 min b) 3,5 min (5000)
7,5 min 6,5 min (10000, 25000)
Development in ammonia, speed approx. 1 min.

6: Printing plate production and print as in Gq 6.

Figure 25 – Methods of production
Reproduction centre 11
Diazo copies



1: 2: As with cont.-tone photos.

3: Screening in contact. Spotlight, potentiometer 60%.

Exposure time: a) 15 sec. with blue filter Agfa U449c
b) 6 sec. with yellow filter 489c (25 272 611 1)
3 sec. with yellow filter 489c (25 272 611 2)
15 sec. with blue filter U449c (25 272 611 3)
c) 5 sec. with yellow filter 489c+(48 1/cm)
15 sec. with blue filter U449c (60 1/cm)

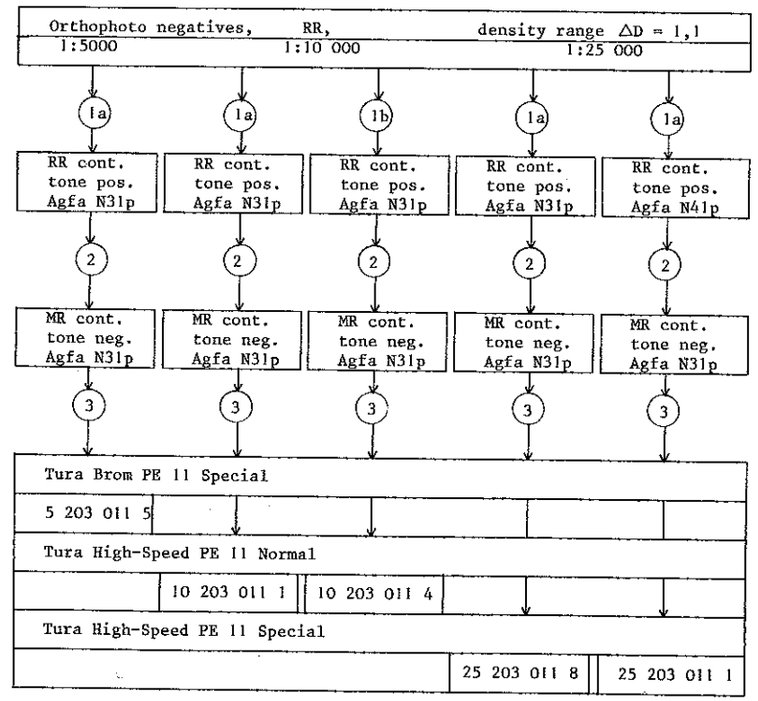
Development in Tetenal-Lithanal S (part A + B dissolved 1:3) at 20°C.

Me 4: magenta-positive screen MPE 2 with 48 1/cm

Me 6: magenta-positive screen MPE 2 with 60 1/cm

4: Diazo-copying with Meteor Meteoplan-flat diazo copying machine. Exposure in direct contact. Exposure time 3,5 - 4 min.

Figure 26 – Methods of production
Reproduction centre 11
Continuous tone photos



1: Contact copying in Klimsch Vakuprint 85, spotlight, potentiometer: 40%. Exposure time 2,5 sec.. Development in a) Agfa Gevaert G 3p
b) Agfa Gevaert G 5c

Development time a) 3 min. and b) 5 min. at 20°C., whereby 1 min. in constant movement.
Acetic acid intermediate bath 1 min., Tetenal-Superfix-fixation-bath 4 min. washing 15 min., drying at 40°C in 12 min..

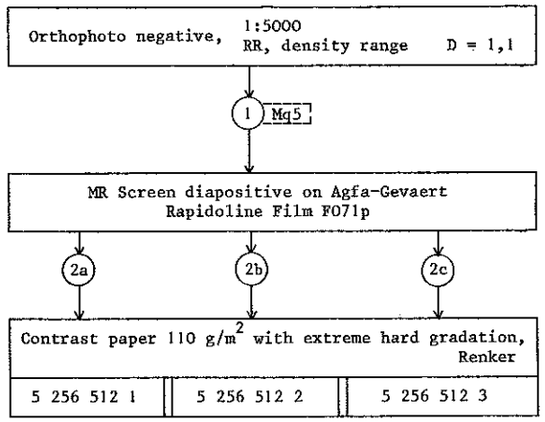
2: Contact copying, spotlight, pot.: 45%. Exposure time: 6 sec. (5000)
2,5 sec.(10000)
2 sec. (25000).

Developer G 3p, development time 1,5 min., temperature 20°C.

3: Contact copying in Klimsch Vakuprint 85, spotlight, potentiometer: 52%. Exposure time 3 sec. Development in Tetenal Eudobrom liquid in dissolution 1:10 at 20°C.

Exposure time 2 min., fixation-bath Tetenal Superfix, duration 1 min., 20°C.

Figure 27 – Methods of production
Reproduction centre 12
Diazo copies



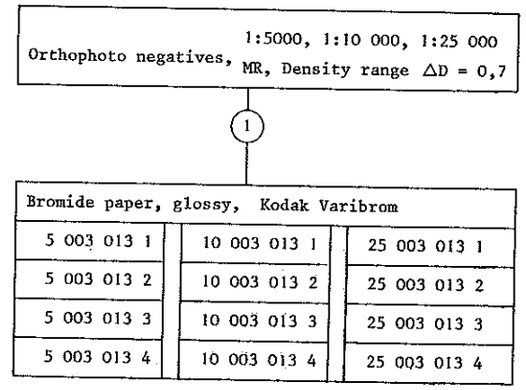
1: Contact copying with Multicopy-contact apparatus (Fa. Mühlhauser) with spotlight at full light value.

Mq 5: Rapidoprint-magenta screen, 54 1/cm.

2: Diazo-copying in Waldhäuser-flat frame, emulsion contact, with MHG-lamp, 5000 W.
Development in diazo-automatic copying 420 Kf Meteor, Siegen, with liquid ammonia.

Exposure times: 2a: 45 beats
2b: 50 beats
3c: 55 beats

Figure 28 – Methods of production
Reproduction centre 13
Continuous tone photos



1: Contact copying with several exposure times.

Figure 29/1 – Questionnaire

Questionnaire
Evalution of orthophoto copies

Enclosed are 4 contact copies on bromide paper at the scales 1:5.000, 1:10.000 and 1:25.000.
The copies are made from the same orthophoto negative, but differ in density range resp. gradation. At the back of the copies the scale-magnification (in thousands) and a continuous photo number are given. For instance the 4th photo- scale 1:25.000 bears the mark 25.4.

We ask you to answer the following questions:

1. How do you evalute the usefulness of the orthophotos for the in the following point 4 given ranges of application, if you look at the copies from a distance of approximate 30 cm ("easy" range of sight)?

	1:5.000	1:10.000	1:25.000
Mark of the best image	.....	.....	.....
Mark of the next-best image	.....	.....	.....
	.....	.....	.....
Mark of the worst image	.....	.....	.....

2. What quality range do you give, if you look at the orthophotos from a distance of approximate 1 m ?

	1:5.000	1:10.000	1:25.000
Mark of the best image	.....	.....	.....
Mark of the next-best image	.....	.....	.....
	.....	.....	.....
Mark of the worst image	.....	.....	.....

3. How do you evaluate the usefulness of the orthophotos, when these are looked at under the employment of usual means of aid for the evaluation (e.g. the magnifying-glass) in your field of application ?

	1:5.000	1:10.000	1:25.000
Mark of the best image	.....	.....	.....
Mark of the next-best image	.....	.....	.....
	.....	.....	.....
Mark of the worst image	.....	.....	.....

Which means of aid did you use ?

Figure 29/2 – Questionnaire

4. For what range of application is this evaluation valid ? (please cross or enter).

- ☐ topography
- ☐ cartography
- ☐ urban survey
- ☐ rural survey
- ☐ re- allotment
- ☐ forestry
- ☐ pedology
- ☐ geology
- ☐ geomorphology
- ☐ geography
- ☐ .....

Are you busy in this scope predominantly or occasionally ?

predominantly	occasionally	trainee
☐	☐	☐

5. What education do you have (please cross or enter) ?

Main education in:

- ☐ geodesy
- ☐ geography
- ☐ geology
- ☐ forestry
- ☐ agriculture
- ☐ civil engineering
- ☐ .....

Where have you been educated ?

university	technical college/lower technical college	practice
☐	☐	☐

What ist your age ? ☐ years of age

6. Further remarks:

Figure 30 – Areas to be evaluated and forms of details 1 : 5000

Visual impression

Question

A entire image
B urban areas and industrial areas
C open land (agricultural land, meadows, watercourses, industrial dumps)

Detailforms

Number

1 bright roof-surface against road-surface
2 car
3 roof-edge
4 line of eaves
5 vent-traps
6 roof-edge
7 chimney-hoods
8 rails
9 roof-angle
10 shadows of chimney-hoods
11 shadow-stripes
12 boundary of roads
13 bright dots in meadow
14 track
15 limit of vegetation
16 bright dots
17 goal-lines
18 dark spot
19 furrow
20 limit of vegetation
21 shrubs
22 fence-hedge
23 stand-limit
24 bright dots on clearance
25 tracks of road
26 forest-limit
27 bright tree-tops
28 road
29 single tree
30 stand-limit
31 seperation between foliage and cast-shadow
32 recognizability of single tree-tops (structure in foliage)
33 limits between two lines of foliage
34 difference of texture of the foliages

Figure 31 – Areas to be evaluated and forms of details 1 : 25 000

Visual impression

Question

A entire image
B urban areas and industrial areas
C forest areas
D open land (fields, meadows, watercourses, industrial dumps)

Detailforms

Number

1 ridge of roof
2 roof-angle
3 grass-stripes between roads
4 limit house-garden
5 bright spot
6 track
7 trees on avenue
8 goods-train
9 roofs of cast shadow
10 small roof
11 roof-step
12 separation of sand-bank and water
13 pylon
14 path
15 field boundary
16 vegetation-spots
17 path
18 shrub
19 field-ridge
20 vegetation-limit
21 shrub
22 field-ridge
23 stand-limit
24 recognizability of texture
25 road-track
26 stand-limit
27 bright tree-tops
28 stand-limit
29 single trees
30 forest-aisles
31 separation between
32 texture of foliage crowns
33 stand-limit
34 not applicable

Figure 32 – Areas to be evaluated and forms of details 1 : 10 000

Visual impression

Question

A entire image
B urban areas and industrial areas
C forest areas
D open land agricultural land, meadow, watercourses, industrial dumps

Detailforms

Number

1 ridge of a roof
2 parked cars
3 traffic tracks on streets
4 line of eaves (edge of roof)
5 vent-traps
6 edge of roof
7 chimney-hoods
8 goodstrain
9 line of eaves (edge of roof)
10 ventilators
11 shadow stripes
12 separation of sand-bank and water
13 pylon
14 path
15 field-boundary
16 two spots in meadow
17 goal-line
18 shrub
19 field-ridge
20 vegetation limit
21 shrubs
22 dam
23 stand-limit
24 road track
25 road track
26 stand-limit
27 bright tree-tops
28 road
29 single tree
30 forest-aisle
31 separation between foliage crowns and cast shadow
32 difference of textures of foliage crowns between the details 30 and 32
33 road
34 not applicable

Figure 33 – Evaluation table for 1 : 5000

OEEPE
Commission E — Essai reprotechnique
OEEPE
Kommission E — Reproversuch

TABLEAU DE POINTAGE
Echelle 1 : 5 000
Feuille 2

Résultats reprotechniques Reproergebnisse	Impr. vis./Vis. Eindr.														
	A	B	C	D	1	2	3	4	5	6	7	8	9	10	11
5 268 809															
5 070 605															
5 270 605															
5 270 607															
5 270 610-1															
5 270 610-2															
5 270 610-3															
5 072 605															
5 072 605-2															
5 272 411-6															
5 272 605															
5 272 605-2															
5 272 607															
5 272 611-6															
5 274 610															
5 276 610															
5 278 807															
5 279 706															
5 080 703															
5 280 703															
5 280 807															
5 082 703															
5 282 703															
5 084 703															
5 284 703															
5 104 002															
5 104 003															
5 304 002															
5 304 003															
5 106 002															
5 106 003															
5 306 002															
5 306 003															
5 108 002															
5 108 003-1															
5 108 003-2															
5 308 002															
5 308 003-1															

Figure 34

Average evaluation
of an evaluation series
for all reproductions and questionings
(Evaluation levels of the evaluators)

Evaluation centres:

1 Staten Landmateriverket, Gavle
2 Topografische Dienst, Delft and ITC, Enschede
3 Universität Karlsruhe
4 Universität Freiburg
5 Istituto Geografico Militare, Firenze

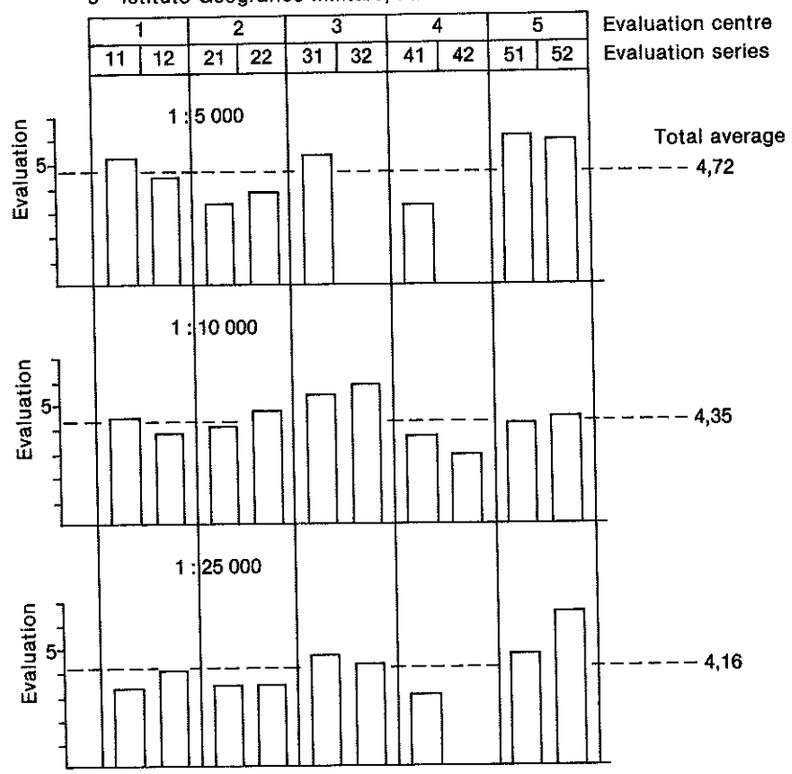


Figure 35

Evaluation
of the questioning A and AS
(Total image)

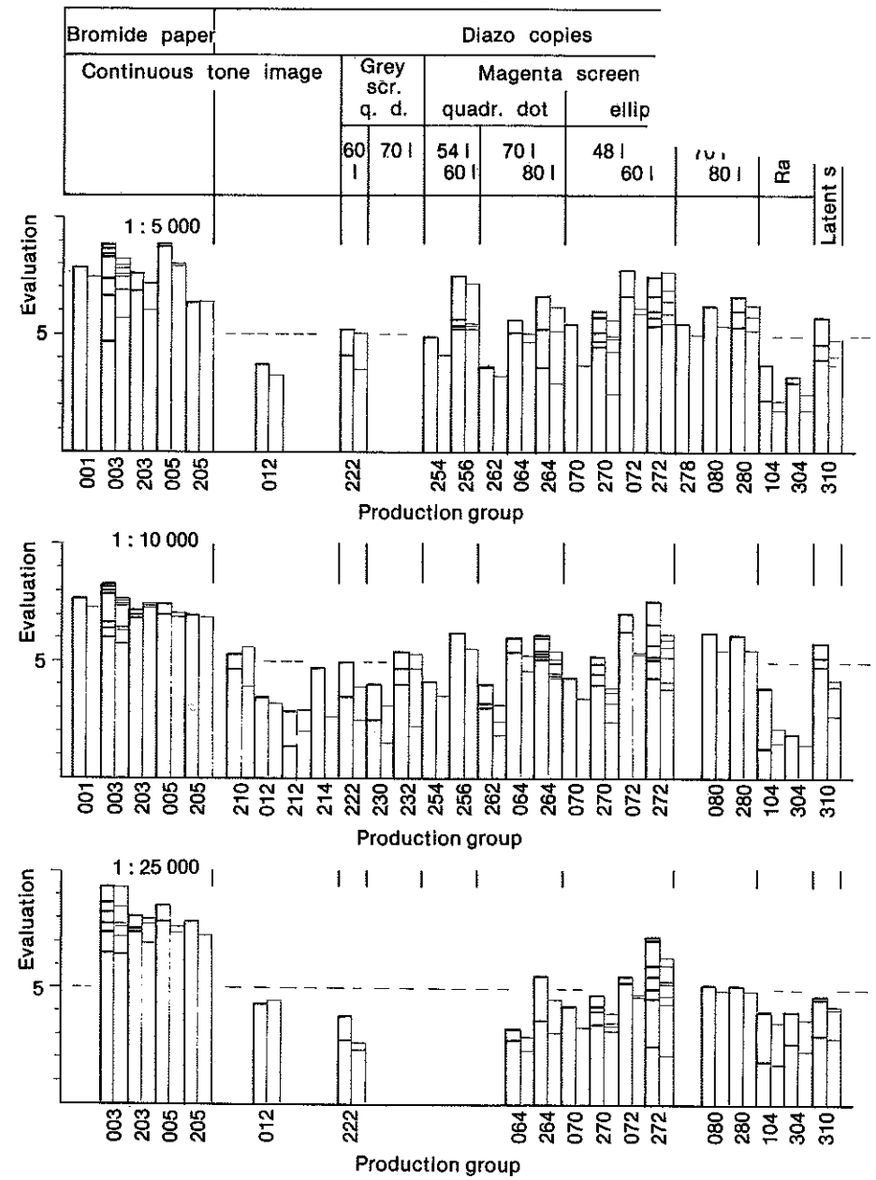


Figure 36

Evaluation
of the questioning A and AS
(Total image)

Offset prints

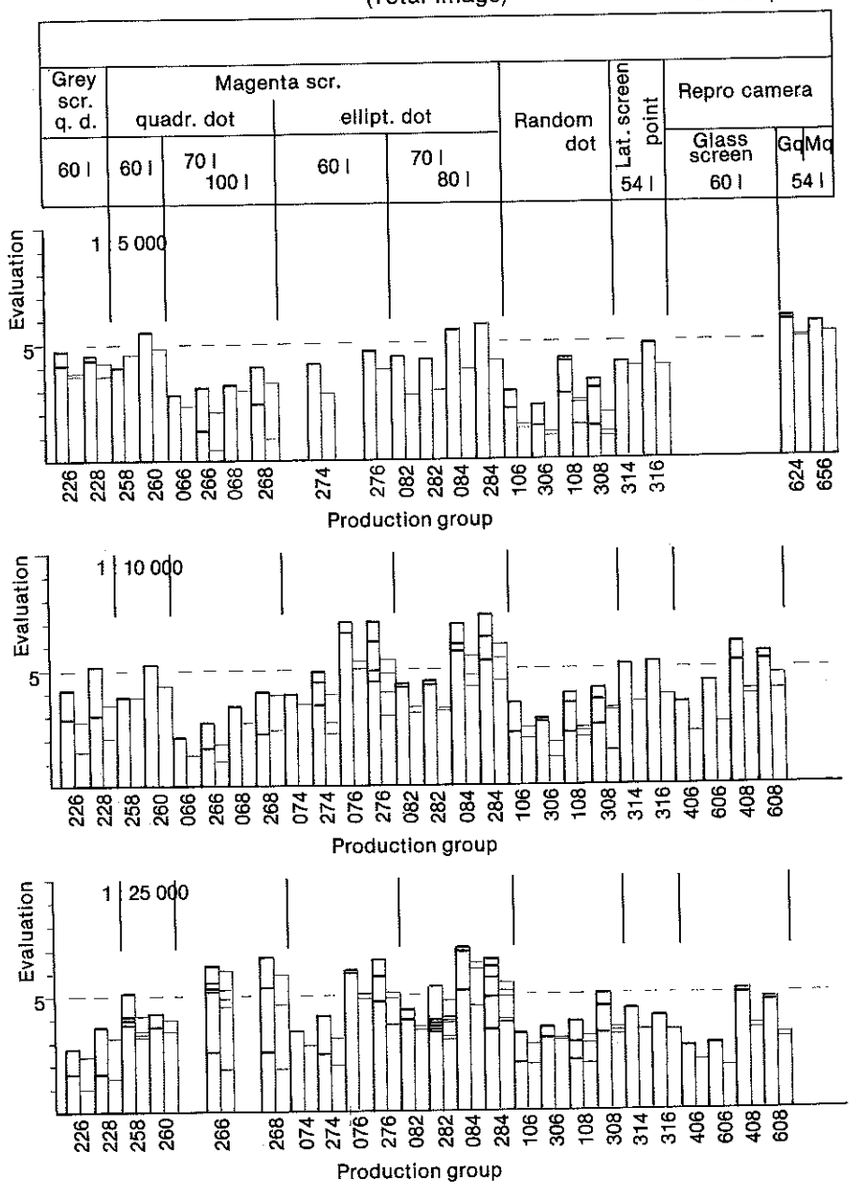


Figure 37

Evaluation
of the questioning B and BS
(Urban area)

Bromide paper
Diazo copies

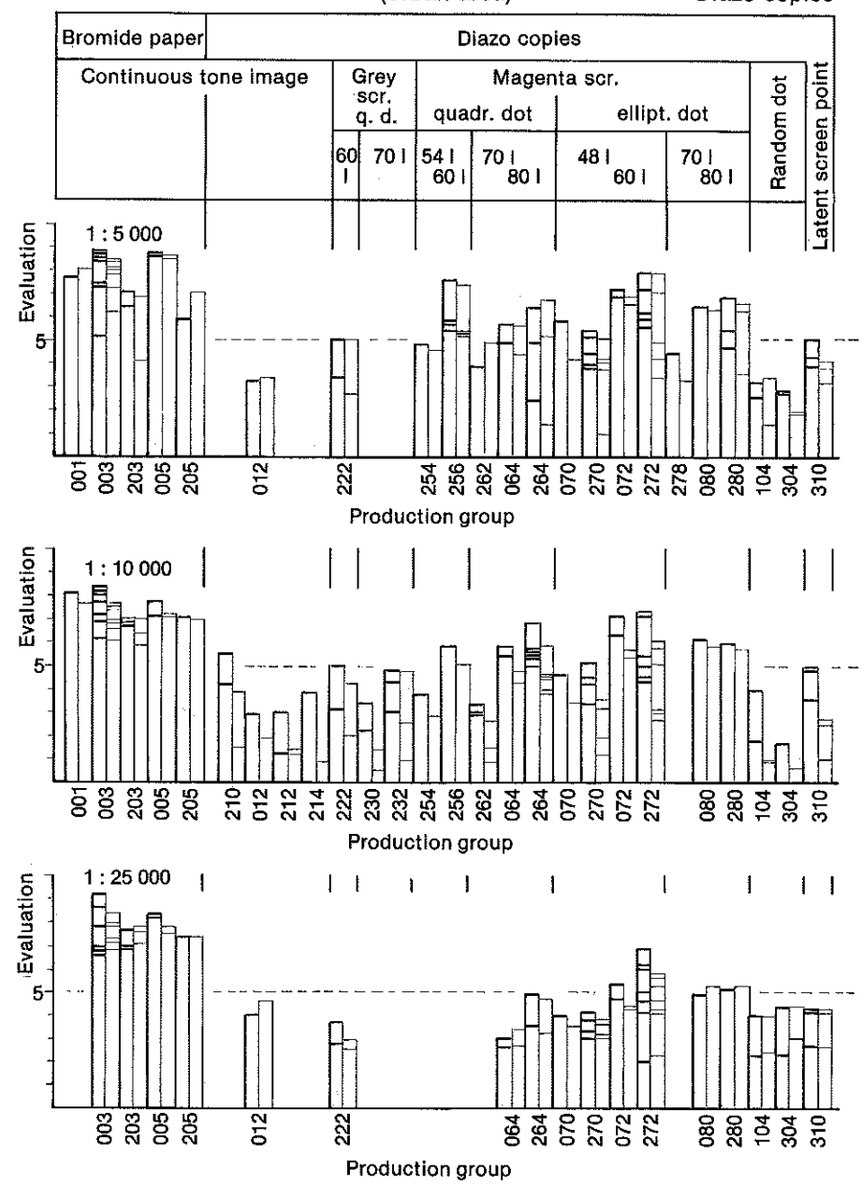


Figure 38

Evaluation
of the questioning B and BS
(Urban area)

Offset prints

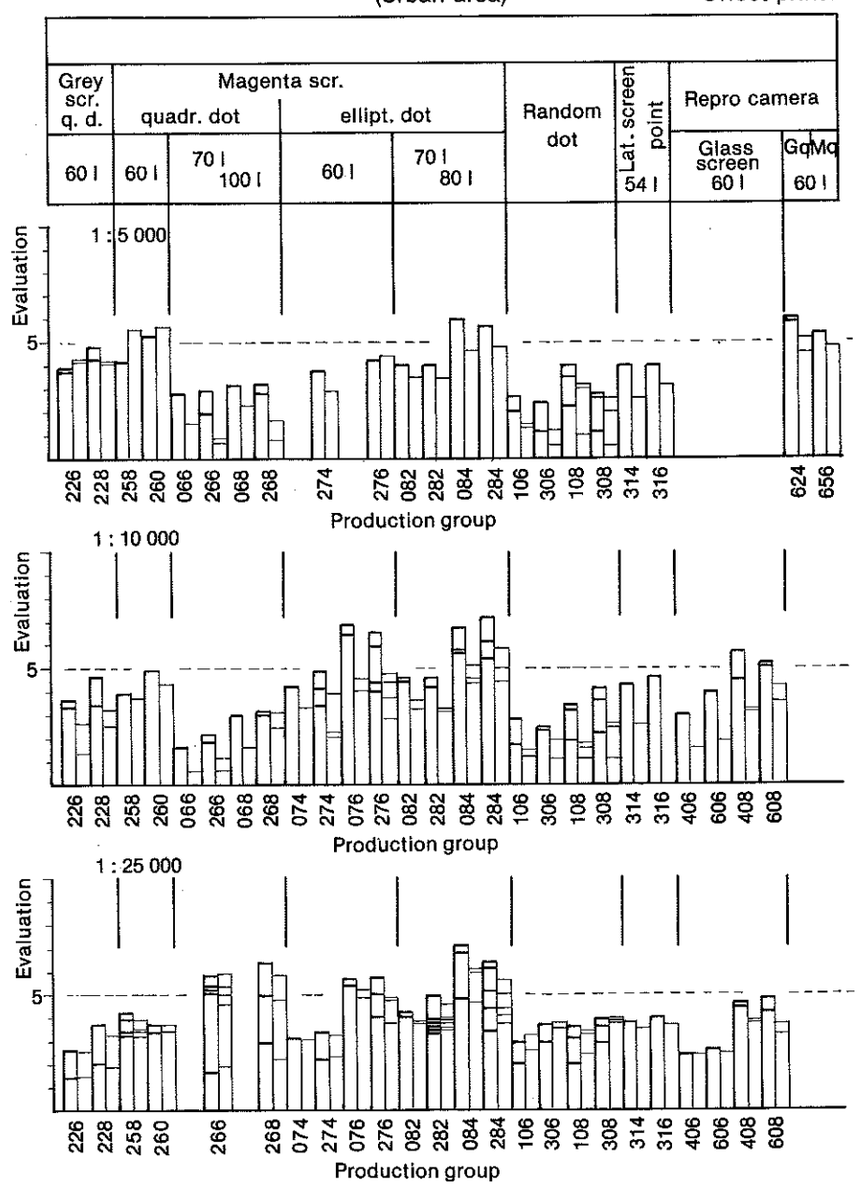


Figure 39

Evaluation
of the questioning C and CS
(Forest area)

Bromide paper
Diazo copies

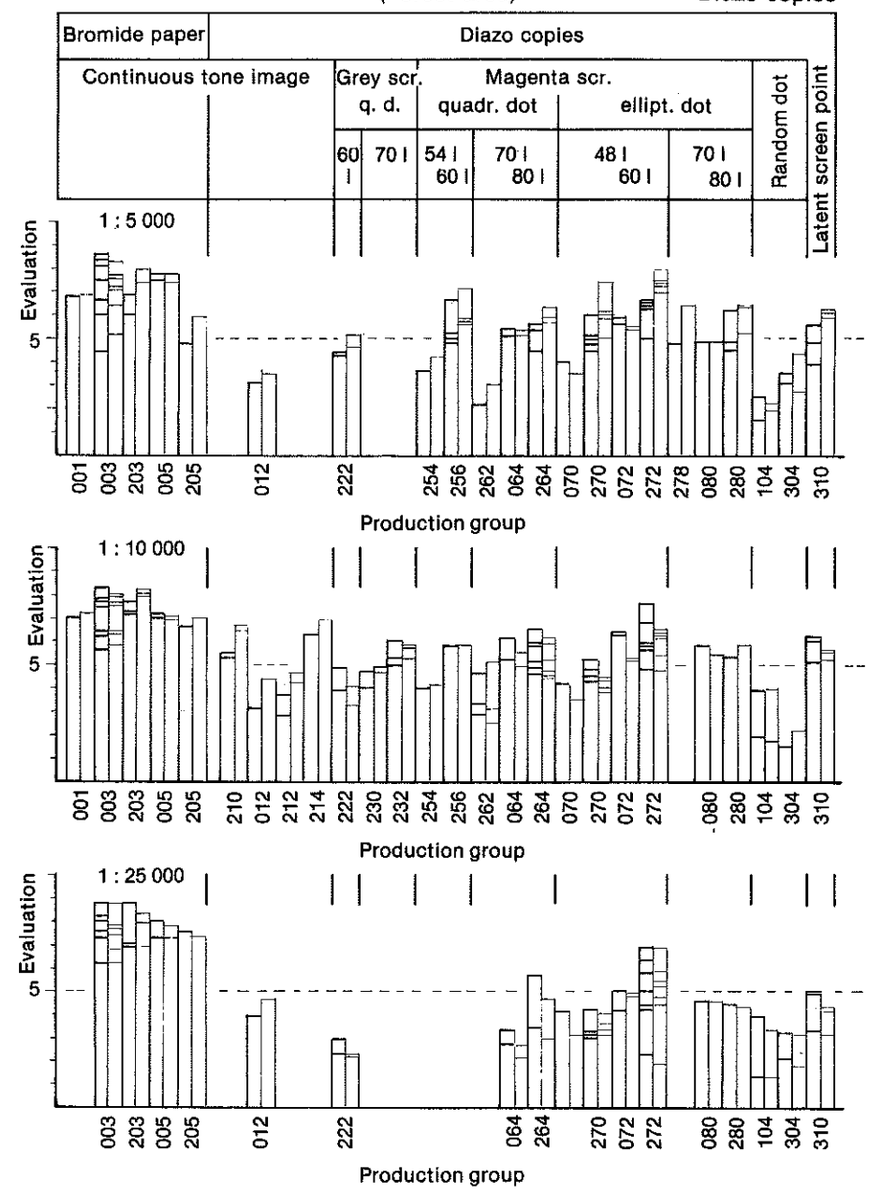


Figure 40

Evaluation
of the questioning C and CS
(Forest area)

Offset prints

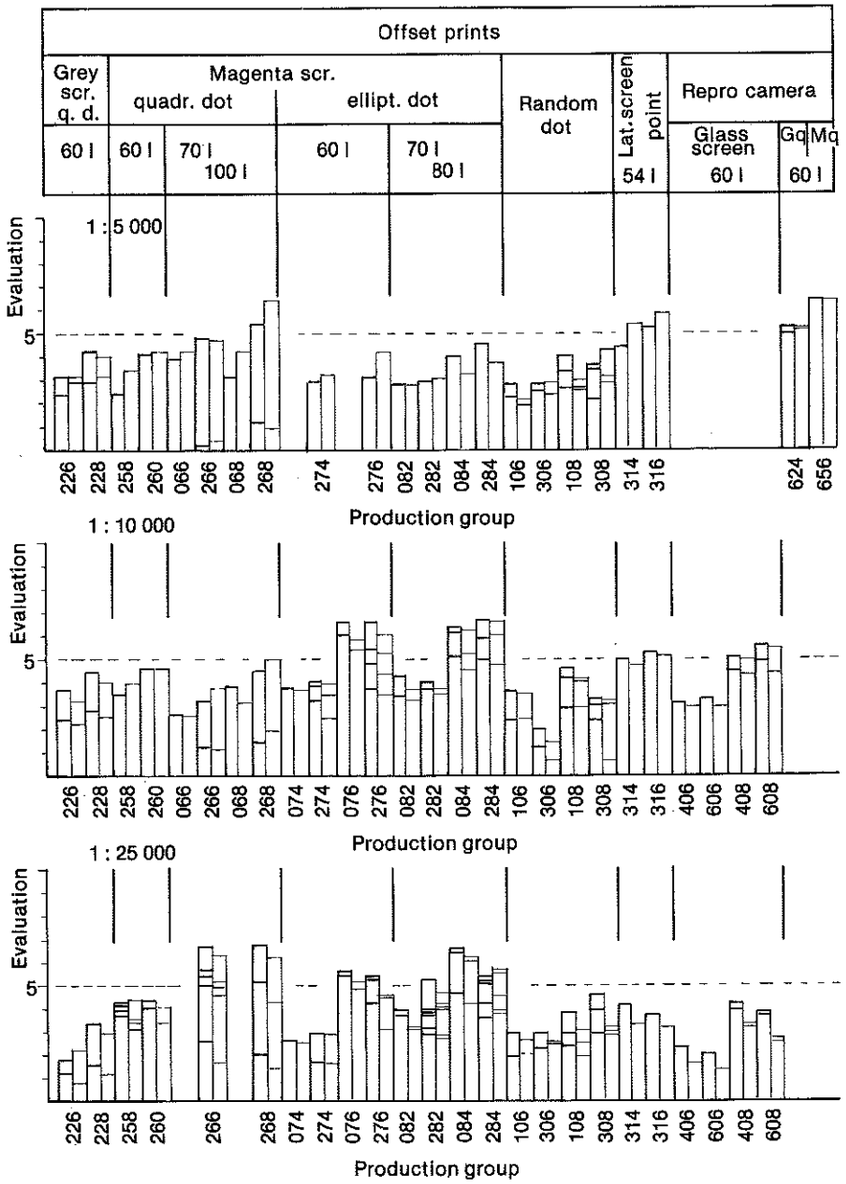


Figure 41

Evaluation
of the questioning D and DS
(Open land)

Bromide paper
Diazo copies

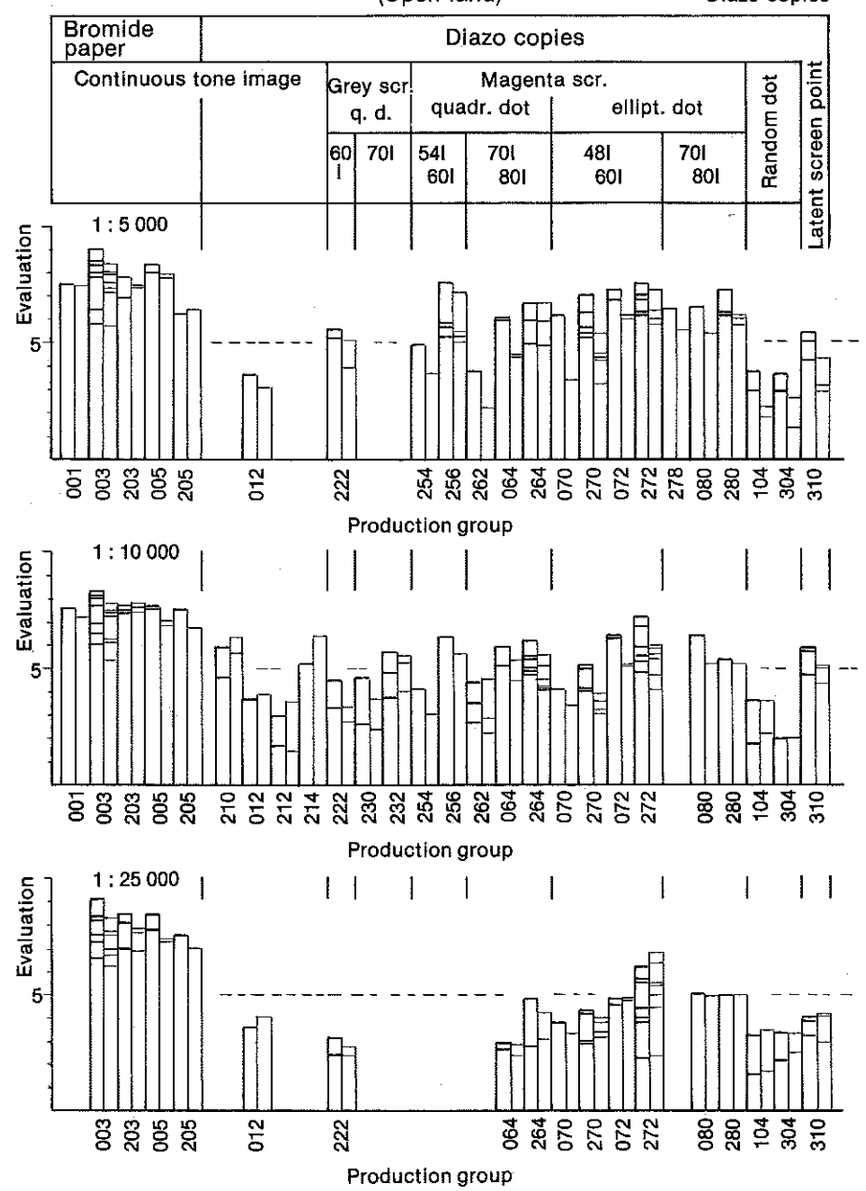


Figure 42

Evaluation
of the questioning D and DS
(Open land)

Offset prints

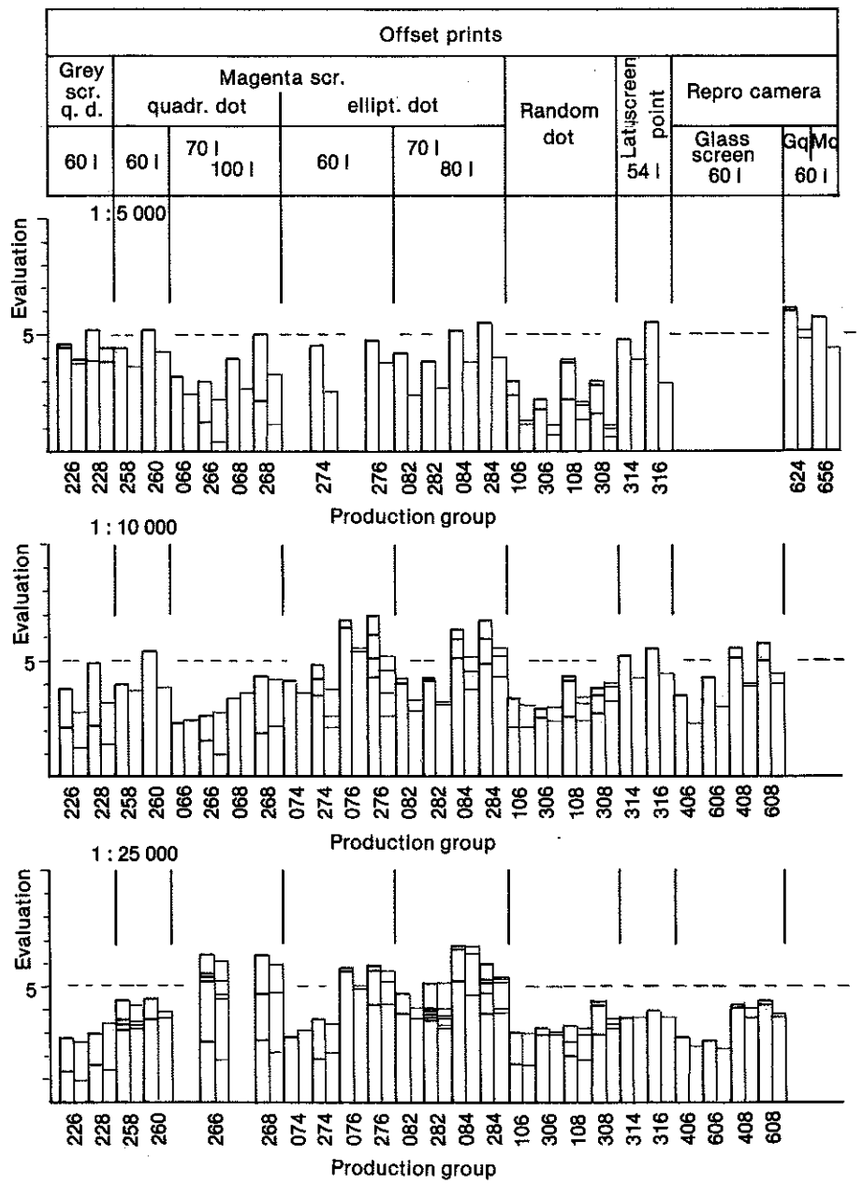


Figure 43

Percentage of questions whose ratings differ
significantly within each production group (F-test, significance-level 1%)

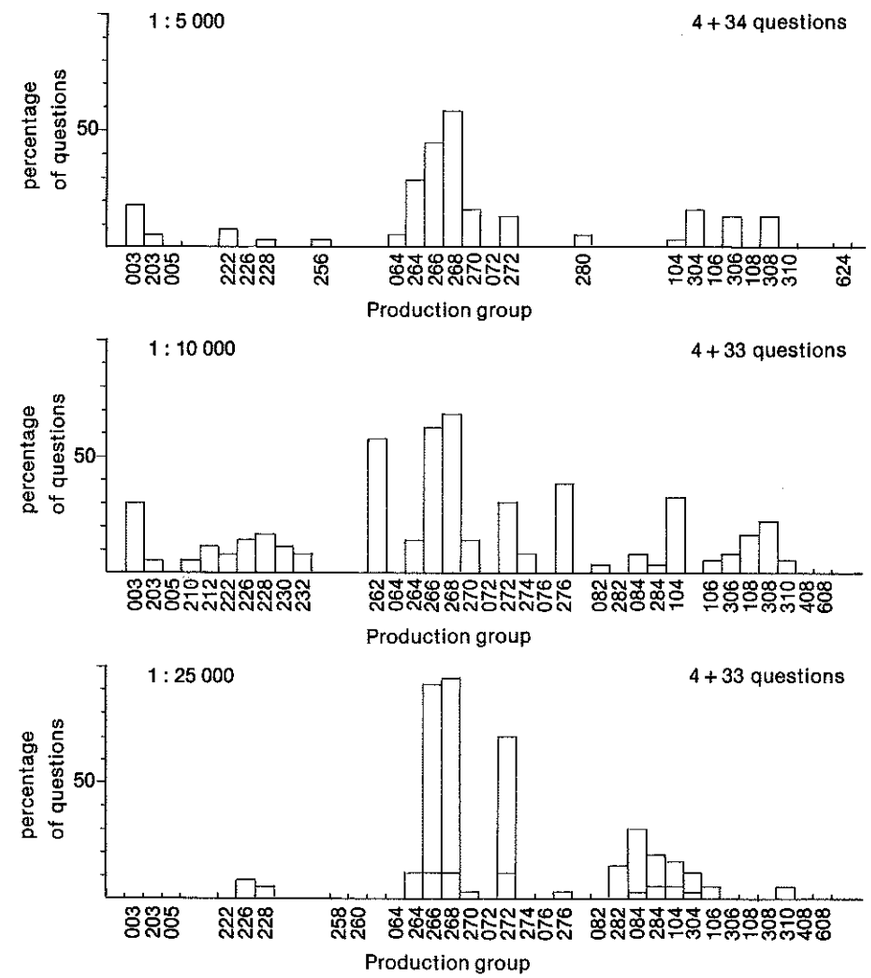


Figure 44

Percentage of production groups for which the ratings of the particular questions differ significantly (F-test, significance-level 1%)

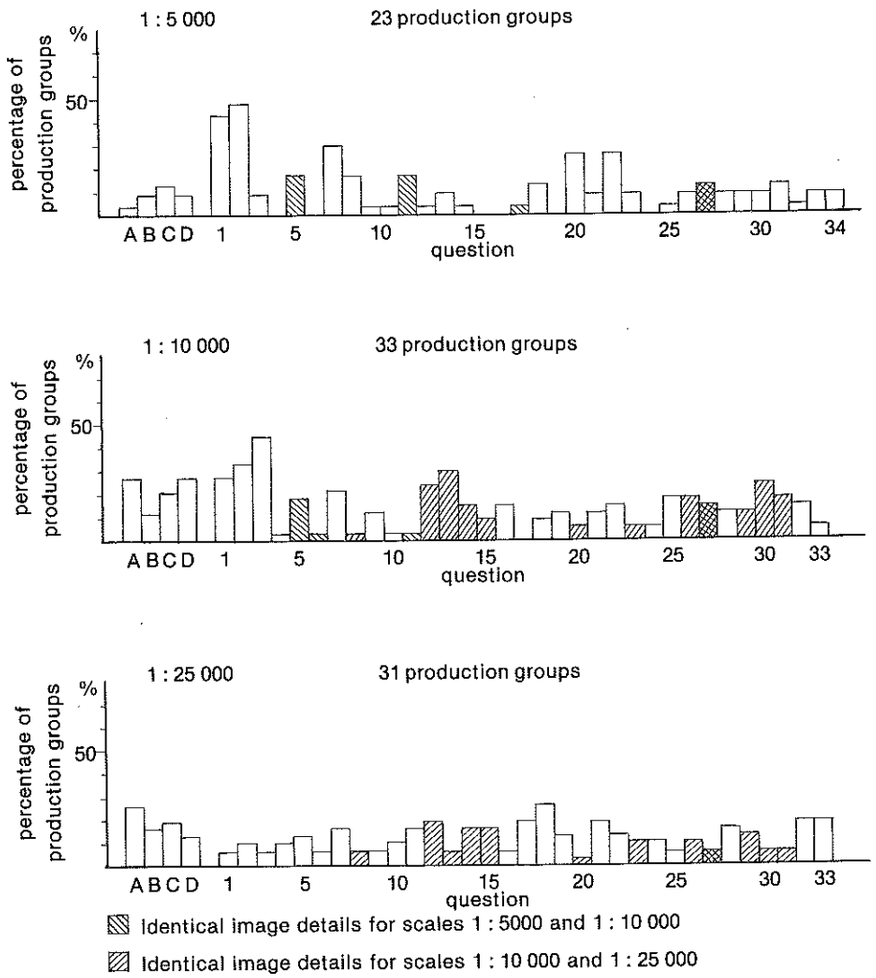
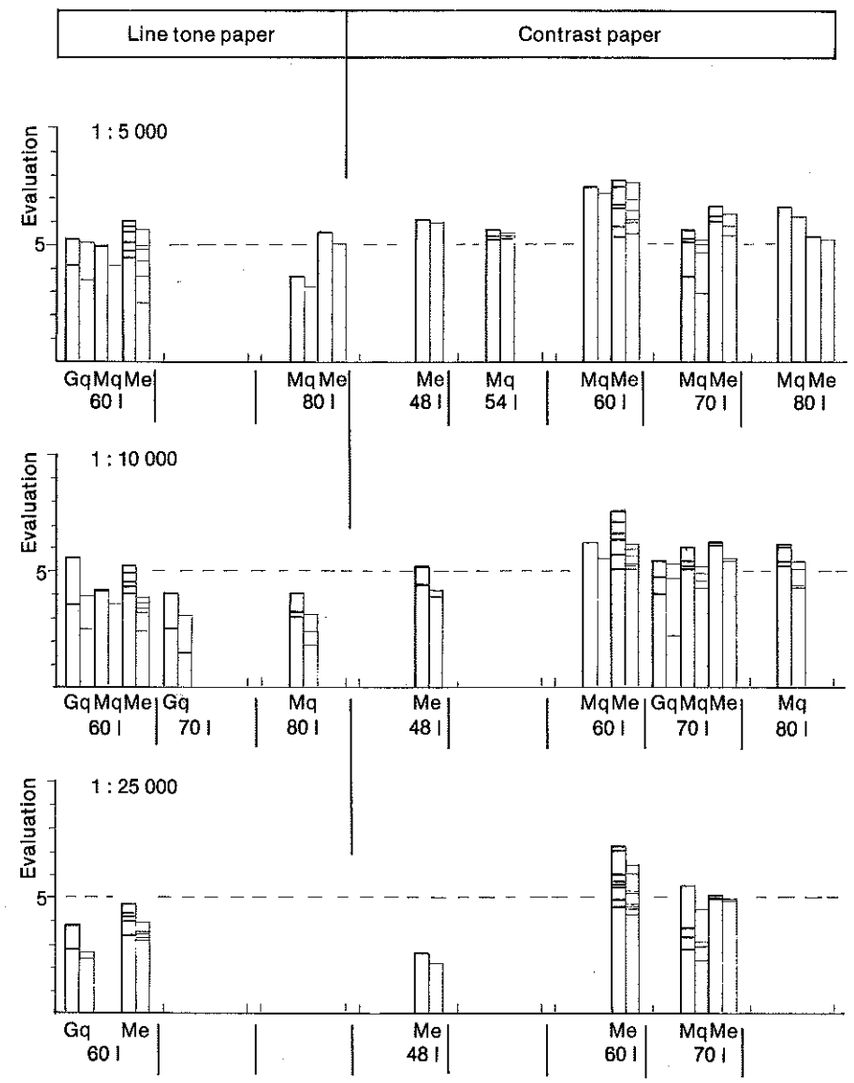


Figure 45

Comparison of screen ruling
Evaluation A and AS

Diazo copies



G = Grey screen M = Magenta screen q = quadr. dot e = ellipt. dot

Figure 48 Offset prints

Comparison offset art type paper – map printing paper
of single reproductions
Evaluation A and AS

Sequence of the performance based on reprocentres

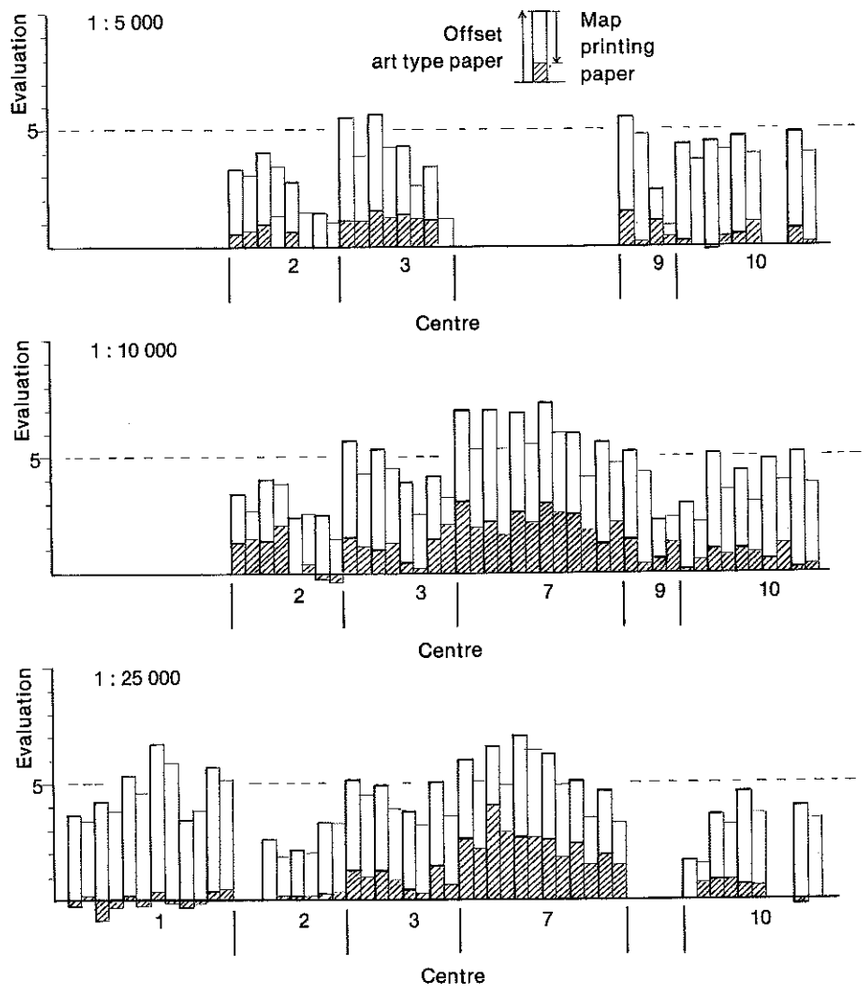


Table 1 – Dates of Photo-flights			
Date	Sept. 27. 1967	Clocktime	9.55 – 11.40
Camera	RC 8	Filmmaterial	Dupont Cronar Pan 30
Longitudinal overlap	60 %	Lateral overlap	30 %
Focal length	f = 152.67 mm	Diaphragm	6,8 ... 8
Filter	450 nm	Exposure time	1/200 sec.
Lighting	sunny	Cloudness	2/8 Ci
Fog	clear	Turbulence	moderate

Table 2 – Amount of produced reproductions.

Method of production	Orthophoto scale 1 : 5 000			1 : 10 000			1 : 25 000					
	P	L	D	P	L	D	P	L	D	P	L	D
Cont.-tone photo	13	1		14	6		12	1		39	8	
Grey screen, q. d.		2	4		7	4		2	4		11	12
Magenta screen, q. d.		11	8		13	8		4	14		28	30
Magenta screen, e. d.		18	6		15	20		16	24		49	50
Random dot		4	10		3	10		4	10		11	30
Latent screen dot		3	2		3	2		3	2		9	6
Repro camera			3			6			6			15
Total	13	39	33	14	47	50	12	30	60	39	116	143
	85			111			102			298		

P = photo L = diazo copies D = offset prints
q(resp. e.) d. = quadratic (resp. elliptical) dot

Table 3 – Used production methods

					Scale	1 : 5000				1 : 10 000				1 : 25 000			
					Orthophotonegative	right reading		mirror reversed		right reading		mirror reversed		right reading		mirror reversed	
					Density range	0,7	1,1	0,7	1,1	0,7	1,1	0,7	1,1	0,7	1,1	0,7	1,1
Final result						Reproduction centres											
Production method					Specification												
In contact	Continuons tone image on bromide paper				High glossy			9				9					
					Glossy			2,9,10,13	2,11			2,9,10,13	2,11			2,10,13	2,11
					Half-mat			3,10	3			3,10	3			3,10	3
					Mat												
	using sensitive film		Cont. tone image on diazo film		Cont. tone p.						1						
					Line tone p.	10				10	1			10			
					Contrast p.						1						
Screening with the reprocamact using	Grey screen	quadr. dot screen	54 or 60l/cm	Diazo copy	Line tone p.		10				10				10		
					Contrast p.												
				Offset print	Map printing p.		10				10				10		
					Offs. art t. p.		10				10				10		
			70 or 80l/cm 60l/cm	Diazo copy	Line tone p.						1						
					Contrast p.						1						
				Offset print	Map printing p.					7	7			7	7		
					Offs. art t. p.					7	7			7	7		
	Grey screen	quadr. dot	54 or 60l/cm	Diazo copy	Line tone p.												
					Contrast p.												
				Offset print	Map printing p.												
					Offs. art t. p.		4										
	Magenta screen	quadr. dot	54 or 60l/cm	Diazo copy	Line tone p.												
					Contrast p.												
				Offset print	Map printing p.												
					Offs. art t. p.		4										

Table 3 – Used production methods

Scale					1 : 5000				1 : 10 000				1 : 25 000			
Orthophotonegative					right reading		mirror reversed		right reading		mirror reversed		right reading		mirror reversed	
Density range					0,7	1,1	0,7	1,1	0,7	1,1	0,7	1,1	0,7	1,1	0,7	1,1
Final result					Reproduction centres											
Production method				Specification												
In contact	Continuons tone image on bromide paper			High glossy			9				9					
				Glossy			2,9,10,13	2,11			2,9,10,13	2,11			2,10,13	2,11
				Half-mat			3,10	3			3,10	3			3,10	3
				Mat												
	using sensitive film	Cont. tone image on diazo film		Cont. tone p.						1						
				Line tone p.	10				10	1			10			
				Contrast p.						1						
Screening in contact using	Grey screen	quadr. dot	54 or 60 l/cm	Diazo copy: Line tone p.		10				10				10		
				Diazo copy: Contrast p.												
				Offset print: Map printing p.		10				10				10		
				Offset print: Offs. art t. p.		10				10				10		
			70 or 80 l/cm	Diazo copy: Line tone p.						1						
				Diazo copy: Contrast p.						1						
				Offset print: Map printing p.												
				Offset print: Offs. art t. p.												
	Magenta screen	quadr. dot	54 or 60 l/cm	Diazo copy: Line tone p.		9				9						
				Diazo copy: Contrast p.		9,12				9						
				Offset print: Map printing p.		9				9				1		
				Offset print: Offs. art t. p.		9				9				1		
			70 or 100 l/cm	Diazo copy: Line tone p.		9				1,9						
				Diazo copy: Contrast p.	2	2,9			2	1,2,9			2	2		
				Offset print: Map printing p.	2	2,9			2	2,9				12		
				Offset print: Offs. art t. p.	2	2,9			2	2,9				12		
	Magenta screen	ellipt. dot	48 or 60 l/cm	Diazo copy: Line tone p.	5	5,7,10			5	5,10			5	5,10		
				Diazo copy: Contrast p.	5	5,7,11			5	5,11			5	5,11		
				Offset print: Map printing p.		10			7	7,10			7	7,10		
				Offset print: Offs. art t. p.		10			7	7,10			7	7,10		
			70 or 80 l/cm	Diazo copy: Line tone p.		7										
				Diazo copy: Contrast p.	3	3,7		6	3	3			3	3		
				Offset print: Map printing p.	3	3			3,7	3,7			3,7	1,3,7		
				Offset print: Offs. art t. p.	3	3			3,7	3,7			3,7	1,3,7		
Random dot method				Diazo copy: Line tone p.												
				Diazo copy: Contrast p.	2,3	2,3			2,3	2			2,3	2,3		
				Offset print: Map printing p.	2,3	2,3			2,3	2,3			2,3	2,3		
				Offset print: Offs. art t. p.	2,3	2,3			2,3	2,3			2,3	2,3		
Film with latent screen dot			54 l/cm	Diazo copy: Line tone p.		10				10				10		
				Diazo copy: Contrast p.												
				Offset print: Map printing p.		10				10				10		
				Offset print: Offs. art t. p.		10				10				10		
Screening with the reprocamera	Distance screen		54 or 60 l/cm	Diazo copy: Line tone p.												
				Diazo copy: Contrast p.												
				Offset print: Map printing p.					7	7			7	7		
				Offset print: Offs. art t. p.					7	7			7	7		
	Grey screen	quadr. dot	54 or 60 l/cm	Diazo copy: Line tone p.												
				Diazo copy: Contrast p.												
				Offset print: Map printing p.												
				Offset print: Offs. art t. p.		4										
	Magenta screen	quadr. dot	54 or 60 l/cm	Diazo copy: Line tone p.												
				Diazo copy: Contrast p.												
				Offset print: Map printing p.												
				Offset print: Offs. art t. p.		4										

Table 4

Main training of the users in:	Number
Geodesy	69
Geography	37
Cartography	13
Geology	8
Agriculture	8
Forestry	4
Urban survey	5
Photography	3
Other fields of trade	9

Table 5

Fields of application:	Number
Topography	73
Cartography	43
Urban survey	9
Rural survey	19
Re-allotment	11
Forestry	7
Soils	5
Geology	8
Geomorphology	8
Geography	31
Special planning	10
Geophysics	1

Table 6 – Specification of the reproduction groups

Final result						Scale	1 : 5000				1 : 10 000				1 : 25 000			
						Orthophotonegative	right reading		mirror reversed		right reading		mirror reversed		right reading		mirror reversed	
						Density range	0,7	1,1	0,7	1,1	0,7	1,1	0,7	1,1	0,7	1,1	0,7	1,1
Production method					Specification	Scale of the orthophoto Reproduction group / Number of reproductions												
In contact	Continuons tone image on bromide paper				High glossy			5 001 1				10 001 1						
					Glossy			5 003 7	5 203 2			10 003 7	10 203 3			25 003 6	25 203 3	
					Half-mat			5 005 2	5 205 1			10 005 2	10 205 1			25 005 2	25 205 1	
					Mat													
	using sensitive film	Cont. tone image on diazo film			Cont. tone p.						10 210 2							
					Line tone p.	5 012 1				10 012 1				25 012 1				
					Contrast p.						10 214 1							
Screening in contact using	Grey screen	quadr. dot	54 or 60 l/cm	Diazo copy	Line tone p.		5 222 2				10 222 2				25 222 2			
					Contrast p.													
				Offset print	Map printing p.		5 226 2				10 226 2				25 226 2			
					Offs. art t. p.		5 228 2								25 228 2			
			70 or 80 l/cm	Diazo copy	Line tone p.						10 230 2							
					Contrast p.						10 232 3							
				Offset print	Map printing p.													
					Offs. art t. p.													
	Magenta screen	quadr. dot	54 or 60 l/cm	Diazo copy	Line tone p.		5 254 1				10 254 1							
					Contrast p.		5 256 4				10 256 1							
				Offset print	Map printing p.		5 258 1				10 258 1				25 258 4			
					Offs. art t. p.		5 260 1				10 260 1				25 260 2			
			70 or 100 l/cm	Diazo copy	Line tone p.						10 262 3							
					Contrast p.	5 064 2	5 264 3			10 064 2	10 264 6			25 064 2	25 264 2			
				Offset print	Map printing p.	5 066 1	5 266 2			10 066 1	10 266 2				25 266 5			
					Offs. art t. p.	5 068 1	5 268 2			10 068 1	10 268 2				25 268 3			
	Magenta screen	ellipt. dot	48 or 60 l/cm	Diazo copy	Line tone p.	5 070 1	5 270 5			10 070 1	10 270 4			25 070 1	25 270 4			
					Contrast p.	5 072 2	5 272 5			10 072 2	10 272 6			25 072 2	25 272 7			
				Offset print	Map printing p.		5 274 1			10 074 1	10 274 3			25 074 1	25 274 2			
					Offs. art t. p.		5 276 1			10 076 2	10 276 4			25 076 2	25 276 3			
			70 or 80 l/cm	Diazo copy	Line tone p.		5 278 1											
					Contrast p.	5 080 1	5 280 2		5 279 1	10 080 1	10 280 1			25 080 1	25 280 1			
				Offset print	Map printing p.	5 082 1	5 282 1			10 082 2	10 282 2			25 082 2	25 282 6			
					Offs. art t. p.	5 084 1	5 284 1			10 084 3	10 284 3			25 084 3	25 284 5			
Random dot method				Diazo copy	Line tone p.													
					Contrast p.	5 104 2	5 304 2			10 104 2	10 304 1			25 104 2	25 304 2			
				Offset print	Map printing p.	5 106 2	5 306 2			10 106 2	10 306 2			25 106 2	25 306 2			
					Offs. art t. p.	5 108 3	5 308 3			10 108 3	10 308 3			25 108 3	25 308 3			
Film with latent screen dot			54 l/cm	Diazo copy	Line tone p.		5 310 3				10 310 3				25 310 3			
					Contrast p.													
				Offset print	Map printing p.		5 314 1				10 314 1				25 314 1			
					Offs. art t. p.		5 316 1				10 316 1				25 316 1			
Screening with the reprocamera	Distance screen		54 or 60 l/cm	Diazo copy	Line tone p.													
					Contrast p.													
				Offset print	Map printing p.					10 406 1	10 606 1			25 406 1	25 606 1			
					Offs. art t. p.					10 408 2	10 608 2			25 408 2	25 608 2			
	Grey screen	quadr. dot	54 or 60 l/cm	Diazo copy	Line tone p.													
					Contrast p.													
				Offset print	Map printing p.													
					Offs. art t. p.		5 624 2											
	Magenta screen	quadr. dot	54 or 60 l/cm	Diazo copy	Line tone p.													
					Contrast p.													
				Offset print	Map printing p.													
					Offs. art t. p.		5 656 1											

Table 7 – Details to be evaluated 1 : 5 000

Criteria of choice / Density combinations	Form	Two surfaces	Point object in surface	Line in surface
bright-bright		1 roof-surface aigainst road-surface	2 car	3 roof-edge
bright-dark		4 line of eaves	5 vent-traps	6 roof-edge
dark-bright		—	7 chimney-hoods	8 rails
dark-dark		9 roof-angle	10 shadows of chimney-hoods	11 shadow-stripes

Open area

bright-bright	12 boundary of roads	13 bright dots in meadow	14 track
bright-dark	15 limits of vegetation	16 bright dots	17 goal-lines
dark-bright	—	18 dark spot	19 furrow
dark-dark	20 limit of vegetation	21 shrubs	22 fence

Forest area

bright-bright	stand-limit	24 bright dots on clearance	25 tracks of road
bright-dark	26 forest-limit	27 bright tree-tops	28 road
dark-bright	—	29 single trees	30 stand-limit
dark-dark	31 separation between foliage and cast-shadow	32 single tree tops structure in foliage	33 limits between two lines of foliage

additional: 34 difference of textures of the foliage

Table 8 – Details to be evaluated for scale 1 : 10 000

Criteria of choice / Form / Density comb.	Two surfaces	Point objekt in surface	Line in surface
Urban areas and industrial areas			
bright – bright	1. ridge on a roof	2. parked cars	3. traffic-tracks on streets
bright – dark	4. line of eaves	5. vent-traps	6. edge of a roof
dark – bright	—	7. chimney-hoods	8. goods-train
dark-dark	9. line of eaves	10. ventilators	11. shadow-stripes
Open area			
bright – bright	12. separation of sand-bank-water	13. pylon	14. road
bright – dark	15. field-boundary	16. 2 spots in meadow	17. goal-line
dark – bright	—	18. shrub	19. field-ridge
dark-dark	20. vegetation-boundary	21. shrubs	22. dam
Forest area			
bright – bright	23. stand-boundary	24. track	25. tracks
bright – dark	26. stand-boundary	27. bright tree-tops	28. road
dark – bright	—	29. single tree	30. forest-aisle
dark-dark	31. separation line between foliage and cast shadow	32. difference of texture of foliage crowns	33. road

Table 9 – Details to be evaluated 1 : 25 000

Criteria of choice / Form / Density comb.	Two surfaces	Point object in surface	Line in surface
Urban areas and industrial areas			
bright-bright	1 ridge on a roof	2 roof-edge	3 grass-stripe between two roads
bright-dark	4 limit house-garden	5 bright spot	6 tracks of road
dark-bright	—	7 avenue-trees	8 goods-train
dark-dark	9 roof-surface against cast shadow	10 little roof	11 roof-edge
Open area			
bright-bright	12 separation sand bank-water	13 pylon	14 road
bright-dark	15 field-boundary	16 vegetation-spots	17 road
dark-bright	—	18 shrub	19 field-ridge
dark-dark	20 vegetation-boundary	21 shrub	22 field-ridge
Forest area			
bright-bright	stand-boundary	24 recognizability of texture	25 tracks of road
bright-dark	26 stand-boundary	27 bright tree-tops	28 stand-boundary
dark-bright	—	29 single trees	30 forest-aisle
dark-dark	31 separation line between foliage and cast shadow	32 texture of foliage	33 stand-boundary

Table 10 – Main education of the evaluators

Main education of the evaluators	Univ.	TC	P	S
Geodesy	31	15	23	69
Geography	36	0	1	37
Cartography	0	7	6	13
Geology	7	1	0	8
Agric.	6	2	0	8
Forestry	3	1	0	4
Urban pl.	4	1	0	5
Photography	0	1	2	3
Other fields of trade	6	2	1	9
Total	93	30	33	156

Univ = University
TC = Technical College
P = Practice
S = Total

Table 11 – Evaluation of the usefulness of orthophotos / Analysis according to the scales: (total-number of evaluators: 156)

Scale of orthophotos		1 : 5 000				1 : 10 000				1 : 25 000			
Number of photo		1	2	3	4	1	2	3	4	1	2	3	4
(1)	+ n =	68	4	78	6	80	0	71	5	84	1	69	2
	- n =	3	145	5	3	1	149	1	(-1) 4	0	146	4	6
(2)	+ n =	92	1	61	2	72	1	81	2	67	1	85	(-1) 1
	- n =	1	150	0	5	1	152	0	3	2	148	1	(-1) 4
(3)	+ n =	72	1	69	(-4) 10	72	1	70	(-5) 8	75	2	69	(-4) 6
	- n =	3	146	0	(-4) 3	0	144	5	(-4) 3	1	137	6	(-5) 7

(1) = Number of questions in questionnaire
+ n = Number of the evaluators, who evaluated this copy as the best

- n = Number of the evaluators who evaluated this copy as the worst

(- n) = n evaluators made no statements about these questions at this scale

Table 12/1 – Evaluation of the usefulnes of orthophotos / Analysis according to fields of application:
(Total number of evaluators: 156)
(Total number of delivered evaluations: 225)

1 = Nr. of the question in the questionnaire

Scale of the orthophotos	1 : 5 000				1 : 10 000				1 : 25 000				N
Photo-number	1	2	3	4	1	2	3	4	1	2	3	4	
Field of application													
Topography	2	65	4	2	1	68	1	2 (-1)	0	71	1	1	73
Cartography	1	38	3	1	0	41	1	1	0	42	1	0	43
Urban planning	0	9	0	0	0	9	0	0	0	8	0	1	9
Country planning	0	19	0	0	0	18	0	1	0	18	1	0	19
Consolidation	0	11	0	0	0	10	0	1	0	10	1	0	11
Forestry	0	7	0	0	0	7	0	0	0	7	0	0	7
Soils	0	5	0	0	0	5	0	0	0	4	1	0	5
Geology	1	7	0	0	0	7	0	0 (-1)	0	7	1	0	8
Geomorphology	1	7	0	0	0	7	0	0 (-1)	0	6	2	0	8
Geography	0	31	0	0	0	30	0	1	0	28	1	2	31
Spacial planning	0	10	0	0	0	10	0	0	0	7	0	3	10
Geophysics	0	1	0	0	0	1	0	0	0	1	0	0	1
Total	5	210	7	3	1	213	2 (-1)	6 (-2)	0	209	9	7	225

N = Total number of the delivered evaluations for the field of application
(-n) = n evaluators made no statements about this question at this scale.

Table 12/2 – Evaluation of the usefulness of orthophotos / Analysis according to fields of application:
(Total number of evaluators: 156)
(Total number of delivered evaluations: 225)

1 = Nr. of the question in the questionnaire +

Scale of the orthophotos	1 : 5 000				1 : 10 000				1 : 25 000				N
Photo-number	1	2	3	4	1	2	3	4	1	2	3	4	
Field of application													
Topography	26	3	43	1	45	0	25	3	48	0	24	1	73
Cartography	19	2	21	1	20	0	21	2	25	0	18	0	43
Urban planning	3	0	5	1	6	0	3	0	3	0	6	0	9
Country planning	8	0	9	2	11	0	8	0	10	1	8	0	19
Consolidation	3	0	6	2	5	0	5	1	5	1	4	1	11
Forestry	3	0	4	0	5	0	2	0	3	0	4	0	7
Soils	3	0	2	0	3	0	2	0	3	0	2	0	5
Geology	2	0	6	0	4	0	4	0	6	0	1	1	8
Geomorphology	6	0	2	0	2	0	6	0	1	0	6	1	8
Geography	17	0	10	4	9	0	21	1	6	1	23	1	31
Spacial planning	6	0	4	0	4	0	6	0	2	0	8	0	10
Geophysics	0	0	1	0	1	0	0	0	0	0	1	0	1
Total	96	5	113	11	115	0	103	7	112	3	105	5	225

N = Total number of the delivered evaluations for the field of application
(-n) = n evaluators made no statements about this question at this scale.

Table 13/1 – Evaluation of the usefulness of orthophotos / Analysis according to fields of application:
(Total number of evaluators: 156)
(Total number of delivered evaluations: 225)

2 = Nr. of the question in the questionnaire –

Scale of the orthophotos	1 : 5 000				1 : 10 000				1 : 25 000				N
Photo-number	1	2	3	4	1	2	3	4	1	2	3	4	
Field of application													
Topography	1	71	0	1	1	70	0	2	1	71	0	0 (-1)	73
Cartography	0	42	0	1	0	43	0	0	0	43	0	0 (-1)	43
Urban planning	0	9	0	0	0	9	0	0	1	6	0	2	9
Country planning	0	18	0	1	0	18	0	1	1	17	1	0	19
Consolidation	0	10	0	1	0	10	0	1	0	10	1	0	11
Forestry	0	7	0	0	0	7	0	0	0	7	0	0	7
Soils	0	5	0	0	0	5	0	0	0	5	0	0	5
Geology	0	8	0	0	0	8	0	0	0	7	0	0 (-1)	8
Geomorphology	0	8	0	0	0	8	0	0	0	7	0	0 (-1)	8
Geography	0	28	0	3	0	30	0	1	1	29	1	0	31
Spacial planning	0	10	0	0	0	10	0	0	0	6	0	4	10
Geophysics	0	1	0	0	0	1	0	0	0	1	0	0	1
Total	1	217	0	7	1	219	0	5	4	209	3	6 (-3)	225

N = Total number of the delivered evaluations for the field of application
(-n) = n evaluators made no statements about this question at this scale.

Table 13/2 – Evaluation of the usefulness of orthophotos / Analysis according to fields of application:
(Total number of evaluators: 156)
(Total number of delivered evaluations: 225)

2 = Nr. of the question in the questionnaire +

Scale of the orthophotos	1 : 5 000				1 : 10 000				1 : 25 000				N
Photo-number	1	2	3	4	1	2	3	4	1	2	3	4	
Field of application													
Topography	42	1	29	1	36	1	35	1	27	1	43	1 (-1)	73
Cartography	27	0	15	1	19	0	24	0	15	0	28	0	43
Urban planning	3	0	6	0	6	0	3	0	4	0	5	0	9
Country planning	9	0	10	0	10	0	8	1	14	0	5	0	19
Consolidation	5	0	6	0	7	0	4	0	7	0	4	0	11
Forestry	5	0	2	0	5	0	2	0	6	0	1	0	7
Soils	4	0	1	0	2	0	3	0	2	0	3	0	5
Geology	5	0	3	0	4	0	4	0	3	0	4	0 (-1)	8
Geomorphology	4	0	4	0	2	0	6	0	2	0	5	0 (-1)	8
Geography	22	0	8	1	10	0	21	0	10	0	21	0	31
Spacial planning	4	0	6	0	7	0	3	0	7	0	3	0	10
Geophysics	1	0	0	0	1	0	0	0	0	0	0	0 (-1)	1
Total	131	1	90	3	109	1	113	2	97	1	122	1 (-4)	225

N = Total number of the delivered evaluations for the field of application
(-n) = n evaluators made no statements about this question at this scale.

Table 14/1 – Evaluation of the usefulness of orthophotos / Analysis according to fields of application:
(Total number of evaluators: 156)
(Total number of delivered evaluations: 225)

3 = Nr. of the question in the questionnaire –

Scale of the orthophotos	1 : 5 000				1 : 10 000				1 : 25 000				N
Photo-number	1	2	3	4	1	2	3	4	1	2	3	4	
Field of application													
Topography	1	71	0	1	0	70	1	2	0	70	1	1 (-1)	73
Cartography	0	42	0	1	0	42	1	0	0	41	1	1	43
Urban planning	0	9	0	0	0	9	0	0	0	8	0	1	9
Country planning	0	18	0	0 (-1)	0	18	0	0 (-1)	0	15	1	2 (-1)	19
Consolidation	0	11	0	0	0	11	0	0	0	9	1	1	11
Forestry	0	7	0	0	0	7	0	0	0	6	0	1	7
Soils	0	3	0	0 (-2)	0	3	0	0 (-2)	0	2	1	0 (-2)	5
Geology	2	4	0	0 (-2)	0	5	1	0 (-2)	0	5	1	0 (-2)	8
Geomorphology	1	6	0	0 (-1)	0	6	1	0 (-1)	0	5	2	0 (-1)	8
Geography	1	29	0	1	0	30	0	1	1	27	0	3	31
Spacial planning	0	10	0	0	0	10	0	0	0	10	0	0	10
Geophysics	0	1	0	0	0	1	0	0	0	1	0	0	1
Total	5	211	0	3 (-6)	0	212	4	3 (-6)	1	199	8	10 (-7)	225

N = Total number of the delivered evaluations for the field of application
(-n) = n evaluators made no statements about this question at this scale.

Table 14/2 – Evaluation of the usefulness of orthophotos / Analysis according to fields of application:
(Total number of evaluators: 156)
(Total number of delivered evaluations: 225)

3 = Nr. of the question in the questionnaire +

Scale of the orthophotos	1 : 5 000				1 : 10 000				1 : 25 000				N
Photo-number	1	2	3	4	1	2	3	4	1	2	3	4	
Field of application													
Topography	34	1	37	1	37	1	30	5	37	1	33	2	73
Cartography	24	0	18	1	18	0	25	0	24	0	19	0	43
Urban planning	4	0	4	1	5	0	3	1	5	0	3	1	9
Country planning	9	0	6	3 (-1)	6	0	10	2 (-1)	10	0	6	2 (-1)	19
Consolidation	4	0	4	3	3	0	6	2	4	0	5	2	11
Forestry	3	0	3	1	2	0	4	1	4	0	2	1	7
Soils	1	0	2	0 (-2)	1	0	1	0 (-3)	2	0	1	0 (-2)	5
Geology	1	1	2	2 (-2)	3	1	1	1 (-2)	1	1	2	2 (-2)	8
Geomorphology	5	1	1	0 (-1)	1	1	5	0 (-1)	1	1	5	0 (-1)	8
Geography	18	0	9	4	11	0	19	1	12	1	16	2	31
Spacial planning	5	0	5	0	4	0	6	0	6	0	4	0	10
Geophysics	0	0	1	0	1	0	0	0	0	0	1	0	1
Total	108	3	92	16 (-6)	92	3	110	13 (-7)	106	4	97	12 (-6)	225

N = Total number of the delivered evaluations for the field of application
(-n) = n evaluators made no statements about this question at this scale.

Table 15 – Evaluation of the usefulness of orthophotos / Analysis based on intensity of the activities:
(Total number of evaluators: 156)

Scale of the orthophoto		1 : 5 000												1 : 10 000												1 : 25 000											
Intensity of the activities		A				B				C				A				B				C				A				B				C			
Number of photo		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	+ n	57	0	60	4	14	0	17	1	1	0	1	1	63	0	54	4	14	1	16	1	1	0	2	0	69	0	50	2	15	0	17	0	0	1	2	0
	— n	2	117	0	2	1	30	0	1	0	3	0	0	0	118	1	(-1) 1	2	29	0	1	0	1	0	2	0	113	3	5	0	31	0	1	0	2	1	0
2	+ n	76	0	43	2	13	1	18	0	2	0	1	0	65	0	64	2	16	1	15	0	2	0	1	0	49	0	69	(-2) 1	17	1	14	0	1	0	2	0
	— n	0	118	0	3	1	30	0	1	0	2	0	1	0	120	0	1	1	30	0	1	0	2	0	1	1	116	0	(-1) 3	1	30	0	1	0	2	1	0
3	+ n	54	1	55	(-3) 8	17	0	13	(-1) 1	1	0	1	1	61	1	50	(-4) 5	10	0	18	(-1) 3	1	0	2	0	63	2	49	(-3) 4	11	0	18	2	1	0	2	0
	— n	3	113	0	(-3) 2	0	30	0	(-1) 1	1	2	0	0	0	111	5	(-3) 2	0	30	0	(-1) 1	0	3	0	0	0	106	5	(-4) 6	0	29	1	1	0	2	0	1

1 = Number of question in the questionnaire
+n = Number of the evaluators, who evaluated this copy as the best
—n = Number of evaluators who evaluated this copy as the worst
(-n) = n evaluators made no statements about this question at this scale

A = Predominant employed
B = Occasionally employed
C = Studying

Table 16/1 – Evaluation of the usefulness of orthophotos / Analysis based on age-classes:

Scale of the orthophoto 1 : 50 000 (Total number of evaluators: 156)

Age of evaluators in years		20...29				30...39				40...49				50...59				60...			
Total of evaluators		19 (12%)				65 (41%)				34 (22%)				29 (19%)				9 (6%)			
Number of photos		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
①	+n	10	0	8	1	32	1	29	3	11	1	21	1	10	1	17	1	5	1	3	0
	-n	1	18	0	0	1	61	2	1	1	31	1	1	0	27	1	1	0	8	1	0
②	+n	9	1	9	0	41	0	23	1	20	0	14	0	15	0	13	1	7	0	2	0
	-n	1	17	0	1	0	62	3	0	0	34	0	0	0	28	0	1	0	9	0	0
③	+n	14	0	4	1	27	0	30	5(-3)	12	1	17	3(-1)	13	0	15	1	6	0	3	0
	-n	0	19	0	0	1	59	0	2(-3)	2	31	0	0(-1)	0	28	0	1	0	9	0	0

① = Number of question in the questionnaire
+n = Number of the evaluators, who evaluated this copy as the best
-n = Number of evaluators who evaluated this copy as the worst

Table 16/2 – Evaluation of the usefulness of orthophotos / Analysis based on age-classes:

Scale of the orthophoto 1 : 10 000 (Total number of evaluators: 156)

Age of evaluators in years		20...29				30...39				40...49				50...59				60...			
Total of evaluators		19 (12%)				65 (41%)				34 (22%)				29 (19%)				9 (6%)			
Number of photos		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
①	+n	8	0	10	1	30	0	33	2	22	0	11	1	18	0	10	1	2	0	7	0
	-n	1	16	0	2	0	65	0	0	0	33	0	1	0	27	1	1	0	9	0	0
②	+n	10	1	8	0	32	0	32	1	16	0	18	0	13	0	15	1	3	0	6	0
	-n	1	17	0	1	0	65	0	0	0	33	0	1	0	28	0	1	0	9	0	0
③	+n	5	0	13	1	33	0	27	1(-4)		1	11	2(-1)	14	0	11	4	1		8	0
	-n	0	19	0	0	0	60	2	0(-3)	0	30	2	1(-1)	0	27	1	1	0	8	0	1

① = Number of question in the questionnaire
+n = Number of the evaluators, who evaluated this copy as the best
-n = Number of evaluators who evaluated this copy as the worst

Table 16/3 – Evaluation of the usefulness of orthophotos / Analysis based on age-classes:

Scale of the orthophoto 1 : 25 000 (Total number of evaluators: 156)

Age of evaluators in years		20...29				30...39				40...49				50...59				60...			
Total of evaluators		19 (12%)				65 (41%)				34 (22%)				29 (18%)				9 (6%)			
Number of photos		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
(1)	+n	7	1	11	0	33	0	32	0	22	0	10	2	20	0	9	0	2	0	7	0
	-n	0	16	1	2	0	61	2	2	0	33	1	0	0	28	0	1	0	8	0	1
(2)	+n	4	1	14	0	32	0	31	1(-1)	18	0	15	0(-1)	12	0	17	0	1	0	8	0
	-n	1	16	1	1	1	63	0	1	0	32	0	1(-1)	0	28	0	1	0	9	0	0
(3)	+n	5	0	12	2	31	1	30	0(-3)	18	1	12	2(-1)	18	0	9	2	2	0	7	0
	-n	0	17	0	2	1	54	3	3(-4)	0	29	3	1(-1)	0	28	0	1	0	9	0	0

(1) = Number of question in the questionnaire
+n = Number of the evaluators, who evaluated this copy as the best
-n = Number of evaluators who evaluated this copy as the worst

Table 17 – Comparison of the image designations

Evaluation orthophoto users	Total evaluation		
Image 1	5 003 0131	10 003 0131	25 003 0131
Image 2	2	2	2
Image 3	3	3	3
Image 4	4	4	4

Table 18 – Comparison user questioning – total evaluation

Question	Scale	1 : 5000					1 : 10 000					1 : 25 000				
	Image	1	2	3	4	∅	1	2	3	4	∅	1	2	3	4	∅
A (General impression)	Evaluation	8.8	4.8	8.5	6.7	7.2	7.9	6.0	8.3	6.4	7.2	8.2	6.6	8.7	7.8	7.8
	Evaluation-average	+1.6	-2.4	+1.3	-0.5		+0.8	-1.2	+1.2	-0.8		+0.4	-1.3	+0.9	-0.0	
2 (Evaluation at a distance of approx. 1 meter)	Number of evaluators who classified the image best (+) or worst (-)	+92	-150	+61			+72	-152	+81			+67	-148	+85		
AS (Average of the evaluations of all details)	Evaluation	8.0	5.7	7.6	6.9	7.1	7.5	5.8	7.5	6.3	6.8	7.7	6.5	7.8	6.9	7.2
	Evaluation-average	+0.9	-1.3	+0.5	-0.2		+0.7	-1.0	+0.7	-0.4		+0.5	-0.8	+0.6	-0.3	
3 (Evaluation when utilising commonly used viewing-aids e. g. magnifying-glass)	Number of evaluators who classified the image best (+) or worst (-)	+72	-146	+69			+72	-144	+70			+75	-137	+69		

∅ = Average

Table 19 – Example for computation of the average evaluation values

EVALUATOR	011	012	021	022	031	032	041	042	051	052	TOTAL AVERAGE
AVERAGE	4.51	3.75	4.11	4.69	5.41	5.79	3.66	2.88	4.21	4.52	4.35
DELTA	-.16	.61	.24	-.34	-1.06	-1.44	.69	1.47	.14	-.16	

INITIAL DATA: ORIGINAL EVALUATIONS

SCALE (THOUSAND): 10
NUMBER OF DETAIL QUESTIONS: 33
NUMBER OF THE EVALUATORS: 10
NUMBER OF REPRODUCTIONS: 111

100010090

	A	B	C	D	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
XM	7.70	8.10	7.00	7.60	8.20	7.00	7.40	7.80	7.50	8.00	7.70	7.70	7.40	5.90	7.10	7.30	6.60	7.90	7.50	6.20	5.80
MXM	.37	.41	.33	.37	.47	.61	.62	.42	.40	.39	.47	.56	.45	.96	.53	.68	.76	.38	.65	.81	.84
MX	1.16	1.29	1.05	1.17	1.48	1.94	1.96	1.32	1.27	1.25	1.49	1.77	1.43	3.03	1.66	2.16	2.41	1.20	2.07	2.57	2.66

	AS	BS	CS	DS	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
XM	7.33	7.60	7.19	7.25	7.30	7.60	6.50	6.80	6.80	7.40	6.40	7.00	6.00	6.10	7.60	6.90	7.40	6.70	7.70	6.90	
MXM	.09	.14	.16	.18	.58	.27	.56	.66	.44	.48	.69	.45	.52	.81	.40	.59	.27	.54	.30	.62	
MX					1.83	.84	1.78	2.10	1.40	1.51	2.17	1.41	1.63	2.56	1.26	1.85	.84	1.70	.95	1.97	

100030020

	A	B	C	D	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
XM	8.30	8.40	7.70	8.10	7.70	5.90	7.30	8.30	7.70	8.10	7.90	8.10	7.40	6.40	7.40	7.30	6.90	7.80	7.70	6.50	5.60
MXM	.33	.40	.33	.50	.70	.69	.56	.40	.58	.59	.43	.48	.62	.88	.48	.73	.60	.29	.42	.85	.88
MX	1.06	1.26	1.06	1.60	2.21	2.18	1.77	1.25	1.83	1.85	1.37	1.52	1.96	2.80	1.51	2.31	1.91	.92	1.34	2.68	2.80

	AS	BS	CS	DS	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
XM	7.70	7.67	7.93	7.47	7.50	7.80	6.90	7.10	7.30	7.70	6.60	7.40	7.10	6.90	8.60	8.00	8.10	8.20	8.40	7.40	
MXM	.11	.19	.19	.15	.45	.33	.62	.67	.52	.52	.60	.40	.41	1.00	.27	.56	.46	.44	.40	.72	
MX					1.43	1.03	1.97	2.13	1.64	1.64	1.90	1.26	1.29	3.18	.84	1.76	1.45	1.40	1.26	2,27	

100030090

	A	B	C	D	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
XM	6.70	7.20	6.40	6.90	7.70	6.50	7.40	7.50	6.80	7.20	6.90	6.90	5.80	5.10	5.60	6.10	5.80	6.30	6.40	5.30	4.80
MXM	.63	.73	.54	.57	.70	.67	.64	.45	.70	.70	.78	.67	.79	.89	.76	.78	.65	.72	.62	.91	.85
MX	2.00	2.30	1.71	1.79	2.21	2.12	2.01	1.43	2.20	2.20	2.47	2.13	2.49	2.81	2.41	2.47	2.04	2.26	1.96	2,87	2.70

	AS	BS	CS	DS	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
XM	6.44	6.86	6.38	6.10	6.00	6.90	5.50	6.10	6.10	6.50	5.60	6.30	5.80	5.20	6.80	7.00	6.50	6.30	6.80	6.20	

Table 20/1 – Averages of the evaluations XM and mean errors MXM

		A	B	C	D	AS	BS	CS	DS
5 001 009 0	XM	7.88	7.63	6.75	7.50	7.53	7.97	6.75	7.41
	MXM	.48	.37	.56	.60	.19	.32	.24	.37
5 003 002 0	XM	8.50	8.50	8.38	8.38	7.87	7.98	7.66	7.96
	MXM	.65	.53	.46	.60	.18	.37	.21	.34
5 003 009 0	XM	7.38	7.38	6.63	7.88	7.43	7.80	7.15	7.29
	MXM	.56	.53	.63	.61	.19	.36	.22	.41
5 003 010 0	XM	8.88	8.63	8.63	9.00	8.31	8.31	8.28	8.36
	MXM	.58	.63	.46	.53	.15	.33	.17	.26
5 003 013 1	XM	8.75	8.63	8.13	8.50	7.99	8.42	7.56	7.95
	MXM	.41	.37	.40	.50	.16	.36	.14	.27
5 003 013 2	XM	4.75	5.13	4.38	5.75	5.71	6.17	5.15	5.72
	MXM	.77	.97	.78	.88	.23	.47	.14	.46
5 003 013 3	XM	8.50	8.38	7.50	8.00	7.59	8.07	7.12	7.57
	MXM	.60	.50	.46	.63	.18	.40	.15	.28
5 003 013 4	XM	6.63	7.25	6.00	6.38	6.90	7.20	6.37	7.11
	MXM	.82	1.05	.78	.71	.20	.41	.19	.40
5 203 002 0	XM	7.63	7.00	6.88	7.75	6.02	4.06	7.95	7.39
	MXM	.60	.76	.67	.73	.48	.90	.17	.43
5 203 011 5	XM	6.88	6.38	6.00	6.88	7.19	6.79	7.37	7.34
	MXM	.58	.65	.68	.67	.26	.52	.40	.47
5 005 003 0	XM	8.88	8.63	7.50	8.00	7.97	8.55	7.42	7.78
	MXM	.35	.37	.50	.38	.17	.32	.14	.27
5 005 010 0	XM	8.88	8.63	7.75	8.38	8.06	8.45	7.76	7.94
	MXM	.44	.37	.37	.50	.18	.41	.11	.29
5 205 003 0	XM	6.38	5.88	4.75	6.25	6.41	6.99	5.90	6.35
	MXM	.68	.72	.86	.70	.34	.62	.34	.73
5 012 010 0	XM	3.75	3.25	3.13	3.63	3.31	3.36	3.48	3.11
	MXM	.31	.65	.74	.73	.25	.62	.28	.43
5 222 610 1	XM	4.13	3.38	4.38	5.13	3.57	2.68	4.61	3.93
	MXM	.55	.53	.71	.95	.33	.68	.28	.52
5 222 610 2	XM	5.25	5.00	4.25	5.50	5.07	5.02	5.11	5.10
	MXM	.56	.68	.90	.76	.26	.52	.28	.54
5 226 610 1	XM	4.13	3.75	2.38	4.50	3.69	4.15	2.96	3.93
	MXM	.77	.70	.65	.91	.35	.78	.37	.60
5 226 610 2	XM	4.63	3.88	3.13	4.50	3.76	4.27	3.07	3.75
	MXM	.68	.55	.74	.71	.33	.61	.44	.62
5 228 610 1	XM	4.38	4.25	2.88	3.88	3.68	4.06	3.14	3.83
	MXM	.75	.67	.58	.95	.32	.75	.32	.55
5 228 610 2	XM	4.50	4.75	4.25	5.13	4.16	4.11	3.99	4.38
	MXM	.65	.75	.62	.88	.31	.69	.35	.61
5 254 609 0	XM	4.88	4.75	3.63	4.88	4.16	4.49	4.21	3.71
	MXM	.69	.41	.71	.83	.28	.59	.35	.46
5 256 512 1	XM	5.38	5.38	4.75	5.25	5.27	5.20	5.56	5.02
	MXM	.53	.42	.49	.62	.19	.40	.25	.35
5 256 512 2	XM	5.63	5.75	5.00	5.63	5.37	5.27	5.61	5.26
	MXM	.56	.49	.68	.68	.20	.48	.25	.34

Table 20/2 – Averages of the evaluations XM and mean errors MXM

		A	B	C	D	AS	BS	CS	DS
5 256 512 3	XM	5.25	5.63	5.25	5.75	5.48	5.21	5.79	5.42
	MXM	.62	.53	.67	.73	.23	.51	.26	.40
5 256 609 0	XM	7.50	7.50	6.63	7.50	7.18	7.32	7.11	7.08
	MXM	.53	.38	.73	.65	.18	.37	.23	.32
5 258 609 0	XM	4.00	4.13	2.38	4.38	4.57	5.56	3.46	3.65
	MXM	.65	.69	.63	.71	.35	.51	.39	.68
5 260 609 0	XM	5.50	5.25	4.13	5.13	4.75	5.61	4.25	4.26
	MXM	.46	.62	.83	.55	.36	.68	.45	.68
5 262 809 0	XM	3.63	3.88	2.13	3.75	3.21	4.86	3.00	2.10
	MXM	.42	.35	.58	.62	.34	.62	.31	.40
5 064 702 1	XM	5.63	5.63	5.38	6.00	5.07	5.56	5.34	4.41
	MXM	.46	.68	.73	.57	.26	.53	.31	.48
5 064 702 2	XM	5.13	4.88	5.13	6.00	4.68	4.33	5.08	4.44
	MXM	.40	.55	.58	.63	.24	.51	.25	.48
5 264 702 1	XM	3.63	2.38	4.50	4.88	2.93	1.36	6.27	3.55
	MXM	1.03	.75	1.00	.91	.54	.79	.64	.81
5 264 702 2	XM	5.25	4.88	5.63	5.88	5.18	5.07	5.91	4.67
	MXM	.49	.61	.75	.67	.26	.48	.31	.47
5 264 809 0	XM	6.63	6.38	5.38	6.63	6.19	6.62	5.69	6.22
	MXM	.46	.68	.73	.65	.30	.62	.23	.63
5 066 702 0	XM	2.75	2.75	3.88	3.25	2.34	1.50	4.20	2.43
	MXM	.49	.49	.52	.86	.31	.33	.34	.61
5 266 702 0	XM	3.13	2.88	4.75	3.00	2.03	.95	4.63	2.20
	MXM	.72	.52	.70	.78	.33	.37	.41	.44
5 266 809 0	XM	1.25	1.88	.13	1.25	.47	.63	.41	.39
	MXM	.37	.44	.13	.31	.20	.53	.15	.28
5 068 702 0	XM	3.25	3.13	3.13	4.00	2.99	2.24	4.26	2.60
	MXM	.73	.64	.83	1.00	.32	.45	.28	.66
5 268 702 0	XM	4.00	3.25	5.38	5.00	3.35	1.60	6.35	3.33
	MXM	.63	.67	1.00	.76	.43	.57	.39	.56
5 268 809 0	XM	2.38	2.75	1.13	2.13	.91	.78	.89	1.19
	MXM	.60	.73	.44	.52	.24	.52	.22	.48
5 070 605 0	XM	5.50	5.75	4.00	6.13	3.70	4.11	3.54	3.41
	MXM	.53	.67	.68	.69	.26	.65	.28	.34
5 270 605 0	XM	4.50	4.38	4.38	5.25	4.32	4.99	5.03	3.21
	MXM	.53	.71	.71	.49	.38	.71	.45	.67
5 270 607 0	XM	5.75	5.38	6.00	7.00	5.66	3.69	7.44	5.34
	MXM	.62	.80	.68	.65	.42	.86	.30	.44
5 270 610 1	XM	4.75	3.75	5.13	5.38	2.52	.95	5.86	4.18
	MXM	.53	.49	.69	.78	.47	.58	.47	.49
5 270 610 2	XM	6.00	5.13	4.75	6.25	4.96	4.13	5.98	4.48
	MXM	.50	.58	.77	.53	.30	.67	.29	.45
5 270 610 3	XM	5.13	3.88	4.88	5.63	4.86	4.02	5.99	4.24
	MXM	.69	.85	.69	.78	.37	.84	.35	.50
5 072 605 0	XM	6.63	6.75	5.88	6.75	5.95	6.51	5.37	5.94
	MXM	.60	.49	.64	.67	.23	.52	.25	.34

Table 20/3 – Averages of the evaluations XM and mean errors MXM

		A	B	C	D	AS	BS	CS	DS
5 072 605 2	XM	7.75	7.13	5.63	7.25	6.09	6.79	5.46	6.10
	MXM	.45	.55	.71	.41	.24	.53	.27	.37
5 272 411 6	XM	6.00	5.88	6.50	6.25	5.94	4.16	6.95	5.80
	MXM	1.02	1.06	.93	.90	.29	.50	.26	.48
5 272 605 0	XM	7.50	7.88	6.63	7.00	6.94	6.96	7.42	6.33
	MXM	.46	.81	.86	.63	.23	.38	.19	.53
5 272 605 2	XM	6.63	7.13	6.13	7.50	7.69	7.83	7.93	7.24
	MXM	.63	.67	.90	.53	.19	.34	.21	.45
5 272 607 0	XM	5.38	5.50	5.00	6.13	5.51	3.31	7.29	5.76
	MXM	.42	.60	.76	.69	.41	.77	.23	.50
5 272 611 6	XM	5.75	6.13	6.25	6.75	6.45	4.82	7.40	5.93
	MXM	1.01	.95	.70	.80	.27	.62	.20	.29
5 274 610 0	XM	4.13	3.75	2.88	4.50	2.85	2.88	3.26	2.52
	MXM	.58	.41	.79	.89	.28	.58	.45	.46
5 276 610 0	XM	4.63	4.25	3.13	4.75	3.90	3.68	4.19	3.78
	MXM	.71	.75	.61	.82	.29	.64	.49	.38
5 278 807 0	XM	5.50	4.38	4.75	6.38	5.01	3.10	6.42	5.51
	MXM	.38	.63	.75	.65	.38	.70	.28	.47
5 279 706 0	XM	6.63	6.75	6.25	7.25	6.30	6.23	6.47	6.17
	MXM	.65	.67	.62	.62	.20	.48	.27	.31
5 080 703 0	XM	6.25	6.38	4.88	6.50	5.41	6.25	4.48	5.34
	MXM	.73	.71	.81	.85	.26	.51	.26	.40
5 280 703 0	XM	6.00	5.38	4.88	6.25	5.82	6.51	5.21	5.68
	MXM	.68	.68	.88	.88	.29	.53	.30	.62
5 280 807 0	XM	5.38	4.63	4.50	6.13	5.20	3.51	6.37	6.00
	MXM	.68	.60	.76	.64	.40	.78	.33	.55
5 082 703 0	XM	4.38	4.00	2.75	4.13	2.76	3.54	2.69	2.36
	MXM	.50	.42	.56	.88	.31	.74	.35	.51
5 282 703 0	XM	4.25	4.00	2.88	3.88	2.96	3.46	2.98	2.65
	MXM	.62	.53	.69	.83	.34	.79	.43	.59
5 084 703 0	XM	5.50	5.88	4.00	5.13	3.86	4.58	3.28	3.75
	MXM	.65	.69	.78	.69	.30	.69	.39	.47
5 284 703 0	XM	5.75	5.63	4.50	5.50	4.20	4.75	3.71	4.04
	MXM	.84	.63	.93	1.05	.35	.75	.54	.55
5 104 002 0	XM	2.25	2.50	1.63	2.88	1.80	1.31	2.23	2.21
	MXM	.49	.71	.26	.85	.21	.37	.37	.30
5 104 003 0	XM	3.75	3.13	2.63	3.75	2.19	3.35	1.93	1.77
	MXM	.62	.35	.46	.86	.27	.54	.42	.40
5 304 002 0	XM	3.25	2.75	3.63	3.63	2.53	1.73	4.28	2.56
	MXM	.77	.49	.80	.91	.30	.53	.39	.46
5 304 003 0	XM	3.00	2.75	3.25	2.88	1.79	1.82	2.68	1.34
	MXM	.53	.49	.65	.61	.34	.73	.62	.45
5 106 002 0	XM	2.13	2.00	2.25	2.38	1.48	1.44	2.12	1.25
	MXM	.55	.53	.49	.71	.19	.30	.35	.35
5 106 003 0	XM	2.88	2.63	2.75	3.00	1.36	1.32	1.96	1.11
	MXM	.52	.50	.56	.63	.24	.50	.39	.37

Table 20/4 – Averages of the evaluations XM and mean errors MXM

		A	B	C	D	AS	BS	CS	DS
5 306 002 0	XM	1.38	1.13	2.75	1.75	1.00	.55	2.98	1.04
	MXM	.63	.52	.67	.56	.23	.32	.43	.31
5 306 003 0	XM	2.25	2.38	2.50	2.25	1.16	1.26	2.36	.73
	MXM	.56	.60	.42	.67	.26	.54	.48	.32
5 108 002 0	XM	2.75	2.25	2.63	2.25	1.43	1.06	2.65	1.37
	MXM	.84	.56	.56	.67	.21	.36	.30	.30
5 108 003 1	XM	4.25	4.00	4.00	3.88	2.55	3.27	2.99	2.04
	MXM	.90	.78	.65	.91	.25	.63	.35	.31
5 108 003 2	XM	4.25	3.50	3.38	3.88	2.44	3.00	2.59	1.98
	MXM	.88	.65	.50	.91	.23	.48	.36	.34
5 308 002 0	XM	1.38	1.13	2.13	1.63	1.00	.54	2.86	.96
	MXM	.63	.52	.52	.56	.23	.33	.39	.35
5 308 003 1	XM	3.38	2.75	3.50	2.88	1.17	1.97	3.14	.55
	MXM	.73	.67	.71	.74	.27	.55	.43	.33
5 308 003 2	XM	3.00	2.63	3.63	3.00	1.95	2.56	4.26	1.13
	MXM	.76	.68	.86	.76	.33	.63	.50	.38
5 310 510 1	XM	4.00	3.88	4.00	4.25	3.75	3.14	5.90	2.86
	MXM	.42	.44	.57	.45	.39	.68	.47	.57
5 310 510 2	XM	5.75	5.00	5.63	5.38	4.81	4.05	6.26	4.32
	MXM	.73	.63	.73	.73	.35	.67	.34	.55
5 310 510 3	XM	4.63	4.25	4.88	5.00	4.14	3.74	6.11	3.12
	MXM	.60	.67	.30	.65	.38	.73	.36	.55
5 314 510 0	XM	4.13	4.00	4.38	4.75	3.93	2.61	5.36	3.92
	MXM	.67	.73	.68	.86	.36	.66	.40	.49
5 316 510 0	XM	4.88	4.00	5.25	5.50	3.95	3.16	5.81	2.95
	MXM	.52	.38	.49	.76	.39	.70	.37	.61
5 624 504 1	XM	5.88	5.88	4.88	6.00	5.06	5.15	5.24	4.82
	MXM	.72	.90	.69	.63	.31	.56	.44	.63
5 624 504 2	XM	6.00	6.00	5.25	6.13	5.01	4.58	5.19	5.20
	MXM	.73	.78	.77	.67	.31	.61	.46	.56
5 656 504 0	XM	5.75	5.38	6.38	5.75	5.30	4.75	6.40	4.40
	MXM	.80	.86	.80	.86	.34	.67	.36	.63

Table 20/5 – Averages of the evaluations XM and mean errors MXM

		A	B	C	D	AS	BS	CS	DS
10 001 009 0	XM	7.70	8.10	7.00	7.60	7.33	7.60	7.19	7.25
	MXM	.37	.41	.33	.37	.09	.14	.16	.18
10 003 002 0	XM	8.30	8.40	7.70	8.10	7.70	7.67	7.93	7.47
	MXM	.33	.40	.33	.50	.11	.19	.19	.15
10 003 009 0	XM	6.70	7.20	6.40	6.90	6.44	6.86	6.38	6.10
	MXM	.63	.73	.54	.57	.12	.23	.15	.17
10 003 010 0	XM	8.00	7.70	8.30	7.70	7.60	6.97	7.96	7.77
	MXM	.15	.33	.26	.37	.20	.55	.15	.18
10 003 013 1	XM	7.90	8.00	7.50	8.00	7.48	7.55	7.49	7.42
	MXM	.48	.56	.40	.49	.08	.13	.15	.15
10 003 013 2	XM	6.00	6.20	5.60	6.00	5.75	6.05	5.79	5.42
	MXM	.52	.66	.56	.54	.11	.20	.18	.15
10 003 013 3	XM	8.30	8.20	7.80	8.30	7.45	7.44	7.61	7.28
	MXM	.33	.44	.36	.45	.10	.16	.21	.15
10 003 013 4	XM	6.40	6.90	6.20	6.50	6.33	6.54	6.31	6.16
	MXM	.58	.64	.51	.54	.10	.17	.17	.16
10 203 002 0	XM	6.90	6.70	7.30	7.40	7.38	6.34	8.05	7.60
	MXM	.35	.42	.30	.27	.24	.61	.17	.22
10 203 011 1	XM	7.20	6.80	7.70	7.70	7.50	6.95	7.96	7.37
	MXM	.36	.51	.42	.52	.13	.26	.16	.15
10 203 011 4	XM	7.00	6.80	7.30	7.50	7.50	5.84	8.18	7.78
	MXM	.33	.42	.26	.40	.27	.74	.14	.24
10 005 003 0	XM	7.00	7.80	7.00	7.60	6.96	7.22	6.87	6.83
	MXM	.58	.49	.52	.48	.11	.19	.15	.22
10 005 010 0	XM	7.50	7.20	7.20	7.60	7.08	7.10	7.02	7.13
	MXM	.56	.53	.53	.45	.12	.31	.16	.19
10 205 003 0	XM	7.00	7.10	6.60	7.50	6.88	6.96	6.99	6.70
	MXM	.52	.50	.34	.45	.12	.27	.16	.19
10 210 001 1	XM	5.30	5.50	5.30	5.90	5.64	3.85	6.43	6.31
	MXM	.52	.79	.42	.62	.31	.74	.18	.18
10 210 001 2	XM	4.70	4.20	5.50	4.60	3.92	1.45	6.64	5.63
	MXM	.45	.65	.37	.56	.52	.70	.23	.53
10 012 010 0	XM	3.50	2.90	3.10	3.70	3.21	1.89	4.37	3.89
	MXM	.43	.59	.60	.50	.31	.59	.22	.30
10 212 001 1	XM	2.90	3.00	3.70	3.00	2.94	1.44	4.68	3.56
	MXM	.23	.45	.47	.39	.35	.53	.30	.44
10 212 001 2	XM	1.40	1.40	2.80	1.60	2.00	1.23	4.25	1.45
	MXM	.37	.40	.51	.48	.36	.57	.36	.52
10 214 001 0	XM	4.70	3.80	6.30	5.20	2.67	.85	6.91	6.35
	MXM	.50	.65	.56	.68	.56	.62	.23	.29
10 222 610 1	XM	3.50	3.10	3.90	3.30	2.54	1.97	3.21	2.68
	MXM	.31	.38	.35	.37	.20	.38	.24	.27
10 222 610 2	XM	5.00	5.00	4.90	4.50	3.89	4.17	3.99	3.34
	MXM	.47	.61	.43	.52	.16	.23	.27	.29
10 226 610 1	XM	2.90	3.30	2.40	2.10	1.51	1.36	2.20	1.23
	MXM	.41	.37	.27	.28	.20	.42	.25	.27

Table 20/6 – Averages of the evaluations XM and mean errors MXM

		A	B	C	D	AS	BS	CS	DS
10 226 610 2	XM	4.10	3.60	3.70	3.80	2.82	2.61	3.18	2.80
	MXM	.50	.37	.60	.49	.19	.32	.24	.39
10 228 610 1	XM	3.00	3.40	2.80	2.20	2.05	2.48	2.54	1.42
	MXM	.45	.60	.44	.42	.18	.36	.15	.28
10 228 610 2	XM	5.10	4.60	4.50	4.90	3.52	3.17	4.03	3.22
	MXM	.41	.60	.54	.41	.19	.35	.27	.31
10 230 701 1	XM	2.50	2.20	4.00	2.60	1.50	.49	4.62	2.28
	MXM	.37	.44	.61	.56	.38	.38	.50	.71
10 230 701 2	XM	4.00	3.40	4.70	4.60	3.11	1.42	4.83	3.67
	MXM	.37	.45	.30	.34	.34	.51	.20	.17
10 232 701 1	XM	4.00	3.00	5.30	3.70	2.21	.92	5.23	4.00
	MXM	.56	.45	.45	.72	.45	.62	.43	.53
10 232 701 2	XM	5.40	4.80	6.00	5.70	5.31	4.68	5.78	5.49
	MXM	.31	.51	.37	.52	.22	.51	.30	.27
10 232 701 3	XM	4.70	4.30	5.00	4.80	4.69	2.50	5.76	5.23
	MXM	.33	.45	.37	.36	.35	.70	.26	.26
10 254 609 0	XM	4.10	3.70	4.00	4.10	3.55	2.80	4.08	2.98
	MXM	.31	.47	.15	.28	.19	.41	.19	.31
10 256 609 0	XM	6.20	5.80	5.80	6.30	5.52	5.03	5.84	5.58
	MXM	.44	.55	.49	.60	.15	.31	.18	.24
10 258 609 0	XM	3.80	3.90	3.50	4.00	3.79	3.69	3.95	3.73
	MXM	.36	.50	.34	.42	.15	.26	.22	.31
10 260 609 0	XM	5.20	4.90	4.60	5.40	4.27	4.30	4.53	3.86
	MXM	.33	.50	.27	.40	.13	.22	.18	.27
10 262 801 1	XM	3.20	2.90	3.30	3.50	1.82	.77	3.07	2.84
	MXM	.33	.28	.40	.34	.26	.37	.21	.28
10 262 801 2	XM	4.00	3.00	4.60	4.40	3.11	1.42	5.07	4.56
	MXM	.30	.45	.37	.43	.41	.62	.29	.42
10 262 809 0	XM	3.00	3.30	2.80	2.60	2.39	2.57	2.46	2.21
	MXM	.39	.33	.36	.34	.17	.37	.22	.29
10 064 702 1	XM	6.00	5.80	6.10	5.90	5.23	4.76	5.51	5.34
	MXM	.61	.65	.59	.59	.16	.29	.27	.25
10 064 702 2	XM	5.40	5.40	5.20	5.10	4.58	4.28	4.91	4.45
	MXM	.62	.62	.55	.66	.15	.34	.22	.23
10 264 702 1	XM	5.20	5.40	5.80	5.50	4.92	3.71	5.87	5.11
	MXM	.53	.62	.47	.48	.26	.57	.16	.30
10 264 702 2	XM	5.10	5.00	5.10	4.70	4.31	3.93	4.73	4.20
	MXM	.43	.52	.59	.52	.17	.36	.26	.22
10 264 801 1	XM	5.30	5.50	4.90	4.90	4.35	4.52	4.53	4.11
	MXM	.52	.48	.50	.48	.14	.27	.23	.24
10 264 801 2	XM	5.40	5.40	4.60	5.00	4.35	4.54	4.50	4.09
	MXM	.54	.54	.52	.60	.15	.32	.19	.26
10 264 801 3	XM	6.00	5.50	6.50	5.50	5.41	4.57	6.10	5.49
	MXM	.47	.48	.43	.45	.26	.68	.20	.28
10 264 809 0	XM	6.10	6.80	5.90	6.10	5.08	5.85	5.18	4.51
	MXM	.74	.80	.66	.75	.21	.39	.24	.33

Table 20/7 – Averages of the evaluations XM and mean errors MXM

		A	B	C	D	AS	BS	CS	DS
10 066 702 0	XM	2.10	1.60	2.60	2.30	1.33	.52	2.59	2.40
	MXM	.18	.31	.43	.33	.21	.24	.19	.23
10 266 702 0	XM	2.70	2.10	3.20	2.60	1.80	.65	3.70	2.76
	MXM	.30	.28	.29	.27	.27	.31	.17	.24
10 266 809 0	XM	1.60	1.80	1.20	1.60	1.07	1.14	1.10	.99
	MXM	.37	.44	.33	.31	.14	.39	.14	.22
10 068 702 0	XM	3.40	2.90	3.80	3.40	2.71	1.64	3.08	3.59
	MXM	.37	.35	.42	.34	.24	.43	.28	.29
10 268 702 0	XM	4.00	3.10	4.50	4.30	3.83	2.43	4.97	4.07
	MXM	.33	.46	.50	.33	.28	.50	.20	.28
10 268 809 0	XM	2.20	3.00	1.40	1.90	2.34	3.06	1.90	2.16
	MXM	.47	.52	.37	.18	.27	.67	.21	.40
10 070 605 0	XM	4.30	4.60	4.20	4.10	3.41	3.40	3.45	3.38
	MXM	.40	.56	.36	.35	.19	.45	.21	.34
10 270 605 0	XM	4.50	4.50	4.50	4.10	3.65	3.53	4.01	3.28
	MXM	.40	.64	.48	.35	.19	.38	.22	.38
10 270 610 1	XM	4.00	3.40	4.30	4.00	2.40	1.11	3.78	3.02
	MXM	.33	.54	.37	.45	.29	.45	.22	.34
10 270 610 2	XM	5.20	5.10	4.80	5.10	3.83	3.16	4.33	3.86
	MXM	.25	.53	.44	.28	.18	.32	.26	.28
10 270 610 3	XM	4.90	4.20	5.20	5.00	3.19	1.91	4.43	3.53
	MXM	.31	.39	.51	.37	.29	.53	.27	.32
10 072 605 0	XM	6.30	6.30	6.30	6.40	5.30	5.43	5.29	5.12
	MXM	.54	.56	.45	.56	.12	.19	.26	.19
10 072 605 2	XM	7.10	7.10	6.40	6.30	5.29	5.60	5.19	5.10
	MXM	.50	.59	.56	.52	.14	.18	.28	.25
10 272 411 2	XM	4.30	4.30	4.80	4.80	3.80	2.58	4.77	4.03
	MXM	.50	.37	.53	.39	.24	.39	.28	.21
10 272 411 3	XM	5.20	5.00	5.60	5.50	4.09	2.91	5.40	4.67
	MXM	.49	.63	.54	.54	.25	.41	.21	.14
10 272 605 0	XM	7.60	7.30	7.60	7.20	6.14	6.05	6.42	5.92
	MXM	.52	.62	.45	.57	.11	.15	.20	.21
10 272 605 2	XM	6.60	7.10	6.80	6.80	5.94	5.69	6.27	5.82
	MXM	.56	.69	.57	.61	.13	.26	.21	.22
10 272 611 2	XM	5.10	4.50	5.90	5.30	5.16	3.05	6.44	5.55
	MXM	.48	.72	.59	.58	.32	.64	.21	.20
10 272 611 3	XM	5.70	5.40	5.90	5.90	5.60	5.04	6.09	5.38
	MXM	.50	.65	.53	.43	.14	.34	.19	.16
10 074 607 0	XM	3.90	4.20	3.70	4.10	3.52	3.31	3.63	3.54
	MXM	.31	.55	.33	.38	.15	.26	.28	.27
10 274 607 0	XM	4.80	4.80	4.00	4.80	3.87	3.93	3.91	3.77
	MXM	.33	.36	.39	.33	.14	.26	.23	.24
10 274 610 1	XM	3.40	3.40	3.20	3.50	2.21	2.04	2.42	2.08
	MXM	.27	.43	.51	.31	.16	.32	.25	.27
10 274 610 2	XM	4.40	4.10	3.80	4.20	2.72	2.23	3.39	2.56
	MXM	.48	.50	.51	.42	.21	.38	.24	.40

Table 20/8 – Averages of the evaluations XM and mean errors MXM

		A	B	C	D	AS	BS	CS	DS
10 076 607 2	XM	7.00	6.80	6.60	6.70	5.33	4.50	5.83	5.53
	MXM	.37	.42	.34	.37	.16	.31	.20	.18
10 076 607 3	XM	6.50	6.40	6.00	6.40	5.03	3.99	5.77	5.40
	MXM	.37	.43	.39	.37	.20	.34	.21	.19
10 276 607 2	XM	7.00	6.50	6.60	6.90	5.37	4.74	6.00	5.18
	MXM	.60	.64	.45	.55	.16	.25	.21	.25
10 276 607 3	XM	6.10	5.90	5.40	6.10	4.80	4.43	5.27	4.54
	MXM	.53	.57	.45	.46	.15	.28	.24	.17
10 276 610 1	XM	4.40	4.00	3.70	4.30	3.01	2.78	3.47	2.56
	MXM	.34	.47	.30	.40	.17	.30	.25	.29
10 276 610 2	XM	4.90	4.40	4.80	5.10	3.93	3.70	4.32	3.59
	MXM	.35	.45	.49	.53	.16	.22	.20	.34
10 080 703 0	XM	6.20	6.10	5.80	6.40	5.46	5.78	5.46	5.19
	MXM	.42	.50	.51	.45	.15	.25	.28	.23
10 280 703 0	XM	6.10	5.90	5.30	5.40	5.54	5.71	5.79	5.17
	MXM	.38	.59	.50	.43	.13	.14	.22	.26
10 082 703 0	XM	4.20	4.40	3.40	4.00	3.17	3.59	3.20	2.80
	MXM	.47	.60	.40	.45	.17	.34	.23	.34
10 082 807 0	XM	4.30	4.60	4.30	4.20	3.37	3.24	3.62	3.23
	MXM	.26	.50	.30	.33	.16	.29	.25	.28
10 282 703 0	XM	4.40	4.60	3.70	4.20	3.25	3.17	3.68	3.04
	MXM	.50	.58	.40	.44	.17	.32	.26	.28
10 282 807 0	XM	4.30	4.20	4.00	4.10	3.31	3.25	3.48	3.16
	MXM	.47	.49	.33	.35	.14	.28	.22	.27
10 084 703 0	XM	5.70	5.60	5.10	5.10	4.22	4.55	4.49	3.72
	MXM	.45	.43	.28	.31	.17	.24	.25	.34
10 084 807 2	XM	6.90	6.70	6.40	6.30	5.50	5.09	6.20	5.14
	MXM	.59	.63	.43	.45	.21	.28	.37	.33
10 084 807 3	XM	6.00	5.70	6.10	5.90	4.70	4.36	5.15	4.50
	MXM	.45	.47	.31	.46	.19	.29	.34	.31
10 284 703 0	XM	5.30	5.40	5.00	4.90	4.47	4.43	4.73	4.28
	MXM	.45	.45	.42	.41	.13	.24	.21	.23
10 284 807 2	XM	7.30	7.20	6.70	6.70	5.96	5.82	6.56	5.46
	MXM	.54	.66	.54	.68	.16	.28	.22	.21
10 284 807 3	XM	6.30	6.10	5.90	5.90	5.39	4.99	6.01	5.25
	MXM	.45	.41	.41	.48	.18	.26	.30	.28
10 104 002 0	XM	1.30	1.70	1.90	1.70	1.51	.90	1.73	2.20
	MXM	.33	.26	.50	.45	.18	.34	.24	.25
10 104 003 0	XM	3.90	3.90	3.90	3.60	2.09	.90	3.97	3.60
	MXM	.38	.43	.46	.40	.33	.45	.25	.27
10 304 002 0	XM	1.90	1.60	1.50	2.00	1.44	.60	2.16	1.97
	MXM	.41	.31	.40	.42	.25	.38	.37	.40
10 106 002 0	XM	2.20	1.70	2.40	2.10	1.96	1.21	2.38	2.06
	MXM	.25	.26	.27	.38	.15	.26	.15	.21
10 106 003 0	XM	3.50	2.80	3.60	3.30	2.42	1.46	3.53	3.02
	MXM	.48	.49	.40	.33	.24	.41	.15	.18

Table 20/9 – Averages of the evaluations XM and mean errors MXM

		A	B	C	D	AS	BS	CS	DS
10 306 002 0	XM	2.80	2.40	2.00	2.90	1.80	1.10	1.39	2.97
	MXM	.33	.22	.26	.35	.26	.39	.44	.29
10 306 003 0	XM	2.70	2.40	1.30	2.50	1.17	1.89	.60	2.36
	MXM	.26	.37	.37	.37	.22	.37	.29	.36
10 108 002 0	XM	2.20	1.90	2.90	2.60	2.31	1.77	2.93	2.39
	MXM	.13	.28	.23	.31	.17	.31	.23	.23
10 108 003 1	XM	3.90	3.40	4.60	4.30	2.49	1.55	4.00	3.38
	MXM	.38	.48	.52	.37	.30	.50	.25	.28
10 108 003 2	XM	3.50	3.20	4.20	4.10	2.04	1.12	4.08	3.14
	MXM	.34	.53	.25	.35	.32	.48	.24	.24
10 308 002 0	XM	2.50	2.20	2.40	2.70	1.42	1.10	.58	3.22
	MXM	.34	.25	.43	.42	.27	.38	.36	.25
10 308 003 1	XM	4.10	4.10	3.00	3.50	3.23	2.65	3.11	3.88
	MXM	.35	.38	.37	.37	.24	.41	.40	.37
10 308 003 2	XM	3.60	3.60	3.30	3.80	3.18	2.46	3.12	3.98
	MXM	.34	.45	.26	.36	.25	.45	.41	.33
10 310 510 1	XM	4.80	3.50	5.10	4.70	2.64	1.01	5.24	4.34
	MXM	.29	.37	.53	.45	.42	.56	.21	.39
10 310 510 2	XM	5.80	4.90	6.20	5.80	4.19	2.70	5.54	4.97
	MXM	.44	.64	.53	.63	.35	.69	.27	.26
10 310 510 3	XM	5.20	4.80	6.00	5.80	3.94	2.44	5.57	5.01
	MXM	.29	.47	.49	.36	.37	.67	.29	.30
10 314 510 0	XM	5.10	4.30	5.00	5.20	3.51	2.57	4.68	4.23
	MXM	.35	.42	.39	.51	.28	.51	.28	.26
10 316 510 0	XM	5.20	4.60	5.30	5.50	3.80	2.80	5.11	4.44
	MXM	.36	.40	.30	.43	.26	.45	.23	.20
10 406 607 0	XM	3.50	3.00	3.10	3.50	2.22	1.58	2.94	2.25
	MXM	.34	.49	.48	.37	.19	.22	.25	.35
10 606 607 0	XM	4.40	3.90	3.30	4.30	2.59	1.86	2.92	2.92
	MXM	.31	.31	.40	.40	.21	.27	.30	.39
10 408 607 2	XM	6.00	5.70	5.10	5.50	3.97	3.18	4.94	3.94
	MXM	.39	.40	.41	.48	.21	.22	.22	.41
10 408 607 3	XM	5.20	4.50	4.50	5.10	3.81	3.16	4.35	3.89
	MXM	.47	.54	.37	.35	.16	.18	.20	.33
10 608 607 2	XM	5.60	5.20	5.60	5.70	4.67	4.27	5.41	4.44
	MXM	.60	.66	.56	.40	.18	.25	.24	.34
10 608 607 3	XM	5.30	5.10	4.90	5.00	3.96	3.51	4.44	3.94
	MXM	.50	.38	.43	.37	.17	.25	.22	.34

Table 20/10 – Averages of the evaluations XM and mean errors MXM

		A	B	C	D	AS	BS	CS	DS
25 003 002 0	XM	7.44	6.78	7.56	7.56	7.26	7.33	7.42	6.99
	MXM	.63	.46	.60	.56	.12	.18	.24	.18
25 003 010 0	XM	9.33	9.11	8.78	9.11	8.51	8.43	8.74	8.26
	MXM	.33	.48	.40	.35	.09	.13	.19	.12
25 003 013 1	XM	8.22	7.78	8.00	8.33	7.67	7.79	7.67	7.55
	MXM	.49	.36	.41	.44	.10	.14	.20	.17
25 003 013 2	XM	6.56	6.56	6.22	6.56	6.46	6.76	6.24	6.27
	MXM	.73	.50	.81	.80	.11	.16	.19	.23
25 003 013 3	XM	8.67	8.56	8.22	8.22	7.79	7.91	7.77	7.71
	MXM	.58	.47	.52	.55	.08	.15	.15	.14
25 003 013 4	XM	7.78	6.78	7.33	7.33	6.91	7.11	6.82	6.72
	MXM	.68	.52	.78	.75	.10	.18	.16	.19
25 203 002 0	XM	8.11	7.67	8.78	8.44	7.96	7.82	8.32	7.65
	MXM	.51	.65	.40	.53	.11	.12	.17	.23
25 203 011 8	XM	7.44	7.00	6.89	8.11	7.78	7.60	7.93	7.83
	MXM	.93	.78	.87	.72	.16	.27	.31	.30
25 203 011 1	XM	7.56	6.89	7.00	7.00	6.96	7.07	6.91	6.88
	MXM	.82	.68	.80	.75	.10	.14	.17	.23
25 005 003 0	XM	7.89	8.22	7.33	7.78	7.40	7.52	7.32	7.34
	MXM	.70	.60	.62	.76	.09	.14	.16	.17
25 005 010 0	XM	8.56	8.33	8.00	8.44	7.68	7.82	7.76	7.42
	MXM	.44	.41	.47	.47	.09	.15	.18	.15
25 205 003 0	XM	7.89	7.44	7.56	7.56	7.28	7.37	7.39	7.02
	MXM	.79	.75	.75	.71	.09	.08	.21	.16
25 012 010 0	XM	4.33	4.00	3.89	3.67	4.46	4.60	4.62	4.11
	MXM	.33	.44	.63	.62	.17	.22	.29	.36
25 222 610 1	XM	2.78	2.78	2.33	2.44	2.36	2.56	2.17	2.35
	MXM	.55	.55	.71	.63	.13	.26	.22	.21
25 222 610 2	XM	3.78	3.67	2.89	3.11	2.60	2.91	2.18	2.71
	MXM	.70	.60	.68	.72	.16	.28	.25	.26
25 226 610 1	XM	1.67	1.44	1.22	1.33	.99	1.48	.80	.88
	MXM	.71	.53	.46	.55	.10	.18	.10	.17
25 226 610 2	XM	2.78	2.56	1.78	2.78	2.40	2.45	2.16	2.65
	MXM	.55	.50	.46	.64	.16	.27	.21	.36
25 228 610 1	XM	1.67	2.00	1.56	1.67	1.46	1.88	1.18	1.41
	MXM	.47	.58	.53	.53	.10	.17	.12	.19
25 228 610 2	XM	3.67	3.67	3.33	3.00	3.21	3.26	2.92	3.44
	MXM	.53	.53	.83	.73	.14	.20	.28	.26
25 258 601 2	XM	4.00	3.89	4.11	3.11	3.49	3.52	3.49	3.47
	MXM	.37	.39	.35	.35	.16	.21	.32	.31
25 258 601 5	XM	5.11	4.22	4.22	4.44	4.13	3.87	4.34	4.15
	MXM	.39	.43	.43	.34	.20	.28	.34	.41
25 258 601 3	XM	4.00	3.33	3.67	3.44	3.25	3.16	3.46	3.14
	MXM	.37	.53	.29	.47	.17	.22	.33	.33
25 258 601 4	XM	3.78	3.44	3.89	3.56	3.34	3.51	3.14	3.41
	MXM	.36	.53	.39	.47	.17	.27	.30	.33

Table 20/11 – Averages of the evaluations XM and mean errors MXM

		A	B	C	D	AS	BS	CS	DS
25 260 601 0	XM	3.67	3.33	4.00	3.56	3.44	3.40	3.34	3.58
	MXM	.37	.55	.37	.47	.17	.25	.27	.37
25 260 601 1	XM	4.22	3.67	4.33	4.44	3.86	3.65	4.05	3.90
	MXM	.43	.55	.41	.58	.19	.30	.32	.40
25 064 702 1	XM	3.33	3.00	3.33	2.89	2.92	3.34	2.59	2.78
	MXM	.41	.47	.44	.51	.17	.35	.25	.21
25 064 702 2	XM	2.78	2.67	2.67	2.67	2.33	2.59	2.10	2.33
	MXM	.36	.47	.33	.37	.14	.27	.21	.24
25 264 702 1	XM	5.56	4.89	5.67	4.78	4.48	4.64	4.65	4.19
	MXM	.53	.45	.37	.36	.17	.29	.27	.32
25 264 702 2	XM	3.67	3.56	3.44	2.78	3.07	3.23	2.91	3.02
	MXM	.55	.63	.58	.55	.15	.25	.26	.27
25 266 101 2	XM	5.56	5.22	5.44	5.44	5.24	5.29	5.14	5.28
	MXM	.38	.28	.41	.24	.14	.19	.26	.30
25 266 101 5	XM	6.33	5.78	6.67	6.33	6.03	5.85	6.29	6.08
	MXM	.44	.32	.44	.41	.13	.17	.25	.28
25 266 101 3	XM	5.22	5.11	5.67	5.44	4.83	4.97	4.87	4.63
	MXM	.28	.31	.41	.24	.15	.22	.28	.32
25 266 101 4	XM	5.22	5.33	5.00	5.22	4.51	4.53	4.49	4.50
	MXM	.28	.29	.33	.28	.15	.21	.20	.37
25 266 702 0	XM	2.56	1.67	2.56	2.56	1.79	1.93	1.62	1.82
	MXM	.34	.41	.67	.71	.11	.19	.16	.21
25 268 101 0	XM	5.33	4.89	5.11	4.67	4.58	4.71	4.32	4.71
	MXM	.44	.31	.31	.29	.14	.14	.24	.32
25 268 101 1	XM	6.67	6.33	6.78	6.33	5.92	5.78	6.10	5.98
	MXM	.47	.50	.55	.44	.13	.18	.23	.28
25 268 702 0	XM	2.56	2.89	2.00	2.67	1.85	2.10	1.40	2.17
	MXM	.65	.59	.90	.75	.15	.23	.24	.28
25 070 605 0	XM	4.22	4.00	4.11	3.78	3.30	3.51	3.06	3.29
	MXM	.43	.41	.45	.40	.14	.23	.25	.25
25 270 605 0	XM	4.22	4.11	3.11	4.11	3.44	3.62	3.04	3.74
	MXM	.43	.70	.73	.45	.16	.23	.27	.31
25 270 610 1	XM	3.44	3.00	3.22	3.00	3.18	3.00	3.30	3.17
	MXM	.58	.55	.60	.60	.18	.27	.31	.36
25 270 610 2	XM	4.67	3.78	4.22	4.22	3.93	3.80	4.02	3.94
	MXM	.50	.55	.70	.55	.16	.26	.29	.32
25 270 610 3	XM	4.00	3.33	3.11	2.89	3.40	3.18	3.57	3.39
	MXM	.44	.47	.54	.65	.17	.26	.28	.34
25 072 605 0	XM	5.22	4.67	4.22	4.56	4.65	4.21	4.88	4.71
	MXM	.32	.29	.43	.34	.17	.27	.29	.32
25 072 605 2	XM	5.56	5.33	5.00	4.78	4.65	4.28	4.76	4.74
	MXM	.47	.62	.60	.46	.19	.37	.33	.30
25 272 411 9	XM	2.56	2.00	2.22	2.22	2.13	2.23	1.86	2.33
	MXM	.77	.55	.72	.70	.15	.25	.24	.29
25 272 605 0	XM	6.00	6.00	5.78	5.67	5.26	5.25	5.19	5.34
	MXM	.55	.53	.49	.53	.17	.30	.31	.29

Table 20/12 – Averages of the evaluations XM and mean errors MXM

		A	B	C	D	AS	BS	CS	DS
25 272 605 2	XM	7.22	6.89	6.89	6.22	6.00	5.76	5.83	6.35
	MXM	.43	.63	.65	.46	.19	.33	.38	.25
25 272 611 1	XM	4.56	4.11	4.11	3.78	4.33	4.07	4.44	4.44
	MXM	.44	.51	.48	.83	.17	.29	.29	.31
25 272 611 2	XM	5.56	5.00	5.00	4.00	5.19	4.59	5.42	5.40
	MXM	.56	.62	.50	.94	.18	.30	.27	.31
25 272 611 3	XM	7.11	6.22	6.33	5.56	6.37	5.59	6.85	6.60
	MXM	.54	.60	.80	.82	.19	.27	.30	.30
25 272 611 9	XM	4.89	4.56	4.33	4.44	4.63	4.21	4.76	4.89
	MXM	.45	.65	.62	.67	.16	.22	.29	.29
25 074 607 0	XM	3.44	3.11	2.56	2.78	2.86	3.03	2.54	3.06
	MXM	.50	.51	.53	.60	.16	.26	.28	.31
25 274 607 0	XM	2.44	2.11	1.67	1.89	1.99	2.32	1.64	2.14
	MXM	.58	.65	.50	.45	.15	.28	.21	.28
25 274 610 0	XM	4.11	3.33	2.89	3.56	3.15	3.24	2.88	3.36
	MXM	.45	.65	.65	.47	.19	.32	.25	.41
25 076 607 2	XM	6.00	5.67	5.56	5.67	5.03	5.14	5.07	4.91
	MXM	.37	.50	.34	.58	.15	.31	.28	.24
25 076 607 3	XM	6.00	5.33	5.44	5.78	4.86	4.81	4.79	5.00
	MXM	.37	.50	.53	.60	.14	.18	.27	.30
25 276 607 2	XM	6.56	5.67	5.33	5.89	4.86	4.83	4.45	5.20
	MXM	.44	.41	.50	.56	.18	.32	.29	.30
25 276 607 3	XM	5.78	5.00	5.22	5.67	5.12	4.77	4.47	5.62
	MXM	.43	.37	.60	.67	.16	.28	.25	.21
25 276 610 0	XM	4.67	4.00	4.22	4.22	3.72	3.70	3.11	4.21
	MXM	.50	.37	.57	.64	.18	.32	.24	.27
25 080 703 0	XM	5.11	4.89	4.56	5.00	4.88	5.21	4.55	4.84
	MXM	.59	.70	.75	.75	.17	.37	.28	.25
25 280 703 0	XM	5.11	5.11	4.44	4.89	4.86	5.20	4.29	4.95
	MXM	.59	.68	.73	.70	.17	.35	.25	.23
25 082 703 0	XM	3.89	4.00	3.89	3.78	3.53	3.78	3.19	3.62
	MXM	.48	.58	.68	.68	.18	.35	.31	.27
25 082 807 0	XM	4.33	4.22	3.67	4.67	3.66	3.87	3.13	4.12
	MXM	.44	.49	.67	.69	.17	.26	.28	.29
25 282 701 2	XM	3.78	3.67	3.78	3.78	3.99	3.91	4.01	4.02
	MXM	.55	.58	.72	.76	.14	.23	.25	.25
25 282 701 5	XM	5.33	4.89	5.22	5.11	4.73	4.53	4.61	5.06
	MXM	.33	.56	.49	.72	.16	.25	.30	.27
25 282 701 3	XM	3.78	3.67	3.89	3.89	3.92	3.84	4.12	3.70
	MXM	.55	.58	.73	.72	.15	.25	.29	.23
25 282 701 4	XM	3.67	3.67	3.78	3.89	3.84	3.76	4.01	3.70
	MXM	.58	.58	.76	.79	.14	.24	.27	.24
25 282 703 0	XM	3.67	3.56	2.89	3.67	3.12	3.50	2.76	3.22
	MXM	.53	.47	.45	.62	.18	.30	.25	.34
25 282 807 0	XM	3.67	3.44	3.22	3.56	3.16	3.52	2.67	3.30
	MXM	.44	.63	.57	.63	.17	.31	.25	.29

Table 20/13 – Averages of the evaluations XM and mean errors MXM

		A	B	C	D	AS	BS	CS	DS
25 084 703 0	XM	5.11	4.78	4.67	5.22	4.49	4.59	4.19	4.63
	MXM	.45	.46	.44	.64	.16	.27	.25	.31
25 084 807 2	XM	7.00	7.11	6.44	6.67	6.39	6.09	6.21	6.74
	MXM	.37	.54	.47	.53	.15	.25	.28	.21
25 084 807 3	XM	7.00	6.78	6.56	6.67	6.16	5.90	6.02	6.45
	MXM	.47	.60	.58	.67	.15	.28	.29	.20
25 284 701 0	XM	3.44	3.44	3.56	3.78	3.86	3.70	3.86	4.01
	MXM	.47	.50	.41	.55	.13	.21	.25	.25
25 284 701 1	XM	5.67	5.11	5.11	5.11	5.15	4.35	5.60	5.16
	MXM	.47	.45	.51	.70	.18	.25	.24	.34
25 284 703 0	XM	4.89	4.33	4.22	4.67	3.91	4.10	3.78	3.85
	MXM	.45	.53	.55	.83	.14	.18	.25	.32
25 284 807 2	XM	6.22	6.11	5.11	5.22	4.93	4.99	4.48	5.19
	MXM	.49	.45	.42	.66	.19	.34	.32	.32
25 284 807 3	XM	6.56	6.44	5.33	6.00	5.48	5.60	5.47	5.36
	MXM	.44	.44	.44	.55	.14	.28	.22	.25
25 104 002 0	XM	1.89	2.33	1.33	1.56	1.73	2.36	1.33	1.66
	MXM	.48	.60	.47	.41	.16	.25	.25	.22
25 104 003 0	XM	4.00	4.00	3.89	3.22	3.56	3.94	3.34	3.45
	MXM	.44	.47	.48	.49	.17	.29	.34	.21
25 304 002 0	XM	2.67	2.33	2.11	2.11	2.28	3.01	1.81	2.46
	MXM	.41	.47	.48	.42	.18	.24	.27	.31
25 304 003 0	XM	4.00	4.33	3.22	3.33	3.61	4.32	3.12	3.31
	MXM	.41	.37	.43	.44	.18	.25	.24	.34
25 106 002 0	XM	2.00	2.00	1.89	1.67	1.97	2.48	2.02	1.57
	MXM	.44	.44	.51	.55	.16	.25	.27	.24
25 106 003 0	XM	3.33	2.89	2.89	3.00	2.92	3.26	2.57	3.02
	MXM	.65	.54	.65	.50	.14	.25	.25	.20
25 306 002 0	XM	3.11	2.89	2.89	2.89	3.05	3.72	2.46	2.91
	MXM	.65	.70	.51	.51	.19	.29	.28	.28
25 306 003 0	XM	3.56	3.67	2.33	3.22	3.03	3.50	2.45	3.01
	MXM	.73	.62	.58	.49	.17	.27	.20	.33
25 108 002 0	XM	2.11	2.00	2.33	2.00	2.00	2.39	1.91	1.81
	MXM	.42	.44	.60	.50	.14	.24	.23	.28
25 108 003 1	XM	3.78	3.56	3.78	3.33	3.20	3.41	3.02	3.21
	MXM	.68	.50	.49	.60	.15	.24	,32	.20
25 108 003 2	XM	2.89	3.11	2.89	2.56	2.86	3.31	2.48	2.91
	MXM	.56	.48	.45	.34	.16	.26	.28	.21
25 308 002 0	XM	3.33	2.89	2.89	2.89	3.28	3.72	2.96	3.14
	MXM	.44	.56	.31	.45	.18	.33	.24	.34
25 308 003 1	XM	5.00	3.89	4.56	4.22	3.60	3.91	3.19	3.63
	MXM	.69	.51	.71	.66	.14	.21	.24	.27
25 308 003 2	XM	4.44	3.56	3.89	4.33	3.44	3.86	2.93	3.42
	MXM	.63	.58	.70	.67	.15	.21	.22	.27
25 310 510 1	XM	3.00	2.67	3.33	3.22	2.86	2.59	3.14	2.86
	MXM	.29	.29	.33	.49	.17	.25	.28	.35

Table 20/14 – Averages of the evaluations XM and mean errors MXM

		A	B	C	D	AS	BS	CS	DS
25 310 510 2	XM	4.56	4.22	4.89	3.89	4.18	4.09	4.30	4.12
	MXM	.41	.49	.35	.48	.15	.31	.25	.26
25 310 510 3	XM	4.67	4.22	5.00	4.00	4.15	4.23	4.14	4.08
	MXM	.37	.40	.33	.47	.17	.32	.23	.34
25 314 510 0	XM	4.33	3.78	3.67	3.67	3.50	3.49	3.32	3.66
	MXM	.67	.66	.44	.50	.17	.24	.30	.33
25 316 510 0	XM	4.00	4.00	4.11	3.89	3.44	3.64	3.12	3.62
	MXM	.44	.55	.39	.39	.16	.24	.22	.35
25 406 607 0	XM	2.67	2.44	2.33	2.78	2.04	2.37	1.60	2.37
	MXM	.44	.50	.41	.49	.18	.37	.23	.28
25 606 607 0	XM	2.78	2.56	2.00	2.67	1.89	2.44	1.35	2.23
	MXM	.32	.41	.44	.50	.17	.34	.21	.22
25 408 607 2	XM	5.11	4.56	3.89	4.11	3.52	3.78	3.16	3.65
	MXM	.35	.41	.31	.42	.16	.26	.30	.26
25 408 607 3	XM	5.00	4.44	4.22	4.11	3.67	3.73	3.32	4.00
	MXM	.29	.34	.36	.35	.16	.24	.31	.26
25 608 607 2	XM	4.67	4.78	3.78	4.22	3.30	3.67	2.73	3.67
	MXM	.33	.40	.40	.46	.17	.32	.28	.21
25 608 607 3	XM	4.67	4.22	3.78	4.33	3.14	3.27	2.53	3.75
	MXM	.29	.43	.43	.29	.18	.30	.28	.26

Table 21 – Example: computation of the F-values

		A	B	C	D	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
10	XGM	2.15	2.20	3.25	2.30	.65	.00	.30	4.00	5.60	5.35	.70	5.40	3.10	2.05	3.05	.70	2.05	2.80	5.20	3.75	2.55
	MGM	.75	.80	.45	.70	.25	.00	.00	.50	.50	.55	.10	.10	.40	.25	.45	.50	1.25	2.00	.20	.15	.05
	MXR	1.06	1.13	.64	.99	.35	.00	.00	.71	.71	.78	.14	.14	.57	.35	.64	.71	1.77	2.83	.28	.21	.07
	F	11.71	7.11	1.67	5.13	.97	.00	.00	2.09	1.03	1.50	.11	.04	1.42	.45	1.98	8.04	20.31	38.71	.29	.11	.01
212		AS	BS	CS	DS	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
	XGM	2.47	1.34	4.46	2.51	4.10	2.90	4.00	4.35	4.25	4.65	1.70	4.15	4.00	4.45	4.95	5.45	4.70	4.75	5.65	3.35	
	MGM	.47	.10	.22	1.05	.40	2.20	.50	.05	.15	.05	.60	.75	.80	.25	.75	.85	.10	.35	.05	.05	
	MXR	.67	.14	.31	1.49	.57	3.11	.71	.07	.21	.07	.85	1.06	1.13	.35	1.06	1.20	.14	.49	.07	.07	
	F					1.05	40.52	1.03	.02	.28	.01	2.36	5.43	4.17	.28	3.28	4.30	.16	1.89	.03	.01	

$F_z = 8{,}29$

Z - 1 = 1 Z6(ZA2 - 1) = 18

		A	B	C	D	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
10	XGM	2.60	2.43	3.20	2.77	.90	.00	.43	4.50	5.10	5.07	1.20	5.30	3.20	2.23	2.90	1.20	2.53	3.47	5.17	3.33	2.43
	MGM	.62	.52	.26	.62	.29	.00	.13	.58	.58	.43	.50	.12	.25	.23	.30	.58	.87	1.33	.12	.43	.12
	MXR	1.08	.90	.46	1.07	.50	.00	.23	1.00	1.00	.74	.87	.20	.44	.40	.52	1.00	1.50	2.31	.21	.74	.21
	F	9.35	3.43	.74	5.46	1.54	.00	.79	4.25	2.31	1.37	3.56	.09	.63	.55	1.48	6.03	12.68	27.27	.15	1.39	.10
12 212		AS	BS	CS	DS	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
	XGM	2.72	1.52	4.43	2.97	4.00	3.57	4.07	3.90	4.13	4.73	2.30	4.23	4.10	4.13	5.17	5.33	4.53	4.27	5.47	3.53	
	MGM	.37	.19	.13	.76	.25	1.43	.30	.45	.15	.09	.69	.44	.47	.35	.48	.50	.18	.52	.19	.19	
	MXR	.63	.34	.22	1.32	.44	2.48	.51	.78	.25	.15	1.20	.76	.82	.60	.84	.87	.31	.91	.32	.32	
	F					.73	50.92	.60	2.34	.33	.05	5.59	2.93	2.34	.86	2.02	2.47	.53	3.87	.71	.28	

$F_s = 3{,}49$

Z - 1 = 2 Z6(ZA2 - 1) = 27

The example shows the caiculated F-values for the reproduction group 10212 and for the pooled reproduction groups 10012-10212; rimed figures exceed the tabulated F-values.

Table 22

Method of reprod.	Paper type	Scale	Number of Reproductions	Screen type	Comparison of screen type for 60l/cm — Evaluation A	B	C	D	AS	BS	CS	DS
Diazo copies	line tone paper	5000	2	Gq	4,7	4,2	4,3	5,3	4,3	3,9	4,9	4,5
			1	Mq	4,9	4,8	3,6	4,9	4,2	4,9	4,2	3,7
			6	Me	5,3	4,7	4,9	5,9	4,3	3,7	5,9	4,1
		10000	2	Gq	4,3	4,1	4,4	3,9	3,2	3,1	3,6	3,0
			1	Mq	4,1	3,7	4,0	4,1	3,6	2,8	4,1	3,0
			5	Me	4,6	4,4	4,6	4,5	3,3	2,6	4,0	3,4
		25000	2	Gq	3,3	3,2	2,6	2,8	2,5	2,7	2,2	2,5
			-	Mq	.	.	.	.	.	.	.	.
			5	Me	4,1	3,6	3,6	3,6	3,5	3,4	3,4	3,5
	Contrast paper	5000	-	Gq	.	.	.	.	.	.	.	.
			1	Mq	5,3	5,6	5,3	5,8	5,5	5,2	5,8	5,4
			6	Me	6,6	6,8	5,9	6,9	6,4	6,0	6,8	6,2
		10000	-	Gq	.	.	.	.	.	.	.	.
			1	Mq	6,2	5,8	5,8	6,3	5,5	5,0	5,8	5,6
			6	Me	6,4	6,3	6,5	6,3	5,6	5,1	6,0	5,5
Offset prints	Map printing paper	5000	2	Gq	4,4	3,8	2,8	4,5	3,7	4,2	3,0	3,8
			1	Mq	4,0	4,1	2,4	4,4	4,6	5,6	3,5	3,7
			1	Me	4,1	3,8	2,9	4,5	2,9	2,9	3,3	2,5
		10000	2	Gq	3,5	3,5	3,1	3,0	2,2	2,0	2,7	2,0
			1	Mq	3,8	3,9	3,5	4,0	3,8	3,7	4,0	3,7
			4	Me	4,1	4,1	3,7	4,1	3,1	2,9	3,3	3,0
		25000	2	Gq	2,2	2,0	1,5	2,1	1,7	2,0	1,5	1,8
			4	Mq	4,2	3,7	4,0	3,6	3,6	3,5	3,6	3,5
			3	Me	3,3	2,9	2,4	2,7	2,7	2,9	2,4	2,9
	Art type offset paper	5000	2	Gq	4,4	4,5	3,6	4,5	3,9	4,1	3,6	4,1
			1	Mq	5,5	5,3	4,1	5,1	4,8	5,6	4,3	4,3
			1	Me	4,6	4,3	3,1	4,8	3,9	3,7	3,3	3,8
		10000	2	Gq	4,1*)	4,0	3,7	3,6*)	2,8	2,8	3,3	2,3
			1	Mq	5,2	4,9	4,6	5,4	4,3	4,3	4,5	3,9
			6	Me	6,0*)	5,7*)	5,5*)	5,9*)	4,6	4,0	5,1	4,5
		25000	2	Gq	2,7	2,8	2,5	2,3	2,3	2,6	2,1	2,4
			2	Mq	4,0	3,5	4,2	4,0	3,7	3,5	3,7	3,7
			5	Me	5,8	5,1	5,2	5,5	4,7	4,7	4,4	5,0

G = grey screen M = magenta screen q = quadr. dot e = ellipt. dot

No significant differentiated evaluation of the seperate reproductions (based on F = test, level of significance 1%) is made. A recapitulation of a group of reproductions is acceptable.

*) The formation of groups of the questioning is not quite acceptable because of the lange differentation of the seperate evaluations (strong deviation of the acceptable fractions of the evaluations).

Table 23

Method of reprod.	Paper type	Scale	Number of Reproductions	Screen type l/cm	Comparison of screen ruling for magenta screen with elliptical dot — Evaluation A	B	C	D	AS	BS	CS	DS
Diazo copies	Line tone p.	5000	1	60	4,9	4,8	3,6	4,9	4,2	4,5	4,2	3,7
			–	70	.	.	.	.	.	.	.	.
			1	80	3,6	3,9	2,1	3,8	3,2	4,9	3,0	2,1
		10000	1	60	4,1	3,7	4,0	4,1	3,6	2,8	4,1	3,0
			–	70	.	.	.	.	.	.	.	.
			3	80	3,4	3,1	3,6*)	3,5	2,4	1,6	3,5	3,2
	Contrast paper	5000	3	54	5,4	5,6	5,0	5,5	5,4	5,2	5,5	5,2
			1	60	5,3	5,6	5,3	5,8	5,5	5,2	5,8	5,4
			4	70	4,9	4,4	5,2	5,7	4,5	4,1	5,7	4,3
			1	80	6,6	6,4	5,4	6,6	6,2	6,6	5,7	6,2
		10000	1	60	6,2	5,8	5,8	6,3	5,5	5,0	5,8	5,6
			4	70	5,5	5,4	5,6	5,3	4,8	4,2	5,3	4,8
			4	80	5,7	5,8	5,5	5,4	4,8	4,9	5,1	4,6
Offset prints	Map printing paper	5000	1	60	4,0	4,1	2,4	4,4	4,6	5,6	3,5	3,7
			2	70	2,9	2,8	4,3	3,1	2,2	1,2	4,4	2,3
			1	80	1,3	1,9	0,1	1,3	0,5	0,6	0,4	0,4
		10000	1	60	3,8	3,9	3,5	4,0	3,8	3,7	4,0	3,7
			2	70	2,4	1,9	2,9	2,5	1,6	0,6	3,2	2,6
			1	80	1.6	1,8	1,6	1,1	1,1	1,1	1,1	1,0
		25000	4	60	4,2	3,7	4,0	3,6	3,6	3,5	3,6	3,5
			1	70	2,6	1,7	2,6	2,6	1,8	1,9	1,6	1,8
			–	80	.	.	.	.	.	.	.	.
			4	100	5,6	5,4	5,7	5,6	5,2	5,2	5,2	5,1
	Art type offset paper	5000	1	60	5,5	5,3	4,1	5,1	4,8	5,6	4,3	4,3
			2	70	3,6	3,2	4,3	4,5	3,2	1,9	5,3	3,0
			1	80	2,4	2,8	1,1	2,1	0,9	0,8	0,9	1,2
		10000	1	60	5,2	4,9	4,6	5,4	4,3	4,3	4,5	3,9
			2	70	3,7	3,0	4,2	3,9	3,3	2,0	4,0	3,9
			1	80	2,2	3,0	1,4	1,9	2,3	3,1	1,9	2,2
		25000	2	60	4,0	3,5	4,2	4,0	3,7	3,5	3,7	3,7
			1	70	2,6	2,9	2,0	2,7	1,9	2,1	1,4	2,2
			–	80	.	.	.	.	.	.	.	.
			2	100	6,0	5,6	6,0	5,5*)	5,3	5,3	5,2	5,4

No significant differentiated evaluation of the seperate reproductions (based on F = test, level of significance 1%) is made. A recapitulation of a group of reproductions is acceptable.

*) The formation of groups of the questioning is not quite acceptable because of the lange differentation of the seperate evaluations (strong deviation of the acceptable fractions of the evaluations).

Table 24

Method of reprod.	Paper type	Scale	Number of Reproductions	Screen type	Comparison of screen ruling for magenta screen with elliptical dot — Evaluation A	B	C	D	AS	BS	CS	DS
Diazo copies	Line tone p.	5000	6	60	5,3	4,7	4,9	5,9	4,3	3,7	5,9	4,1
			–	70	.	.	.	.	.	.	.	.
			1	80	5,5	4,4	4,8	6,4	5,0	3,1	6,4	5,5
	Contrast paper	5000	1	48	6,0	5,9	6,5	6,3	5,9	4,2	7,0	5,8
			6	60	6,6	6,8	5,9	6,9	6,4	6,0	6,8	6,2
			3	70	6,3	6,2	5,3	6,7	5,8	6,3	5,4	5,7
			1	80	5,4	4,6	4,5	6,1	5,2	3,5	6,4	6,0
		10000	2	48	4,8	4,7	5,2	5,2	4,0	2,7	5,1	4,4
			6	60	6,4	6,3	6,5	6,3	5,6	5,1	6,0	5,5
			2	70	6,2	6,0	5,6	5,9	5,5	5,8	5,6	5,2
		25000	1	48	2,6	2,0	2,2	2,2	2,1	2,2	1,9	2,3
			8	60	5,8*)	5,4	5,2	4,9	5,1	4,8	5,3	5,3
			2	70	5,1	5,0	4,5	5,0	4,9	5,2	4,4	4,9
Offset prints	Map printing paper	5000	1	60	4,1	3,8	2,9	4,5	2,9	2,9	3,3	2,5
			2	70	4,3	4,0	2,8	4,0	2,9	3,5	2,8	2,5
			–	80	.	.	.	.	.	.	.	.
		10000	4	60	4,1	4,1	3,7	4,2	3,1	2,9	3,3	3,0
			2	70	4,3	4,5	3,7	4,1	3,2	3,4	3,4	2,9
			2	80	4,3	4,4	4,2	4,2	3,3	3,3	3,6	3,2
		25000	3	60	3,3	2,9	2,4	2,7	2,7	2,9	2,4	2,9
			6	70	4,0	3,9	3,9	4,0	3,9	3,9	3,8	3,9
			2	80	4,0	3,8	3,5	4,1	3,4	3,7	2,9	3,7
	Art type offset paper	5000	1	60	4,6	4,3	3,1	4,8	3,9	3,7	3,3	3,8
			2	70	5,6	5,8	4,3	5,3	4,0	4,7	3,5	3,9
			–	80	.	.	.	.	.	.	.	.
		10000	6	60	6,0*)	5,7*)	5,5*)	5,9*)	4,6	4,0	5,1	4,5
			2	70	5,5	5,5	5,1	5,0	4,4	4,5	4,6	4,0
			4	80	6,6	6,4	6,3	6,2	5,4	5,1	6,0	5,1
		25000	5	60	5,8	5,1	5,2	5,5	4,7	4,7	4,4	5,0
			4	70	4,5	4,4	4,4	4,7	4,4	4,2	4,4	4,4
			4	80	6,7	6,6	5,9	6,1	5,7	5,7	5,6	5,9

No significant differentiated evaluation of the seperate reproductions (based on F = test, level of significance 1%) is made. A recapitulation of a group of reproductions is acceptable.

*) The formation of groups of the questioning is not quite acceptable because of the lange differentation of the seperate evaluations (strong deviation of the acceptable fractions of the evaluations).

Table 25

	Centre	Scale	Number of comparisons	Comparison of paper types — Evaluation A	B	C	D	AS	BS	CS	DS
				△ – Evaluation contrast paper – line tone paper							
Diazo copies	1	10	4	+1,8	+1,8	+1,5	+1,2	+1,9	+2,6	+1,0	+1,4
	5	5	2	+2,1	+2,3	+2,1	+1,2	+2,4	+2,0	+2,1	+2,8
		10	2	+2,6	+2,3	+2,6	+2,7	+2,2	+2,3	+2,1	+2,2
		25	2	+1,4	+1,3	+1,4	+1,2	+1,6	+1,2	+2,0	+1,5
	7	5	2	-0,2	+0,2	-0,6	+0,6	0,0	0,0	+0,1	+0,5
	9	5	2	+2,8	+2,6	+3,1	+2,8	+3,0	+2,3	+2,8	+3,8
		10	2	+2,6	+2,7	+2,4	+2,8	+2,3	+2,8	+2,2	+2,5
Offset prints				△ – Evaluation offset art type paper – map printing paper							
	1	25	6	-0,1	0,0	-0,1	-0,1	-0,1	-0,1	-0,1	+0,2
	2	5	4	+0,5	+0,3	-0,1	+0,6	+0,4	+0,3	+0,6	+0,5
		10	4	+0,6	+0,6	+0,9	+0,6	+0,9	+0,9	+0,4	+0,8
		25	3	+0,1	+0,6	+0,2	-0,1	+0,1	0,0	+0,1	+0,3
	3	5	4	+1,3	+1,3	+1,3	+1,0	+0,9	+1,2	+0,8	+0,9
		10	3	+1,3	+1,2	+1,6	+0,9	+1,4	+1,0	+2,3	+1,2
		25	4	+1,1	+0,6	+1,3	+0,9	+0,7	+0,5	+0,8	+0,6
	7	10	6	+2,4	+2,1	+2,4	+2,1	+2,0	+1,7	+2,4	+1,8
		25	6	+2,7	+2,7	+2,4	+2,2	+2,1	+1,8	+2,2	+2,0
	9	5	2	+1,3	+1,0	+1,4	+0,8	+1,1	+1,1	+0,8	+1,2
		10	2	+1,0	+1,1	+0,7	+0,9	+0,9	+1,3	+0,7	+0,7
	10	5	4	+0,3	+0,5	+0,7	+0,3	+0,4	+0,3	+0,6	+0,2
		10	5	+0,5	+0,5	+0,6	+0,6	+0,7	+0,8	+0,7	+0,5
		25	4	+0,3	+0,6	+0,9	+0,4	+0,5	+0,5	+0,3	+0,5

LIST OF THE OEEPE PUBLICATIONS

State — August 1985

A. Official publications

1 *Trombetti, C.:* „Activité de la Commission A de l'OEEPE de 1960 à 1964" — *Cunietti, M.:* „Activité de la Commission B de l'OEEPE pendant la période septembre 1960—janvier 1964" — *Förstner, R.:* „Rapport sur les travaux et les résultats de la Commission C de l'OEEPE (1960—1964)" — *Neumaier, K.:* „Rapport de la Commission E pour Lisbonne" — *Weele, A.J. v. d.:* „Report of Commission F." — Frankfurt a. M. 1964, 50 pages with 7 tables and 9 annexes.

2 *Neumaier, K.:* „Essais d'interprétation de »Bedford« et de »Waterbury«. Rapport commun établi par les Centres de la Commission E de l'OEEPE ayant participé aux tests" — „The Interpretation Tests of »Bedford« and »Waterbury«. Common Report Established by all Participating Centres of Commission E of OEEPE" — „Essais de restitution »Bloc Suisse«. Rapport commun établi par les Centres de la Commission E de l'OEEPE ayant participé aux tests" — „Test »Schweizer Block«. Joint Report of all Centres of Commission E of OEEPE." — Frankfurt a. M. 1966, 60 pages with 44 annexes.

3 *Cunietti, M.:* „Emploi des blocs de bandes pour la cartographie à grande échelle — Résultats des recherches expérimentales organisées par la Commission B de l'O.E.E.P.E. au cours de la période 1959—1966" — „Use of Strips Connected to Blocks for Large Scale Mapping — Results of Experimental Research Organized by Commission B of the O.E.E.P.E. from 1959 through 1966." — Frankfurt a. M. 1968, 157 pages with 50 figures and 24 tables.

4 *Förstner, R.:* „Sur la précision de mesures photogrammétriques de coordonnées en terrain montagneux. Rapport sur les résultats de l'essai de Reichenbach de la Commission C de l'OEEPE" — „The Accuracy of Photogrammetric Co-ordinate Measurements in Mountainous Terrain. Report on the Results of the Reichenbach Test Commission C of the OEEPE." — Frankfurt a. M. 1968, Part I: 145 pages with 9 figures; Part II: 23 pages with 65 tables.

5 *Trombetti, C.:* „Les recherches expérimentales exécutées sur de longues bandes par la Commission A de l'OEEPE." — Frankfurt a. M. 1972, 41 pages with 1 figure, 2 tables, 96 annexes and 19 plates.

6 *Neumaier, K.:* „Essai d'interprétation. Rapports des Centres de la Commission E de l'OEEPE." — Frankfurt a. M. 1972, 38 pages with 12 tables and 5 annexes.

7 *Wiser, P.:* „Etude expérimentale de l'aérotriangulation semi-analytique. Rapport sur l'essai »Gramastetten«." — Frankfurt a. M. 1972, 36 pages with 6 figures and 8 tables.

8 „Proceedings of the OEEPE Symposium on Experimental Research on Accuracy of Aerial Triangulation (Results of Oberschwaben Tests)"
Ackermann, F.: „On Statistical Investigation into the Accuracy of Aerial Triangulation. The Test Project Oberschwaben" — „Recherches statistiques sur la précision de l'aérotriangulation. Le champ d'essai Oberschwaben" — *Belzner, H.:* „The Planning. Establishing and Flying of the Test Field Oberschwaben" — *Stark, E.:* Testblock Oberschwaben, Programme I. Results of Strip Adjustments" — *Ackermann, F.:* „Testblock Oberschwaben, Program I. Results of Block-Adjustment by Independent Models" — *Ebner, H.:* Comparison of Different Methods of Block Adjustment" — *Wiser, P.:* „Propositions pour le traitement des erreurs non-accidentelles" — *Camps, F.:* „Résultats obtenus dans le cadre du project Oberschwaben 2A" — *Cunietti, M.; Vanossi, A.:* „Etude statistique expérimentale des erreurs d'enchaînement des photogrammes" — *Kupfer, G.:* „Image Geometry as Obtained from Rheidt Test Area Photography" — *Förstner, R.:* „The Signal-Field of Baustetten. A Short Report" — *Visser, J.; Leberl, F.; Kure, J.:* „OEEPE Oberschwaben Reseau Investigations" — *Bauer, H.:* „Compensation of Systematic Errors by Analytical Block Adjustment with Common Image Deformation Parameters." — Frankfurt a. M. 1973, 350 pages with 119 figures, 68 tables and 1 annex.

9 *Beck, W.:* „The Production of Topographic Maps at 1 : 10,000 by Photogrammetric Methods. — With statistical evaluations, reproductions, style sheet and sample fragments by Landesvermessungsamt Baden-Württemberg, Stuttgart." — Frankfurt a. M. 1976, 89 pages with 10 figures, 20 tables and 20 annexes.

10 „Résultats complémentaires de l'essai d'«Oberriet» de la Commission C de l'OEEPE — Further Results of the Photogrammetric Tests of «Oberriet» of the Commission C of the OEEPE"
Härry, H.: „Mesure de points de terrain non signalisés dans le champ d'essai d'«Oberriet» — Measurements of Non-Signalized Points in the Test Field «Oberriet» (Abstract)" — *Stickler, A.; Waldhäusl, P.:* „Restitution graphique des points et des lignes non signalisés et leur comparaison avec des résultats de mesures sur le terrain dans le champ d'essai d'«Oberriet» — Graphical Plotting of Non-Signalized Points and Lines, and Comparison with Terrestrial Surveys in the Test Field «Oberriet»" — *Förstner, R.:* „Résultats complémentaires des transformations de coordonnées de l'essai d'«Oberriet» de la Commission C de l'OEEPE — Further Results from Co-ordinate Transformations of the Test «Oberriet» of Commission C of the OEEPE" — *Schürer, K.:* „Comparaison des distances d'«Oberriet» — Comparison of Distances of «Oberriet» (Abstract)." — Frankfurt a. M. 1975, 158 pages with 22 figures and 26 tables.

11 „25 années de l'OEEPE"
Verlaine, R.: „25 années d'activité de l'OEEPE" — „25 Years of OEEPE (Summary)" — *Baarda, W.:* „Mathematical Models." — Frankfurt a. M. 1979, 104 pages with 22 figures.

12 *Spiess, E.:* „Revision of 1 : 25,000 Topographic Maps by Photogrammetric Methods." — Frankfurt a. M. 1985, 228 pages with 102 figures and 30 tables.

13 *Timmerman, J.; Roos, P. A.; Schürer, K.; Förstner, R.:* On the Accuracy of Photogrammetric Measurements of Buildings — Report on the Results of the Test "Dordrecht", Carried out by Commission C of the OEEPE. — Frankfurt a. M. 1982, 144 pages with 14 figures and 36 tables.

14 *Thompson, C. N.:* Test of Digitising Methods. — Frankfurt a. M. 1984, 120 pages with 38 figures and 18 tables.

15 *Jaakkola, M.; Brindöpke, W.; Kölbl, O.; Noukka, P.:* Optimal Emulsions for Large-Scale Mapping — Test of "Steinwedel" — Commission C of the OEEPE 1981—84. — Frankfurt a. M. 1985, 102 pages with 53 figures.

16 *Waldhäusl, P.:* Results of the Vienna Test of OEEPE Commission C.— *Kölbl, O.:* Photogrammetric Versus Terrestrial Town Survey. — Frankfurt a. M. 1986, 57 pages with 16 figures, 10 tables and 7 annexes.

B. Special publications

— Special Publications O.E.E.P.E. — Number I

Solaini, L.; Trombetti, C.: Relation sur les travaux préliminaires de la Commission A (Triangulation aérienne aux petites et aux moyennes échelles) de l'Organisation Européenne d'Etudes Photogrammétriques Expérimentales (O.E.E.P.E.). Ière Partie: Programme et organisation du travail. — *Solaini, L.; Belfiore, P.:* Travaux préliminaires de la Commission B de l'Organisation Européenne d'Etudes Photogrammétriques Expérimentales (O.E.E.P.E.) (Triangulations aériennes aux grandes échelles). — *Solaini, L.; Trombetti, C.; Belfiore, P.:* Rapport sur les travaux expérimentaux de triangulation aérienne exécutés par l'Organisation Européenne d'Etudes Photogrammétriques Expérimentales (Commission A et B). — *Lehmann, G.:* Compte rendu des travaux de la Commission C de l'O.E.E.P.E. effectués jusqu'à présent. — *Gotthardt, E.:* O.E.E.P.E. Commission C. Compte-rendu de la restitution à la Technischen Hochschule, Stuttgart, des vols d'essai du groupe I du terrain d'Oberriet. — *Brucklacher, W.:* Compte-rendu du centre «Zeiss-Aerotopograph» sur les restitutions pour la Commission C de l'O.E.E.P.E. (Restitution de la bande de vol, groupe I, vol. No. 5). — *Förstner, R.:* O.E.E.P.E. Commission C. Rapport sur la restitution effectuée dans l'Institut für Angewandte Geodäsie, Francfort sur le Main. Terrain d'essai d'Oberriet les vols No. 1 et 3 (groupe I). — I.T.C., Delft: Commission C, O.E.E.P.E. Déroulement chronologique des observations. — Photogrammetria XII (1955—1956) 3, Amsterdam 1956, pp. 79—199 with 12 figures and 11 tables.

— Publications spéciales de l'O.E.E.P.E. — Numéro II

Solaini, L.; Trombetti, C.: Relations sur les travaux préliminaires de la Commission A (Triangulation aérienne aux petites et aux moyennes échelles) de l'Organisation Européenne d'Etudes Photogrammétriques Expérimentales (O.E.E.P.E.). 2e partie. Prises de vues et points de contrôle. — *Gotthardt, E.:* Rapport sur les premiers résultats de l'essai d'«Oberriet» de la Commission C de l'O.E.E.P.E. — Photogrammetria XV (1958—1959) 3, Amsterdam 1959, pp. 77—148 with 15 figures and 12 tables.

— *Trombetti, C.:* Travaux de prises de vues et préparation sur le terrain effectuées dans le 1958 sur le nouveau polygone italien pour la Commission A de l'OEEPE. — Florence 1959, 16 pages with 109 tables.

— *Trombetti, C.; Fondelli, M.:* Aérotriangulation analogique solaire. — Firence 1961, 111 pages, with 14 figures and 43 tables.

— Publications spéciales de l'O.E.E.P.E. — Numéro III

Solaini, L.; Trombetti, C.: Rapport sur les résultats des travaux d'enchaînement et de compensation exécutés pour la Commission A de l'O. E. E. P. E. jusqu'au mois de Janvier 1960. Tome 1: Tableaux et texte. Tome 2: Atlas. — Photogrammetria XVII (1960—1961) 4, Amsterdam 1961, pp. 119—326 with 69 figures and 18 tables.

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Gigas, E.: „Beitrag zur Geschichte der Europäischen Organisation für photogrammetrische experimentelle Untersuchungen" — *N. N.:* „Vereinbarung über die Gründung einer Europäischen Organisation für photogrammetrische experimentelle Untersuchungen" — „Zusatzprotokoll" — *Gigas, E.:* „Der Sechserausschuß" — *Brucklacher, W.:* „Kurzbericht über die Arbeiten in der Kommission A der OEEPE" — *Cunietti, M.:* „Kurzbericht des Präsidenten der Kommission B über die gegenwärtigen Versuche und Untersuchungen" — *Förstner, R.:* „Kurzbericht über die Arbeiten in der Kommission B der OEEPE" — „Kurzbericht über die Arbeiten in der Kommission C der OEEPE" — *Belzner, H.:* „Kurzbericht über die Arbeiten in der Kommission E der OEEPE" — *Schwidefsky, K.:* „Kurzbericht über die Arbeiten in der Kommission F der OEEPE" — *Meier, H.-K.:* „Kurzbericht über die Tätigkeit der Untergruppe „Numerische Verfahren" in der Kommission F der OEEPE" — *Belzner, H.:* „Versuchsfelder für internationale Versuchs- und Forschungsarbeiten." — Nachr. Kt.- u. Vermesss.-wes., R. V, Nr. 2, Frankfurt a. M. 1962, 41 pages with 3 tables and 7 annexes.

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Annex
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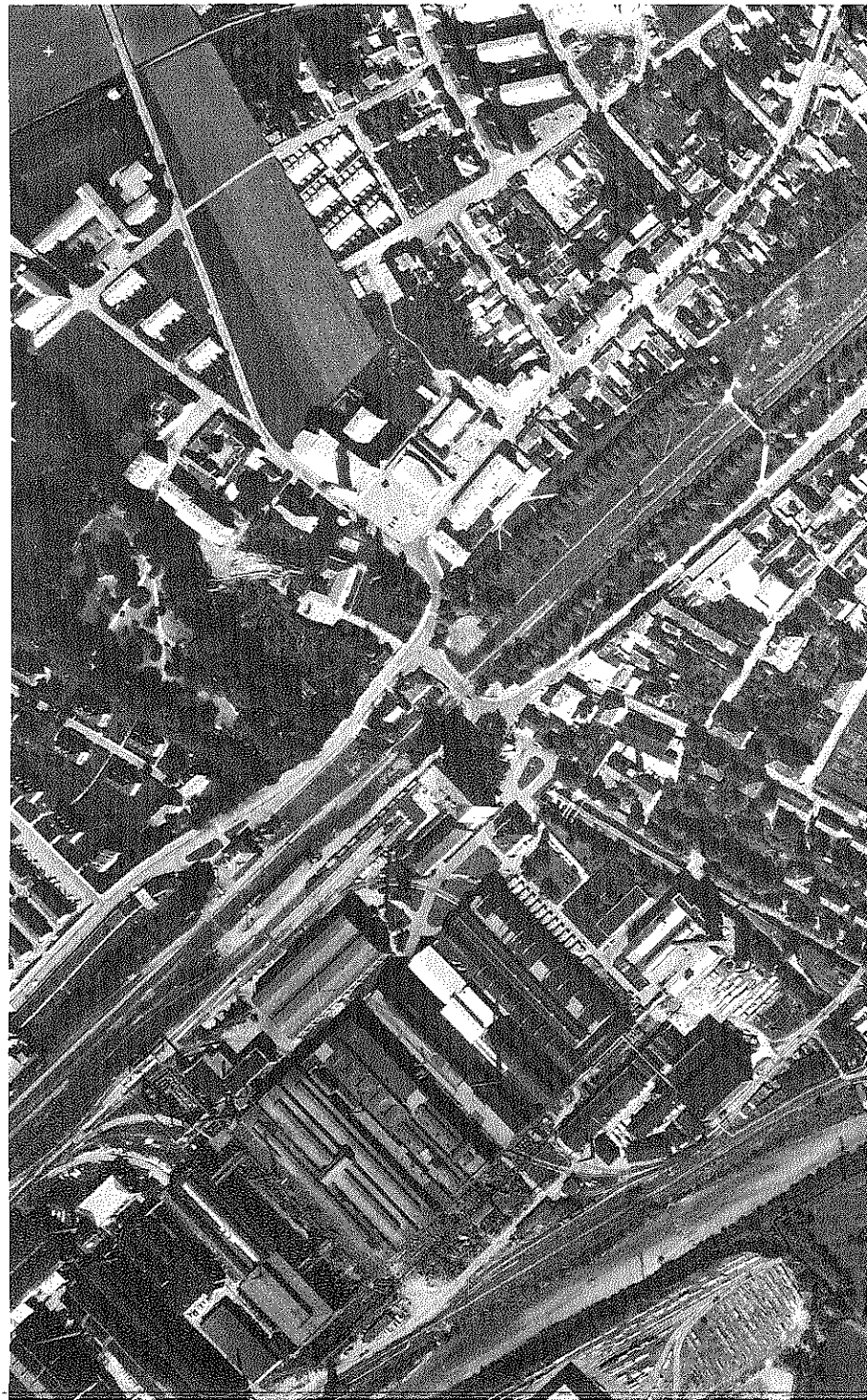

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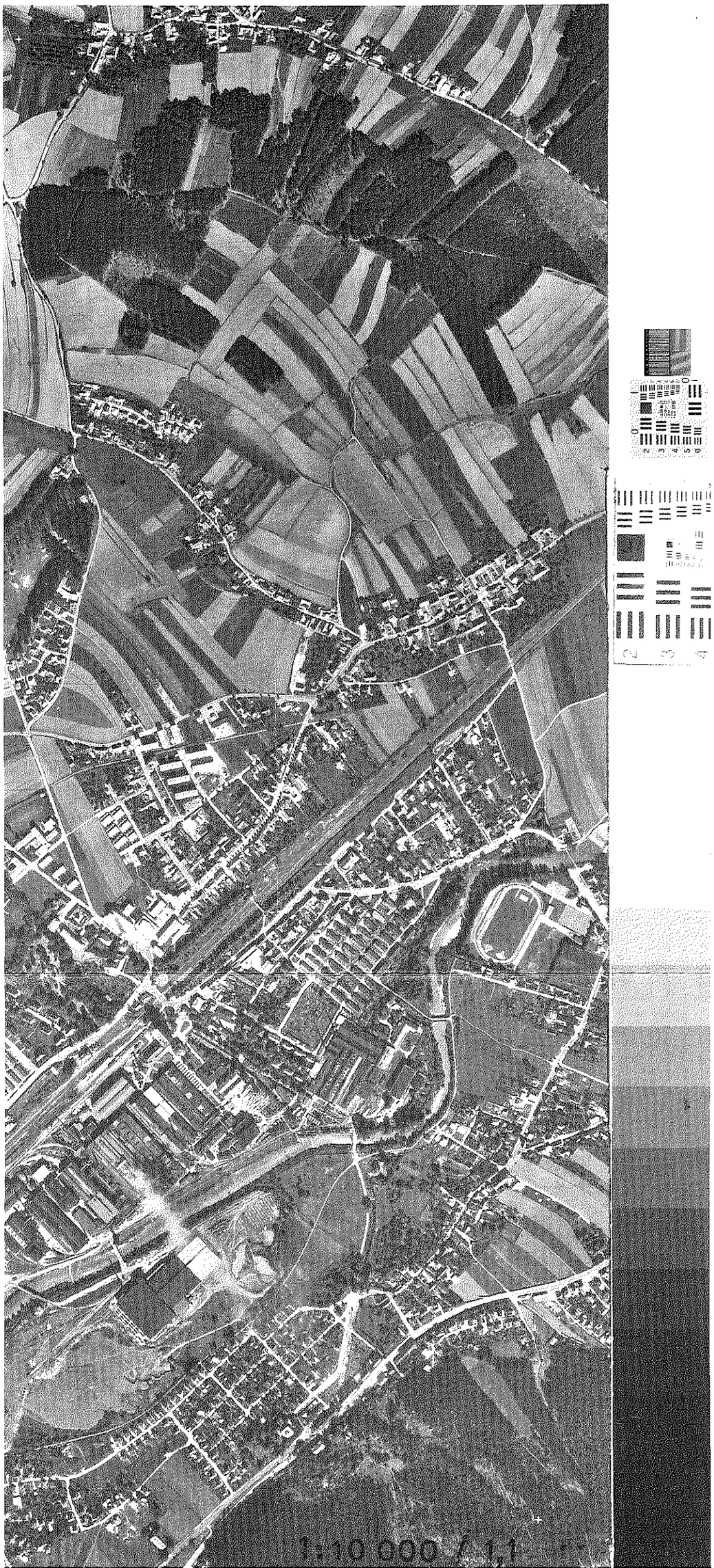

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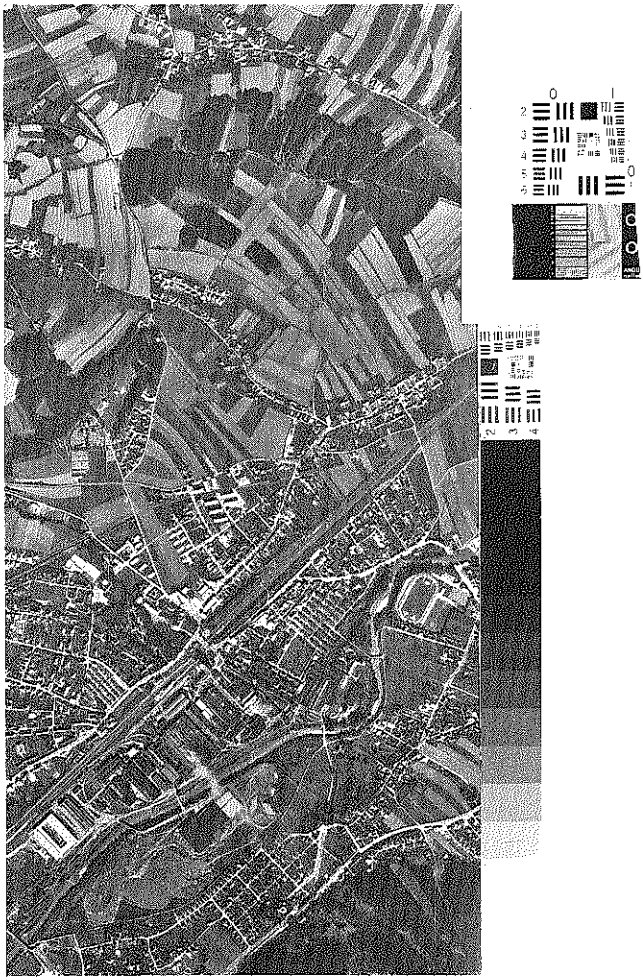

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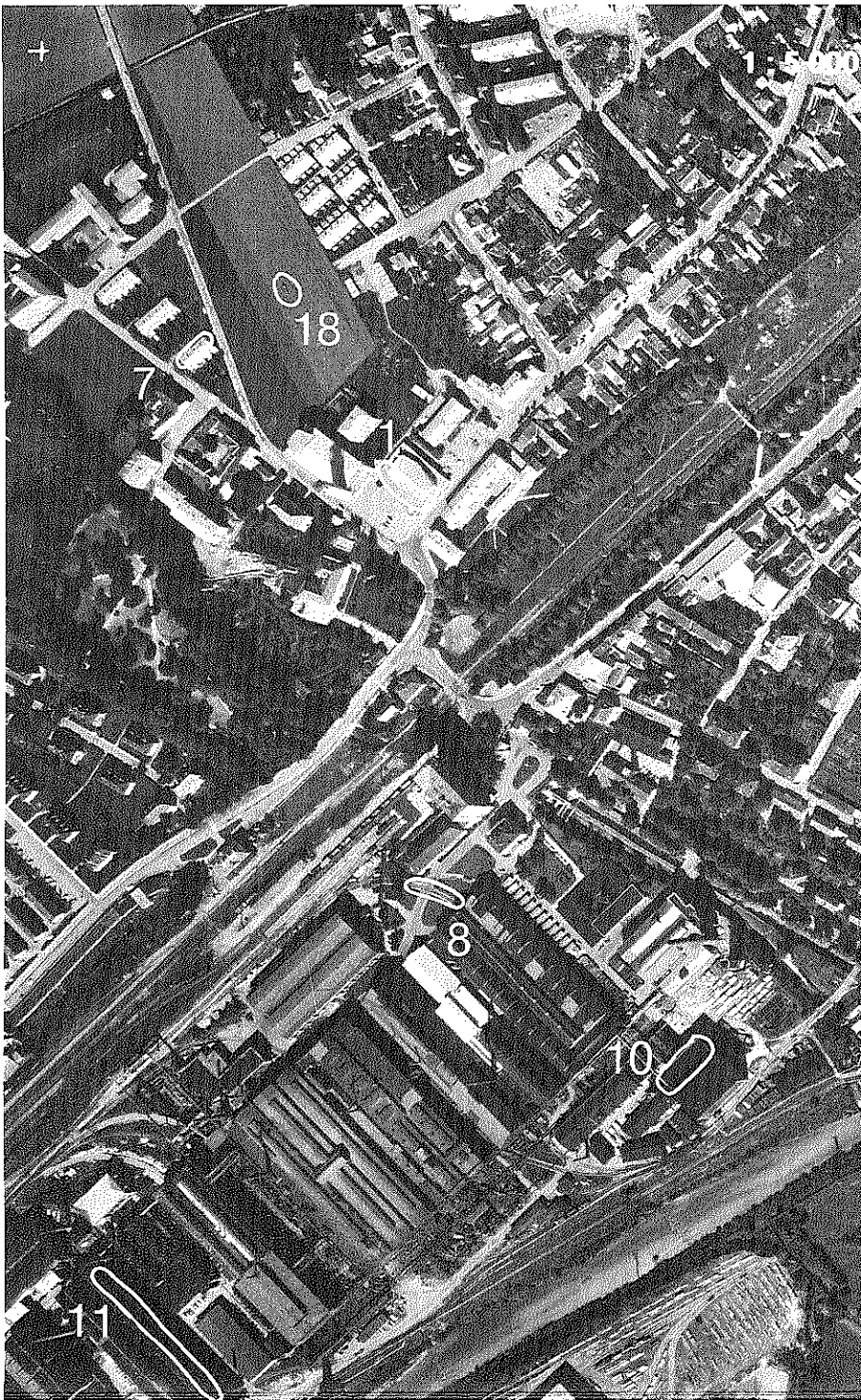
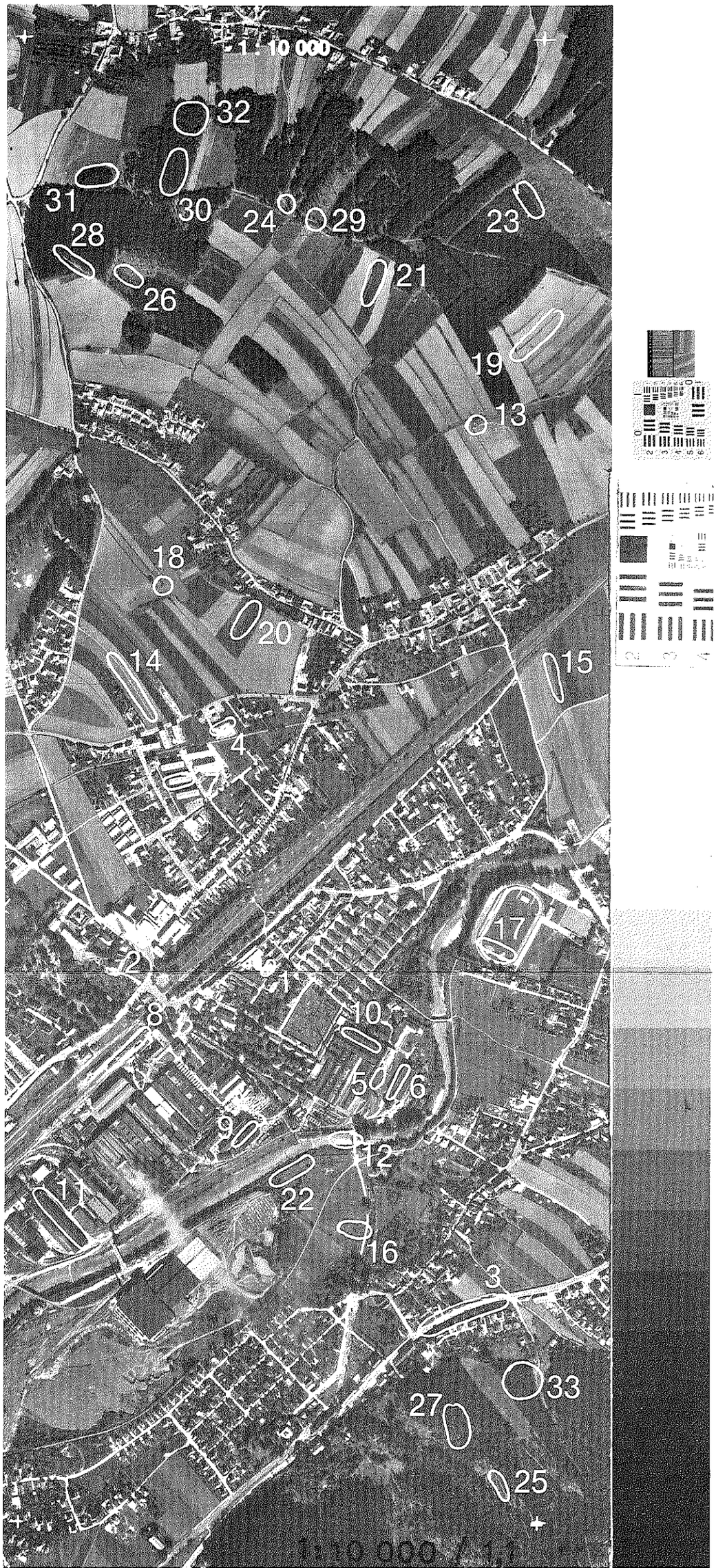
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