

A Journey from Pain to Gain

HeCheck

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Housing Bureau

29 February 2024



Housing Bureau

The Government of the Hong Kong Special Administrative Region
of the People's Republic of China

Presentation Agenda

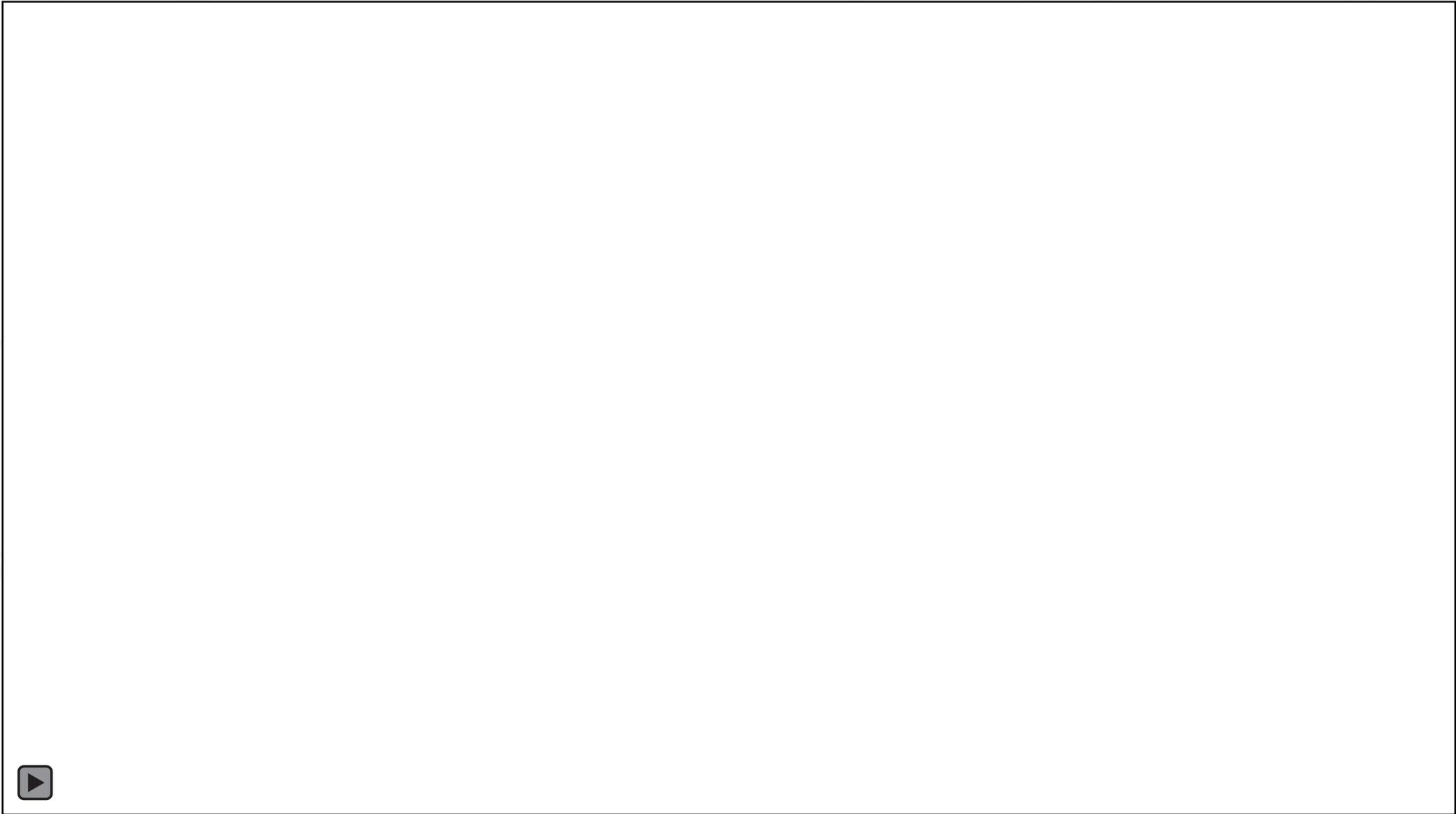
- 1 Introduction
- 2 Technologies Used
- 3 Implementation of HeCheck



1

Introduction

Introduction



Introduction

➤ Evolution of Mobile Phones



1980s



2020+

➤ Evolution of Test Report Checking



Introduction

PAIN POINT

Sheer Volume of Reports

Labour Intensive

Time Consuming

Vulnerable to Human Error



Import Test Results

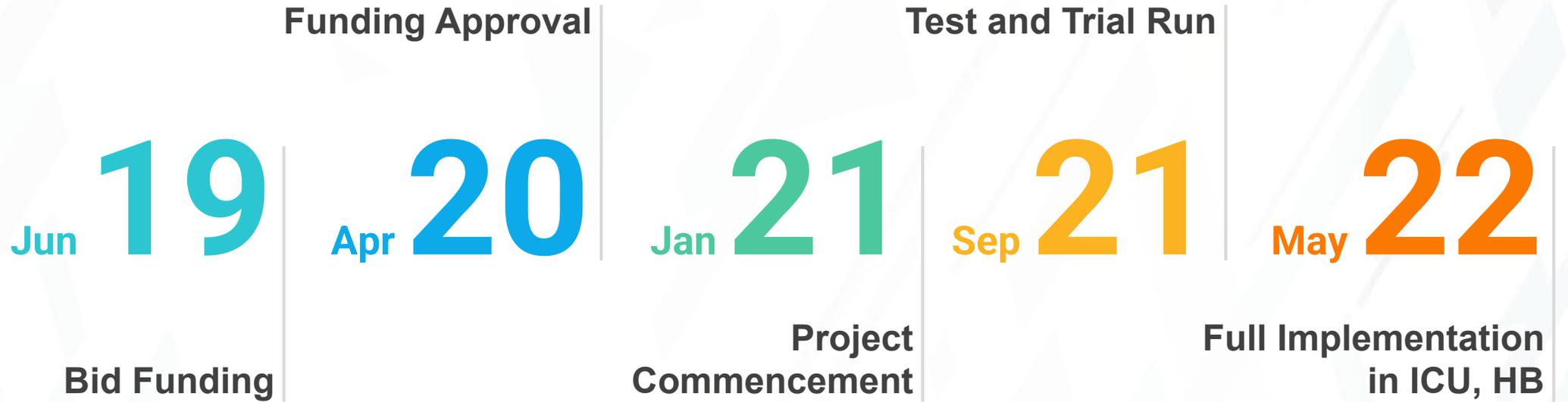


Export Test Results

Sl#	Cubes Mark	Strength (MPa)	Mean (MPa)	SD (MPa)	Dev. (%)	Age of C	Col A	C1	C2	C3
1	HO-001A	HO-001B	55.00	55.00	55.00	—	0.40	—	—	—
2	HO-002A	HO-002B	49.50	49.50	49.50	4.38	0.80	0.20	Y	Y
3	HO-003A	HO-003B	57.50	57.50	57.40	4.24	0.30	54.07	Y	Y
4	HO-004A	HO-004B	54.00	54.70	54.80	3.48	0.40	54.25	Y	Y
5	HO-005A	HO-005B	55.50	55.60	55.45	3.17	0.50	54.49	Y	Y
6	HO-006A	HO-006B	57.40	59.50	58.25	3.19	2.80	56.71	Y	Y
7	HO-007A	HO-007B	58.80	59.80	59.50	3.28	1.70	57.20	Y	Y
8	HO-008A	HO-008B	52.00	55.00	55.00	3.95	0.40	57.28	Y	Y
9	HO-009A	HO-009B	49.00	49.50	49.70	3.50	0.80	55.59	Y	Y
10	HO-010A	HO-010B	50.80	49.20	50.20	3.89	1.40	51.54	Y	Y
11	HO-011A	HO-011B	52.50	54.40	53.50	3.49	3.70	52.09	Y	Y
12	HO-012A	HO-012B	55.40	54.40	54.80	3.33	1.80	52.04	Y	Y
13	HO-013A	HO-013B	52.50	52.50	52.25	3.95	0.50	52.86	Y	Y
14	HO-014A	HO-014B	52.60	51.60	52.50	3.18	1.90	53.19	Y	Y
15	HO-015A	HO-015B	52.60	53.80	53.50	3.97	2.50	53.11	Y	Y
16	HO-016A	HO-016B	55.90	55.90	55.90	3.37	3.30	53.16	Y	Y
17	HO-017A	HO-017B	52.70	52.70	52.70	3.97	2.50	53.96	Y	Y
18	HO-018A	HO-018B	59.70	59.50	59.50	3.11	1.50	55.53	Y	Y
19	HO-019A	HO-019B	57.40	54.50	54.50	3.11	1.50	55.55	Y	Y
20	HO-020A	HO-020B	54.00	52.50	53.50	3.70	3.70	55.13	Y	Y
21	HO-021A	HO-021B	54.70	52.50	53.50	3.10	2.80	54.79	Y	Y
22	HO-022A	HO-022B	54.70	49.70	49.50	3.10	2.70	52.51	Y	Y
23	HO-023A	HO-023B	47.40	49.70	49.50	3.10	2.00	52.51	Y	Y
24	HO-024A	HO-024B	47.40	49.70	49.50	3.10	2.00	52.51	Y	Y
25	HO-025A	HO-025B	51.50	51.50	51.50	3.47	0.00	49.93	Y	Y
26	HO-026A	HO-026B	56.00	56.50	56.60	3.43	3.00	52.29	Y	Y
27	HO-027A	HO-027B	54.00	53.50	54.00	3.37	3.30	51.79	Y	Y
28	HO-028A	HO-028B	54.00	55.50	55.50	3.32	3.50	54.29	Y	Y
29	HO-029A	HO-029B	54.20	54.20	54.20	3.29	1.00	54.29	Y	Y
30	HO-030A	HO-030B	35.00	35.00	35.00	3.44	1.50	45.51	Y	Y
31	HO-031A	HO-031B	35.00	35.00	35.00	3.57	0.50	45.56	Y	Y
32	HO-032A	HO-032B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
33	HO-033A	HO-033B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
34	HO-034A	HO-034B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
35	HO-035A	HO-035B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
36	HO-036A	HO-036B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
37	HO-037A	HO-037B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
38	HO-038A	HO-038B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
39	HO-039A	HO-039B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
40	HO-040A	HO-040B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
41	HO-041A	HO-041B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
42	HO-042A	HO-042B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
43	HO-043A	HO-043B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
44	HO-044A	HO-044B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
45	HO-045A	HO-045B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
46	HO-046A	HO-046B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
47	HO-047A	HO-047B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
48	HO-048A	HO-048B	55.50	55.50	55.50	3.25	1.40	55.54	Y	Y
49	TPP-2002A	TPP-2002B	50.50	49.00	49.00	4.52	0.00	46.79	Y	Y
50	TPP-2003A	TPP-2003B	54.00	51.80	52.80	4.56	4.00	48.50	Y	Y
51	TPP-2004A	TPP-2004B	50.00	48.00	48.00	4.56	6.00	46.14	Y	Y

Doubtful Results

Introduction





2

Technologies

Used

Technologies Used – Hurdles to Overcome

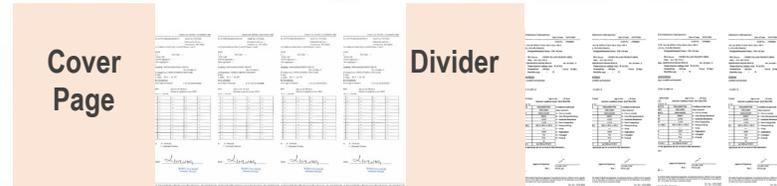


No Precedence Case



Mixed Type of Documents

- Irrelevant Pages
- Different Types of Reports



Different Formats / Description



Accuracy of Extraction

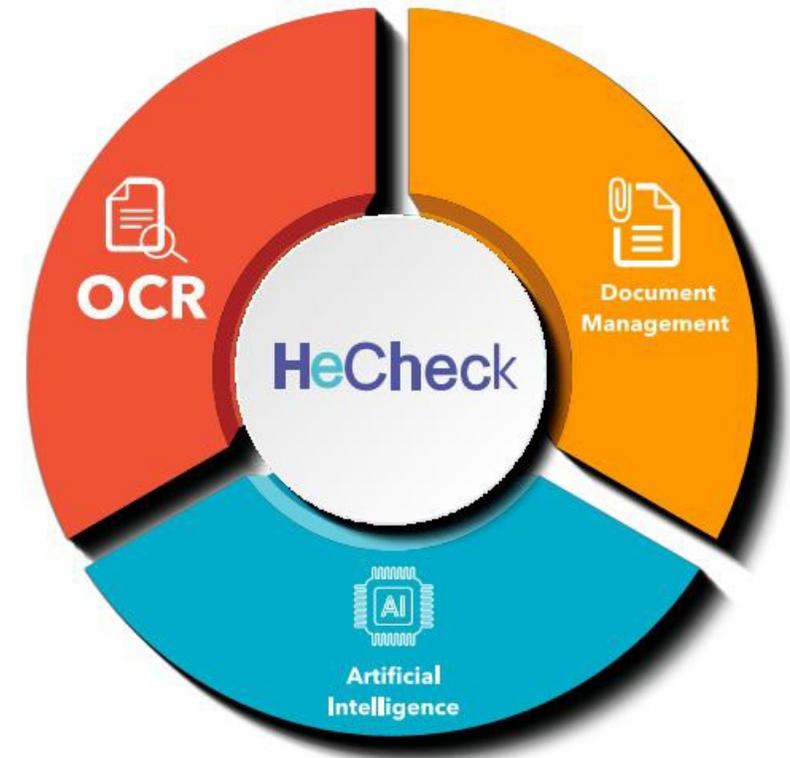
3. LABORATORY TEST RESULT		Date of Test: 16-06-2016	Age at test: 28 days
Date received: 31-05-2016		Max./Min. temp.: 30.0 / 24.0°C	Moisture condition at test: WET
Laboratory curing method: WATER CURING TANK			
Tank No.: A			
RFID Tag No.	HA30000084262	HA30000084263	--
Cube Mark	ARAB8428A	ARAB8428B	--
Mould no.	SITE-CM-298	SITB-CM-778	--
Mass in air	kg 2.370	2.372	--
Mass in water	kg 1.265	1.371	--
Measured dimension	Height	99.4	99.5
	Width	100.5	100.3
	Length	100.6	100.3
Saturated	Vol. by calculation	2360	2370
Density(kg/m ³)	Vol. by water disp.	2350	2360
Load at failure	kN	578.1	569.5
Compressive strength	MPa	57.9	57.1
Observation code	--	--	--

4. LABORATORY TEST RESULTS			
Date received	: 18/06/2020	Date tested	: 02/07/2020
Lab. curing method	: WATER CURING TANK (TROPICAL 27 °C)	Age at test	: 28 days
Tank No.	: 6	Moisture condition at test	: SATURATED
		Max/Min temp	: 28.5 / 27.0 °C
Laboratory Reference Number	HDA200607552	HDA200607564	Condition of specimen
Cube Mark	PH2-149C	PH2-149D	when received :
RFID Tag No.	10000486279	10000486280	A - Dry on receipt
Mould No.	D2134	D0623	B - Out of Perpendicularity
Mass in air (Saturated condition) (kg)	2.330	2.353	C - Incorrect dimensions
Mass in water (kg)	1.337	1.354	D - Poor Compaction
Measured Dimensions (L x H x W) (mm)	100.1 x 99.3 x 100.2	100.4 x 99.3 x 100.3	E - Honeycombing
Saturated	Vol. by calculation	---	F - Voids
Density (kg/m ³)	Vol. by water displacement	2340	G - Segregation
Load at failure (kN)	718	734	H - Damaged
Compressive strength MPa (N/mm ²)	72.2	73.6	N - Normal
Condition of specimen when received	N	N	
Type of failure	SATISFACTORY	SATISFACTORY	

Technologies Used – Summary of Technologies Used

To adopt the use of following technologies

- 💡 Optical Character Recognition (OCR)
- 💡 Artificial Intelligence (AI)
- 💡 Document Management System (DMS)



Technologies Used – Handling of Scanned Documents

Documents

Image Enhancement

Incoming Scans

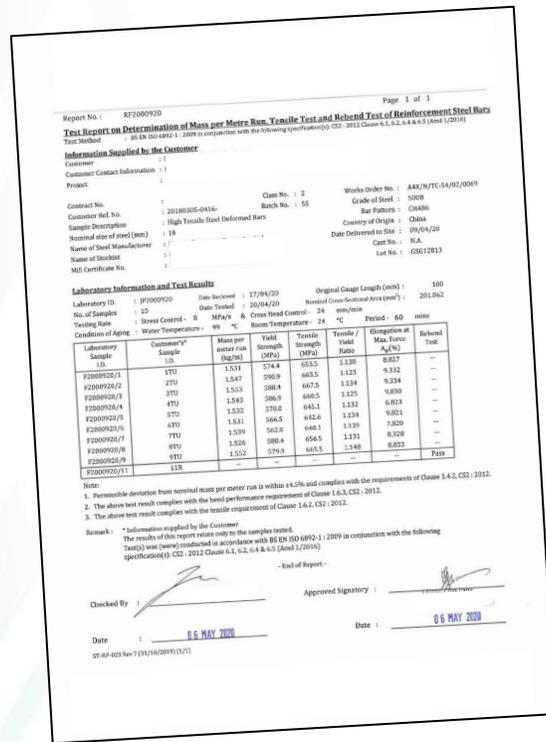
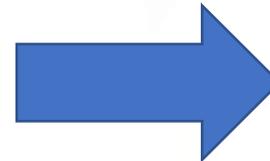


Image Processing Techniques



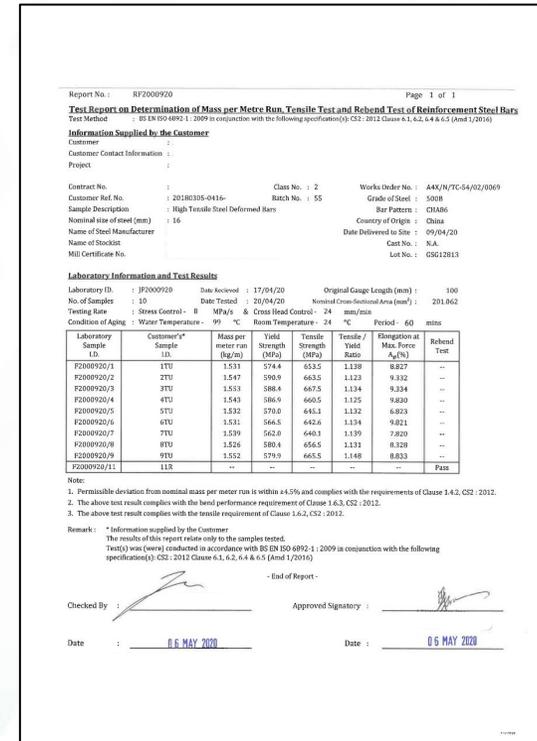
Convert to B&W

De-skew

Brightness & Contrast Adjustment

etc...

Enhanced Image



Increase Accuracy of the OCR

Technologies Used – General OCR

Standard Form / Template Data Extraction

NexScan - CR SIDB (Data Entry One)

Data Entry

v191223.2342

Re-load

PCCW1583_A112_NAR1_A_E_35223472_20190320 - (Vendor)Indexing/Data Entry
From: System (2019-12-23 08:54:07)

PCCW1583A112_NAR1_A_E_35223472_20190320

NAR12 pages of shareholders-09.tif

Company Number
3888888

Total Share
100 000

Data Table

NAME	ADDRESS	CURRENT I	TRANSFER	TRANSFER	REMARKS
高致權	香港九龍長沙灣道1號	50 000			
一本德利有限公司	香港金鐘道1號 快樂商業大廈 88樓	無	10 000	11/11/2014	轉讓予周年旺
利豐盈	香港山頂道1號綠悠閣33樓 A室	0			
周年旺	Room A, 15/F, Road Town,	50,000			

NAR12 pages of shareholders-02.tif

Company Number
6888888

Total Share
100 000

表格 NAR1
Form (非上市公司適用)
FOR NON-LISTED COMPANY

附表一 Schedule 1
(非上市公司適用)
FOR NON-LISTED COMPANY

本申報表的結算日期
Date to which this Return is Made Up
11 03 2015
公司編號 Company Number
3888888

非上市公司的成員詳情 (第 13 項)
Particulars of Member(s) of a Non-listed Company (Section 13)
(非列於香港交易所證券上市之公司，如股本不足，或超過一類股份，可免填此項。)
(Non-listed company having a share capital must complete this page. If the space provided is insufficient, or if there is more than one class of shares, please use additional Schedule 1.)
截至本申報表結算日期的成員詳情 Particulars of Member(s) as at the Date to which this Return is Made Up

股份類別 Class of Shares 普通股

此類別股份的已發行總數 Total Number of Issued Shares in this Class 100,000

姓名/名稱 Name	地址 Address	股份 Shares		備註 Remarks
		現時持有量 Current Holding	轉讓* Transferred*	
		數量 Number	日期 Date	
高致權	香港九龍長沙灣道1號	50,000		
一本德利有限公司	香港金鐘道1號 快樂商業大廈88樓	無	10,000 11/11/2014	轉讓予周年旺
利豐盈	香港山頂道1號綠悠閣33樓 A室	0		
周年旺	Room A, 15/F, Road Town,	50,000		

* 如公司的股份自上一份周年申報表日期以來(如屬首份周年申報表，則自公司成立為法團以來)有任何轉讓，有關詳情亦應一併申報；股份受讓人的姓名/名稱請在「備註」一欄註明。
* If there have been any transfers of the company's shares since the date of the last annual return (or since incorporation if this is the first annual return), please also provide details of the transfers; the name of the transferee should be stated in the 'Remarks' column.

SIH/MAK 1/2014 (2014年3月) Specification No. 1/2014 (March 2014)

NAR1_2 pages of shareholders-10.tif

NAR1_2 pages of shareholders-09.tif

NAR1_2 pages of shareholders-07.tif



Cannot fulfil all HeCheck's Project Requirements

- Provide **algorithm** to cater user specific needs that general OCR solution could not satisfy.
- Capturing table values from dynamic table and without explicit line on each row
- Auto separate records instead of separate by row

Technologies Used – AI-aided Extraction

Same content but in different format / location



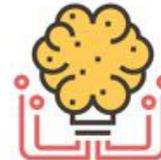
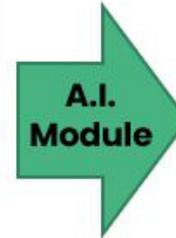
Automatically identify, classify reports and extract required information

Report No.	: A3S200700025	Date of Issue	: 03-07-2020
Sample Details as Supplied by Client :			
Client	: Hong Kong Housing Authority	Contract No.	:
Client Address	: HOUSING AUTHORITY HEADQUARTERS, 33 FAT KWONG STREET, KOWLOON	W.O. / Req. No.	: A3X/NQH-P1/08/0144
Project / Site	:		
Nominal Bar Size	: 16 mm	Serial No.	: --
Grade	: 500B	Bar Pattern Code	: CHA86
Country of Origin	: CHINA	Steel Manufacturer	: JIANGSU YONGGANG GROUP CO., LTD.
Class No.	: 2	Cast / Heat No.	: --
Batch No.	: 252(Gray)	Date delivered to Site	: --
Laboratory Test Results			
Date Received	: 29-06-2020	GCE Reg. No.	: GCE/HA200548
Date Tested	: 02-07-2020	Test Unit No.	: HA/SL20252
Nos. of Sample	: 11	Gauge Length for Tensile Test	: 100 mm
Test Location	: Steel Laboratory of GCE at San Po Kong		

Country_of_origin	: CHINA	✓
Manufacturer_Name	: JIANGSU YONGGANG GROUP CO., LTD.	✓
No._of_Sample	: 11	✓
Report_number	: A3S200700025	✓
Test_Date	: 02-07-2020	✓

Same Content ↔ Different Format

Date of issue: 23-07-2019	Castco Lab. Ref No.: 190712-2157
Page 1 of 1 page(s)	Report No.: 315679
Details As Supplied By Customer	
Customer: Hong Kong Housing Authority (MTS Term Contract No. 20180124)	Works Order No.: DIX/G/OME/02/0445
Address: Housing Authority Headquarters 33 Fat Kwong Street Kowloon	Serial No.: --
Job Title: :	Contract No.:
Location: Slope Feature No. 11NW-DF31 at Oi Man Estate	Batch No.: --
Steel Grade: see remark 8	Mass of test unit: 0.100 tonnes
Origin of Steel: Turkey	Cast No.: --
Manufacturer: Kroman Celik Sanayii A.S.	Date Delivered to Site: 21-06-2019
Stockist/Supplier: Ever Success Construction Engineering Materials Limited	Reinforcement Classification: Class 2
	Stockist/Supplier Certificate Available: Yes
	Bar Pattern Code: TUK37
Laboratory Test Result	
Date Received: 11-07-2019	Date of Test Completed: 16-07-2019
Nominal Bar Diameter: 16 mm	



Country_of_origin	: Turkey	✓
Manufacturer_Name	: Kroman Celik Sanayii A.S.	✓
Report_number	: No.:315679	✓
Test_Date	: 16-07-2019	✓
No._of_Sample	: Draw a box over this data on the image	

Technologies Used – AI-aided Extraction

Data Table Detection



Automatically extract required information and turn into structured data

Specimen No.		Mass per metre run		Yield strength, R_e (N/mm ²)	Tensile strength, R_m (N/mm ²)	Tensile / yield strength ratio, R_m / R_e	Total elongation at max. force, A_{gt} (%)	Rebend Test
Lab.	Client	Measured (kg/m)	Deviation (%)					
R3000012274	QH1-20170203-0024-13-TU	1.533	-2.9	569	655	1.15	7.4	--
R3000012275	QH1-20170203-0024-14-TU	1.538	-2.6	576	659	1.14	7.0	--
R3000012276	QH1-20170203-0024-15-TU	1.541	-2.4	575	655	1.14	7.1	--
R3000012277	QH1-20170203-0024-16-TU	1.544	-2.2	583	664	1.14	8.6	--
R3000012278	QH1-20170203-0024-17-TU	1.534	-2.8	569	653	1.15	7.1	--
R3000012279	QH1-20170203-0024-18-TU	1.536	-2.7	577	656	1.14	7.4	--
R3000012280	QH1-20170203-0024-19-TU	1.532	-3.0	575	653	1.14	6.7	--
CS2 : 2012 Requirement		N/A	+/- 4.5 %	500 to 650 MPa	N/A	≥ 1.08	≥ 8.0 %	--
Result (Comply / Not Comply)		N/A	Comply	Comply	N/A	Comply	Comply	N/A

Same Content  Different Format



Laboratory Sample I.D.	Customer's* Sample I.D.	Mass per meter run (kg/m)	Yield Strength (MPa)	Tensile Strength (MPa)	Tensile / Yield Ratio	Elongation at Max. Force A_{gt} (%)	Rebend Test
F2000920/1	1TU	1.531	574.4	653.5	1.138	8.827	--
F2000920/2	2TU	1.547	590.9	663.5	1.123	9.332	--
F2000920/3	3TU	1.553	588.4	667.5	1.134	9.334	--
F2000920/4	4TU	1.543	586.9	660.5	1.125	9.830	--
F2000920/5	5TU	1.532	570.0	645.1	1.132	6.823	--
F2000920/6	6TU	1.531	566.5	642.6	1.134	9.821	--
F2000920/7	7TU	1.539	562.0	640.1	1.139	7.820	--
F2000920/8	8TU	1.526	580.4	656.5	1.131	8.328	--
F2000920/9	9TU	1.552	579.9	665.5	1.148	8.833	--
F2000920/11	11R	--	--	--	--	--	Pass

Normalized Headers

Specimen Identity	Add header	Mass per Metre	Yield Stress	Tensile Strength	Add header	Elongation	Add header
Laboratory Sample I.D.	Customer's* Sample I.D.	Mass per meter run (kg/	Yield Strength (MPa)	Tensile Strength (MPa)	Tensile / Yield Ratio	Elongation at Max. Force	Rebend Test
F2000920/1	1TU	1.531	574.4	653.5	1.138	8.827	--
F2000920/2	2TU	1.547	590.9	663.5	1.123	9.332	Text
F2000920/3	3TU	1.553	588.4	667.5	1.134	9.334	Text
F2000920/4	4TU	1.543	586.9	660.5	1.125	9.830	Text
F2000920/5	5TU	1.532	570.0	645.1	1.132	6.823	--
F2000920/6	6TU	1.531	566.5	642.6	1.134	9.821	--
F2000920/7	7TU	1.539	562.0	640.1	1.139	7.820	Text
F2000920/8	8TU	1.526	580.4	656.5	1.131	8.328	Text
F2000920/9	9TU	1.552	579.9	665.5	1.148	8.833	Text
F2000920/11	11R	Text	Text	Text	Text	Text	Pass

Extraction Result

Technologies Used – AI-aided Extraction

Workflow and Validation Rules



Validate Accuracy of Extracted Data,
Avoid False-True / True-False
Scenario

Details as supplied by customer

Concrete mix:	W1260D151	Concrete grade (MPa):	60/20D
Admixtures used:	(BYZ) SMA-PLACEMENT-V2 (BY11M) SHONENT / VEGOCORIS 11000T	Slump designed (mm):	175
Sampling location:	Discharge from truck	Slump measured (mm):	188
Method of compaction:	Using compacting bar	Date cast:	01/04/2020
Place of making cube:	Site Lab	Test at (Days):	28
Site curing method:	Water Tank (Standard at 27 C)	Cube nominal size (mm):	100
Curing temperature(°C):	28/27	Sampled and made by:	CIGISMEC

Laboratory test results

Date received:	16/04/2020	Date tested:	29/04/2020
Lab curing method:	Water Tank (Standard at 27 C)	Age (Days):	28

The test cube were immediately immersed in water by laboratory.
(Water curing is in accordance with CS1:2010 Section 10)

The curing temperature: 27 ± 3 °C

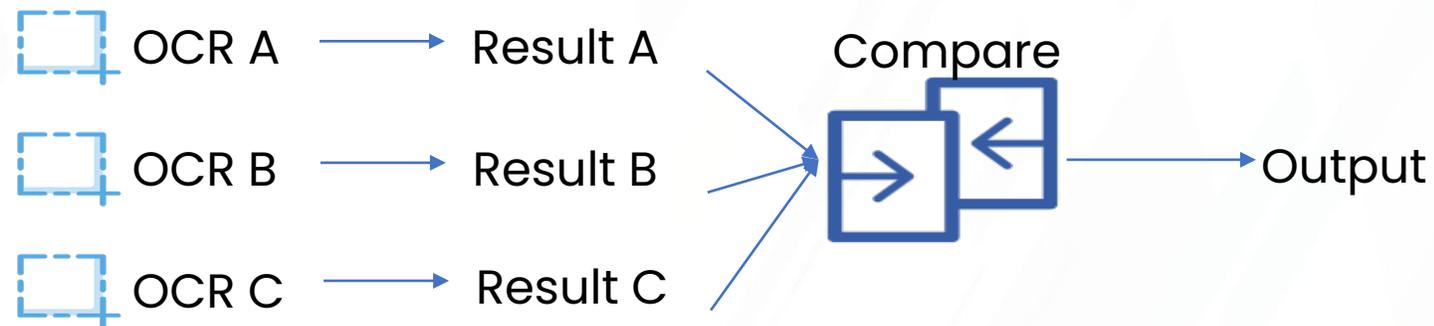
Test results

Data Field	Extracted Value	Confidence	Validation Error
Date Tested	29/94/2020	45%	Not a Date
Age (Days)	28	96%	N/A
Date Received	16/94/2020	98%	N/A
Curing Temperature	27 ± 3 °C	95%	N/A

Technologies Used – Multiple OCR

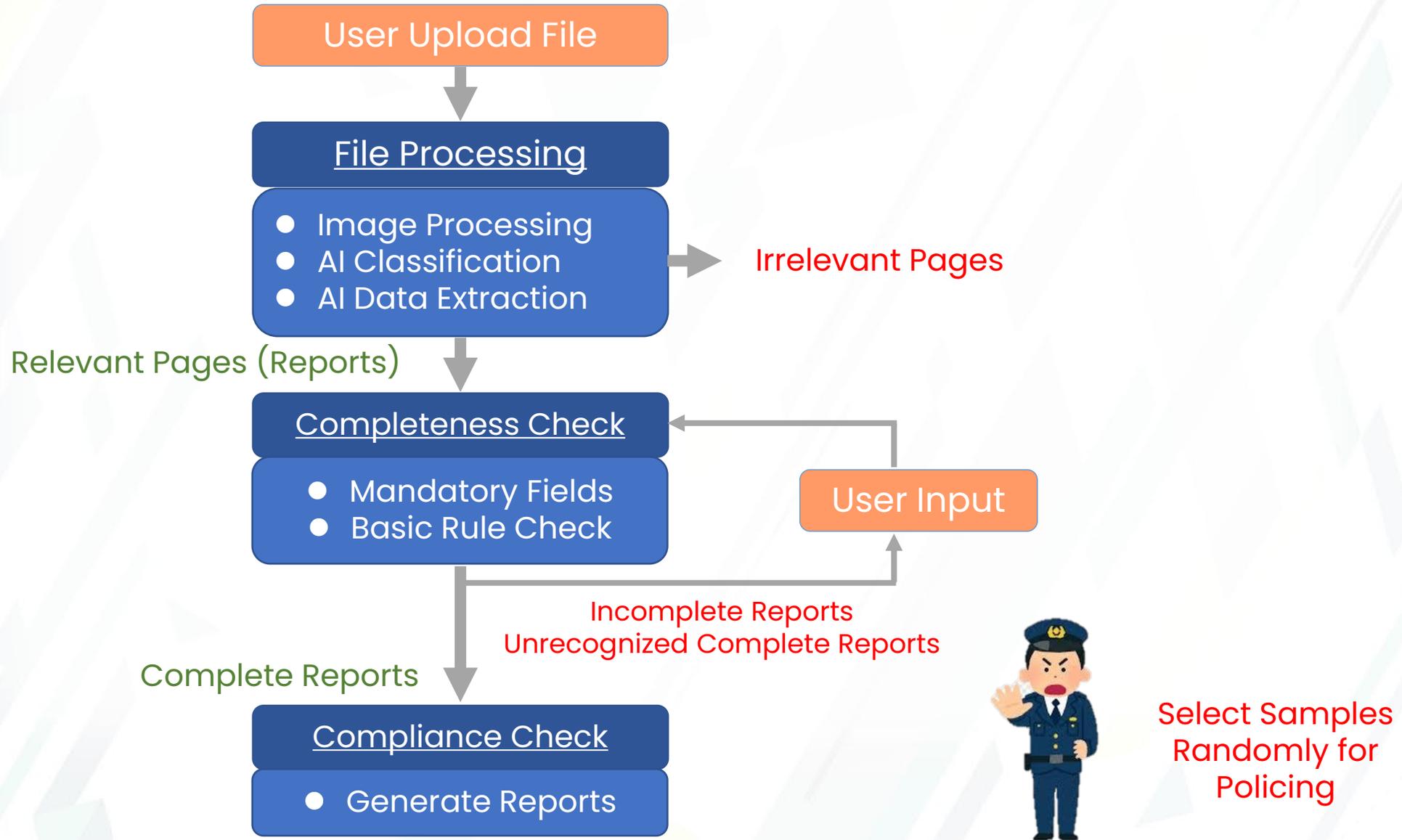
✓ Use of Multiple OCR Engines

- Increase accuracy
- Higher reliability



3 Implementation of HeCheck

Implementation of HeCheck



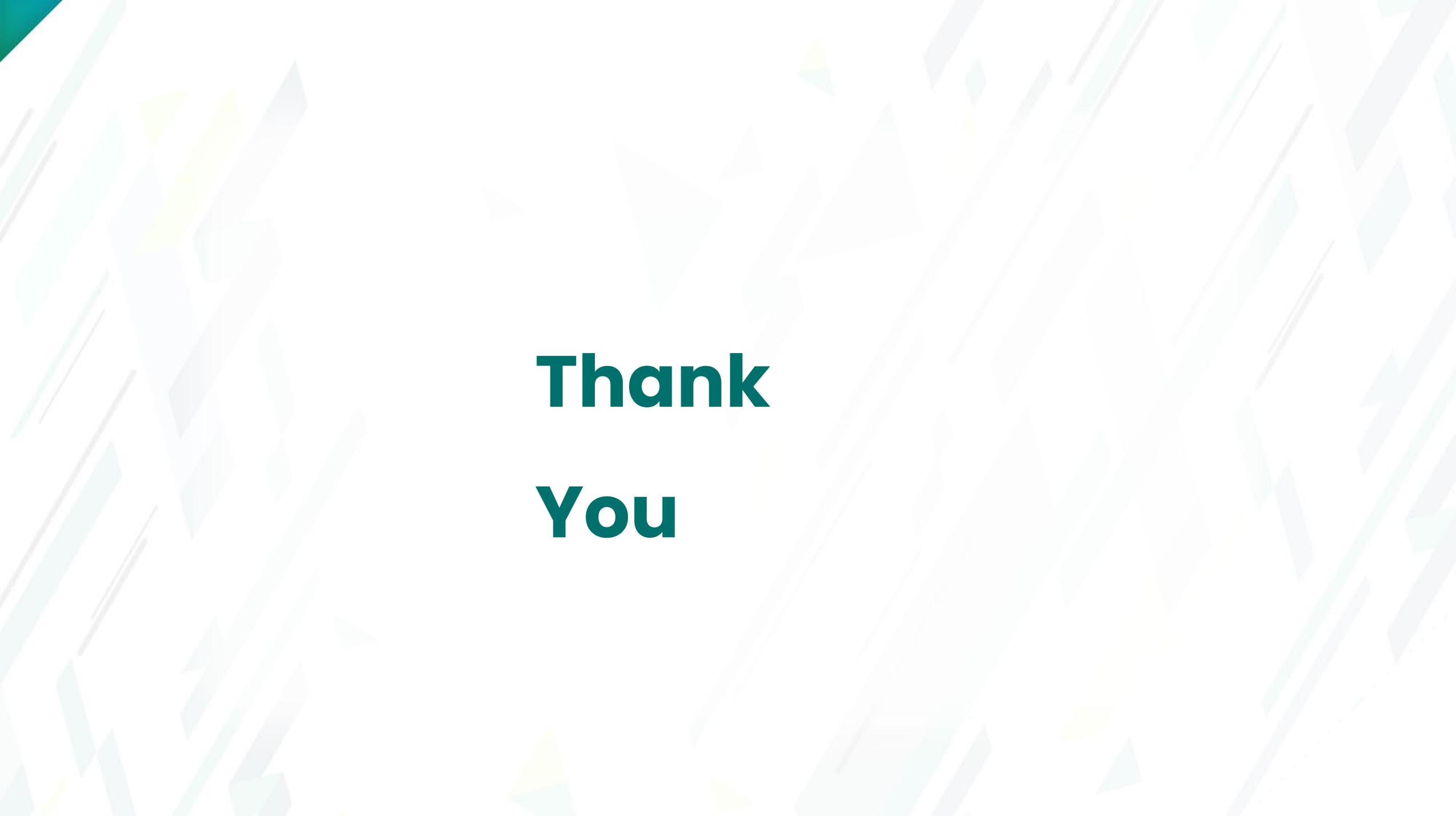
Implementation of HeCheck

Performance Since Implementation in HB

- **Over 60,000** reports checked since 26.5.2022
- **No** irregularity was spotted during the 10% policing check
- **85% to 90%** of reports were automatically handled by HeCheck
- **10% to 15%** handled manually
- Use about **30% of time** to achieve **100% work done**

Cube Test Report Accuracy After Using Standard Template for Cube

- **95%+** in recent months, some could achieve **99%**



**Thank
You**