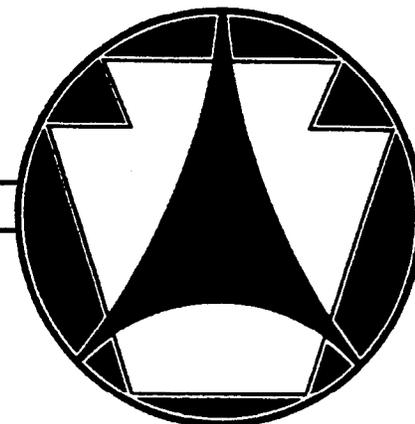


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**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION**

**PENNDOT RESEARCH**



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**IMPLEMENTATION AND  
ADMINISTRATION OF A PILOT PROGRAM  
FOR PENNDOT MAINTENANCE BITUMINOUS  
TECHNICIAN CERTIFICATION**

**University-Based Research, Education and Technology  
Transfer Center  
AGREEMENT NO. 359704, WORK ORDER 38**

**FINAL REPORT**

**NOVEMBER 2000**

**A. Stonex and D. Anderson**

**PENNSSTATE**



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IMPLEMENTATION AND ADMINISTRATION OF A PILOT PROGRAM FOR PENNDOT  
MAINTENANCE BITUMINOUS TECHNICIAN CERTIFICATION

University-Based Research, Education and  
Technology Transfer Center  
Agreement No. 359704  
Work Order 38

FINAL REPORT

Prepared for

Commonwealth of Pennsylvania  
Department of Transportation

By

Anne Stonex and David A. Anderson

The Pennsylvania Transportation Institute  
The Pennsylvania State University  
Transportation Research Building  
University Park, PA 16802-4710

November 2000

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<b>16. Abstract</b> <p>This project, "Implementation and Administration of a Pilot Program for PennDOT Maintenance Bituminous Technician Certification" (Contract No. 359704, Work Order 38), was initiated in January 2000 to support the continuing efforts of the PennDOT Bureau of Maintenance and Operations (BOMO) Maintenance Division to improve the quality of its asphalt paving operations and materials. The Northeast Center of Excellence for Pavement Technology (NECEPT) joined this effort in 1997 and 1998 when PennDOT District 8-0 Maintenance and the District 3 District Materials Engineer asked NECEPT to modify the existing PennDOT Bituminous Field Technician Review and Certification course to correspond to the specific limited roles of Maintenance personnel in hot-mix asphalt paving activities. The purpose was to provide a uniform, consistent technical background for all agency field personnel involved in asphalt paving operations, regardless of affiliation, to improve and promote quality. NECEPT delivered pilot sessions of the modified course to personnel selected by those districts that were deemed successful, and the program was subsequently continued in 2000 as Work Order 38.</p> <p>In April and May 2000, NECEPT delivered three 2-day sessions of the PennDOT Maintenance Bituminous Technician Certification pilot program to a total of 119 maintenance personnel from Districts 3-0, 5-0, 8-0, 9-0, 10-0, and 12-0. Ninety-nine participants initially passed the certification examination. Examination reviews and retests were delivered to nine applicants, eight of whom achieved certification, yielding a total of 107 newly certified Maintenance Bituminous Technicians by this pilot program. The examination results were statistically analyzed to assess the difficulty and effectiveness of the questions and reliability of the scores, and course participants evaluated the course and the instructors to provide information to improve content and delivery for should the program be continued in the future.</p>					
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## 1. INTRODUCTION

In response to a mandate from the Federal Highway Administration (FHWA), the Pennsylvania Department of Transportation (PennDOT) Bureau of Construction and Materials (BOCM) implemented a policy requiring certification of bituminous plant and field technicians for work on PennDOT asphalt pavement construction projects by March 15, 1998. The PennDOT Bituminous Technician Certification Program was initiated in early 1996 for bituminous pavement technicians in two primary categories, plant and field. The Northeast Center of Excellence for Pavement Technology (NECEPT) became the program administrator in fall 1996. The program applies equally to technicians from PennDOT and from private industry, including contractor and consultant personnel. Field representatives of contractors, consultants, and the PennDOT BOCM from all PennDOT engineering districts obtain consistent technical information on asphalt paving operations through the field technician program. The program has been evolving, improving, and expanding since its inception and more than 3,000 technicians had participated as of June 30, 2000.

In 1997 and 1998, NECEPT modified the existing PennDOT Bituminous Field Technician Review and Certification course for delivery to Maintenance Division personnel involved in asphalt paving operations as requested by PennDOT District 8-0 Maintenance and District 3-0's District Materials Engineer. The purpose was to provide a uniform, consistent technical background for all agency field personnel involved in asphalt paving operations, regardless of affiliation, and to improve and promote quality. NECEPT engineers tailored a pilot 2-day session to correspond to the specific limited roles of maintenance personnel in hot-mix asphalt paving activities and delivered it to District 8-0 personnel in 1997. No examination was requested or included at that time.

In 1998, District 3-0 requested some additional revisions and the course was further refined and delivered to personnel from District 3-0, including a written certification examination. Representatives of the Bureau of Maintenance and Operations (BOMO) from Harrisburg, including Mr. Amar Bhajandas, who was then the bureau director, participated throughout to evaluate the course and the certification examination. Mr. Bhajandas requested a proposal to continue the program and NECEPT responded with a submittal in July 1998. In 1999, PennDOT

asked NECEPT to convert that proposal into work order format, and Work Order 38 was subsequently developed.

Work Order 38, "Implementation and Administration of a Pilot Program for PennDOT Maintenance Bituminous Technician Certification," was initiated in January 2000 to support the continuing efforts of the PennDOT Maintenance Division to improve the quality of its asphalt paving operations and materials. The ultimate goal is to improve performance and lengthen the serviceable life of pavement placed or repaired by maintenance personnel. This report describes the conduct and measurable results to date of this pilot program.

## **2. PROGRAM PREPARATION**

Program preparations began with the project kick-off meeting at PTI on February 11, 2000. The participants included: Mr. Don Wise, PennDOT technical contact and chief, Maintenance Division, BOMO; Mr. Michael LeLack, Roadway Programs manager, PennDOT BOMO; Ms. Fran Treisbach, PennDOT program manager, and Ms. Anne Stonex, NECEPT, principal investigator. Ms. Stonex presented background information and described in detail the intent of the original request for proposal, as well as the basis for project cost estimates and budget limitations, as much of this information could not be retained within the work order format.

Other topics discussed included instructor availability for scheduling course dates at the respective delivery locations, procedures and schedules for the deliverables based on the corresponding course delivery dates available, course manuals, and procedures for examination review and retest by applicants who fail the certification exam. Due to conflicting scheduling demands of the districts for the limited number of dates for which the instructors were available, it was decided that Mr. Wise would arrange the delivery schedule with the district coordinators and notify NECEPT.

Ms. Stonex informed the meeting participants that there was a problem with obtaining one of the two primary course references, the *Participant's Manual* for National Highway Institute (NHI) course no. 13132, "Hot Mix Asphalt Construction." The manual was drastically revised by an NHI subcontractor in 1999, from an excellent full-text reference into a series of poorly

reproduced PowerPoint slide handout sheets (3 slides per page with no text). Ms. Stonex showed the participants the revised version, and they deemed it unsatisfactory. Mr. Wise requested that the original version of the *Participant's Manual* be used instead for Work Order 38 course delivery.

Ms. Stonex provided copies of the examination administered during the April 1998 session in District 3-0 to Mr. Wise and Mr. LeLack for review for possible revisions. The details of the procedure for reporting examination results were also discussed, including to whom the results should be addressed and whether to report actual scores or simply pass/fail status. These questions were taken under consideration by BOMO to determine an appropriate policy.

Mr. Carl W. Lubold, P.E, is the senior instructor for NECEPT's HMA-related review and certification and Superpave training courses, and also instructs many asphalt technology related courses for LTAP. Mr. Lubold was instrumental in developing and delivering the first two pilot course sessions for PennDOT Maintenance bituminous technicians. Although Mr. Lubold was not able to attend the kick-off meeting, afterwards he coordinated directly with Mr. Wise to update the course topics, program emphasis, handout materials, and certification examinations for the 2000 pilot program. As requested by Mr. Wise, Ms. Stonex obtained permission from NHI and the copyright holder, the National Asphalt Pavement Association (NAPA), to make 150 copies of the original version of the *Participant's Manual* for NHI course no. 13132, "Hot Mix Asphalt Construction" for this limited pilot program.

### **3. COURSE CONTENT AND DESCRIPTION**

The two-day pilot course for certification of PennDOT Maintenance Bituminous Technicians is based primarily on the NHI course no. 13132, "Hot Mix Asphalt Construction," developed by the joint AASHTO/FHWA/Industry Training Committee on Asphalt. Although modified to meet the needs of Maintenance personnel, this is not an entry-level course for personnel who have no experience with asphalt paving materials or related equipment and procedures. A considerable amount of information is conveyed in a very short time, so much that someone unfamiliar with the topics would be very unlikely to pass the certification examination. Primary emphasis has been given to placement and compaction activities because these are the most

critical to the performance of the resulting pavement. The course agenda in table 1 indicates the sections of the parent course designated by BOMO as applicable for Maintenance Division personnel and the relative amount of time spent on each.

Table 1. PennDOT Maintenance Bituminous Technician Certification course agenda.

Day	Time	Topic
<b>Day One</b>	8:00 – 8:30 a.m.	Orientation and Introduction
	8:30 – 9:30 a.m.	Specifications
	9:30 – 10:00 a.m.	Surface Preparation
	10:00 – 10:15 a.m.	Break
	10:15 – 11:15 a.m.	HMA Delivery
	11:15 a.m. – 12:00 noon	HMA Placement
	12:00 – 1:00 p.m.	Lunch
	1:00 – 3:30 p.m.	HMA Placement, continued
	3:30 - 4:30 p.m.	Joint construction
	<b>Day Two</b>	8:00 – 10:00 a.m.
10:00 – 10:15 a.m.		Break
10:15 - 11:00 a.m.		Compaction, continued
11:00 a.m.– 12:00 noon		Troubleshooting
12:00 – 1:00 p.m.		Lunch
1:00 – 1:30 p.m.		Review/Question and Answer
1:30 – 3:30 p.m.		Exam
3:30 p.m.		Dismissal

Course materials provided to spring 2000 attendees included the NHI *Hot Mix Asphalt Construction Participant Manual for Course 13132*, the *Hot-Mix Asphalt Paving Handbook* (approved as a guide by AASHTO, FHWA, FAA, NAPA, U.S. Army Corps of Engineers, APWA, and NACE) and Section 401 of PennDOT Publication 408 specifications. These materials were supplemented by slides, videos, overheads, and handouts prepared by NECEPT. The open-book, open-note certification examination consisted of 50 true/false and multiple-choice questions, including some calculations. Participants were allowed 2 hours to complete the exam. A score of 70% or better was required to achieve certification.

#### 4. COURSE DELIVERY

NECEPT delivered three review and certification sessions as planned, followed by two sets of exam review sessions and retest sessions for failing applicants. The instructors were Mr. Carl W. Lubold, P.E. and Mr. Patrick S. Powers, P.E., also as planned, who delivered both of the previous pilot courses. These gentlemen have been the primary instructors for the established PennDOT Bituminous Technician Certification Program since January 1997, and both are accustomed to a wide range of audiences. Ms. Stonex and Mr. Lubold worked directly with the PennDOT district training coordinators regarding delivery locations and other details. All participants at each session were asked to complete anonymous course evaluation forms. A copy of the form and compiled responses from each of the three sessions are included in Appendix A.

The first session of the 2000 PennDOT Maintenance Bituminous Technician Certification pilot program was delivered to 33 personnel from District 3-0 at the Holiday Inn in Montoursville on April 24 and 25, 2000. The instructors reported that the session itself went very well and that the course materials and the times allotted for the respective topics proved satisfactory. The evaluation responses in Appendix A generally support their opinion. A seven-point scale was used for the evaluation, with 1 equivalent to very poor, 4 identified as "OK," and 7 regarded as excellent. Most of the scores were 5s and above, with some 4s, but there were some isolated responses of 1, 2, and 3. This is typical based on NECEPT's experience.

The instructors voiced some concerns with participant registration and identity verification policies that should be addressed if the program is to continue. In March, Mr. Lubold had been specifically directed by the district training coordinators with whom he interacted *not* to check identification of maintenance personnel participating in this program (although that has been a standard practice for the existing PennDOT Bituminous Technician Certification Program). The coordinators indicated that PennDOT would take that responsibility. The district training coordinator had reportedly arranged for a PennDOT representative to be present to verify the identity of all participating personnel for certification purposes and to check them in prior to the start of the session. However, no such PennDOT representative ever appeared. In order to deliver the course, the instructors had the participants print and sign their names to make an attendance list, but no master list or responsible agency person was available for reference.

The second session was delivered to 43 participants from Districts 5-0 and 8-0 on May 1 and 2 at the District 8-0 facility. The instructors felt that the session went well, and the evaluation responses were very similar to those received following the first session and indicate that the participants generally agreed (see Appendix A).

The third session was delivered to 43 personnel from Districts 9-0, 10-0 and 12-0 at the Rustic Lodge in Indiana, Pa. on May 4 and 5. Although the scores awarded were still generally better than OK, the evaluations for the third session showed more scores of four and below than for the other two sessions. The reason for the difference is not clear, but experience indicates that each audience has its own "character" and that the responses of various audiences may differ considerably from each other.

## **5. EXAMINATION RESULTS**

The certification examinations were graded by Penn State University Testing Services to obtain analysis of the results. The analysis provides score distributions, rates questions for difficulty and effectiveness based on the relative performance of the group being analyzed, and gives an estimate of the reliability of the scores for the test. This information was obtained for each session and then all of the results from all three sessions were compiled for overall analysis. A total of 119 maintenance personnel took the certification examination. Two different versions of the examination, Form A and Form B, were administered to discourage copying. Both forms included all of the same questions so as to avoid any difference in difficulty or subject matter. Form B was simply Form A with the questions presented in reverse order.

Four participants in the first session failed the certification examination, yielding a failure rate of about 12 percent. This is reasonable when compared to similar failure rates in the parent program for applicants for certification as PennDOT Bituminous Field Technician, but it is slightly higher than the overall average for that program. The failure rate was highest for the second session, 9 out of 43, nearly 21 percent. Seven out of 43 failed the exam given at the third session. The overall failure rate for the program was 20 out of 119, which is 16.8 percent.

According to the overall analysis, the average test score was 39.13 correct out of 50 questions (78.3 percent), with a standard deviation of  $\pm 5$  correct. Results ranged from a minimum of 23 correct (46 percent) to a maximum of 47 correct (94 percent). Ninety-nine participants were certified.

To track the participants in this program, PTI computer support personnel (primarily Ms. Sue Rossman) constructed a simple database using the Microsoft ACCESS program. Data included are limited to first and last names, middle initial, PennDOT organizational affiliation and individual PennDOT and database identification numbers, what sessions were attended, exam score, and certification status. This database was used to generate the certificates for newly certified personnel. Records for District 3-0 personnel certified in 1998 were also entered into the database. As directed by Mr. Wise, the lists of results and the corresponding certificates were mailed to Mr. Grabusnik at BOMO in Harrisburg for distribution to the participants.

## **6. EXAMINATION REVIEWS AND RETESTS**

The purpose of this pilot program is to promote better understanding of principles and the importance of good practices related to bituminous paving materials. In order to allow the participants full opportunity to become certified, a policy for examination review and retest was included in the program for applicants who did not pass the certification exam.

In some cases, failure was not necessarily due to lack of knowledge or understanding. Test anxiety was an important factor for a number of participants, many of whom have not taken any formal examinations since they graduated from school. Experience indicates that many who scored between 60 and 69 percent were as likely to have failed because of anxiety or lack of experience in taking tests as for any other reason.

During the exam review, participants are given their original answer sheets and a copy of the corresponding test form with the correct answers marked so that they can determine what questions or topic areas they understood and which they had difficulty addressing. NECEPT representatives proctor the reviews and answer questions about principles, practices, and where specific information can be found in the course materials. Participants often find that they did

not read the respective questions carefully enough when taking the exam, or did not take the answers at face value, i.e., interpreted the questions as tricks or ambushes rather than direct as intended. The answer sheets and exam keys are collected by NECEPT at the end of the review, but participants are allowed to take notes. The retest is based on the original examination, with at least 35% of the questions changed in some fashion so that participants cannot pass just by making notes of the original answers. Exam review has proven to be very helpful to almost all participants who exercise that option. In the larger PennDOT Bituminous Field Technician certification program, nearly 99% of those who review their exams pass the retest. Of those who do not review their exams, including those whose original scores are within a few percent of passing, only about 50 percent pass the retest.

An exam review was offered for all failing participants. District 3-0 personnel declined. The District 8-0 coordinator, Sue Moravetz, worked directly with Mr. Lubold to arrange review and retest sessions in Harrisburg for the Session 2 participants. These were administered on September 12 and 14, 2000 to five of the nine failing participants. All five passed the retest and achieved certification.

Mr. Bob Korhan, District 9-0 training coordinator, worked directly with Ms. Stonex to arrange exam reviews and retests for interested failing participants from Districts 9-0, 10-0, and 12-0. These were administered on September 26 and 28 at the District 9-0 office in Hollidaysburg to four of the seven failing participants from the third session. Three of the four passed the retest and achieved certification. The fourth just missed, but performed significantly better than on the original exam.

The retests increased the number of PennDOT Maintenance Bituminous Technicians certified in the 2000 pilot program to 107 out of 119 participants, nearly 90 percent. This brings the remaining overall failure rate to about 10 percent, which corresponds closely to that of the previously established certification program.

## 7. CONCLUSIONS AND RECOMMENDATIONS

Based on the overall 90 percent certification rate, it appears that the pilot program started out well. While not every participant is qualified for certification, any program that all participants from a diverse pool of applicants can pass would be considered too easy. However, some mechanism for exam review and retest is needed to foster opportunity for personal improvement for those who do not achieve certification on the first attempt. The results of the exam review and retests were very encouraging in this respect.

It is the research team's understanding that PennDOT is considering implementing a program for Maintenance Bituminous Technician Certification on a permanent basis. NECEPT strongly supports such implementation. The pilot program appears to provide a good foundation that can be further tailored as appropriate to fit the needs of the Bureau while promoting consistency of knowledge and practice within the Department.

It should be noted that this pilot certification program represents a change that not all personnel may welcome or understand. Change is often difficult, especially for older employees who have been following the same policies and routines for many years. At each of the three sessions, some attendees asked the instructors about the purpose of and need for this program. Not all personnel believe that change is necessary, and some may feel that their jobs are threatened. Others, regardless of age or time of service, are ready to expand their horizons. These factors affect the conduct and results of the program.

To be truly successful, any new program must be supported by management from the top down. This sets the tone for the participants. If management does not buy into it, why should the employees? The program participants should be informed of the purpose and need before they attend the certification course, whether or not they are convinced of its merit. For this program, the purpose is quality of workmanship and of the finished product to promote longer-lasting pavements in the Commonwealth of Pennsylvania.

**APPENDIX A: COURSE EVALUATION FORM AND  
SUMMARY OF RESPONSES**

## COURSE EVALUATION FORM

Please fill in the name of the course and today's date at the top of the form. (Refers to computer form.)

Please answer each of the following questions relating to the quality of this course, using the following rating scale:

1      2      3      4      5      6      7  
very poor                      OK                      excellent

Darken the number on your computer form that corresponds to your rating for that item. Use only a number two pencil,

1. What was the overall quality of this course?

1      2      3      4      5      6      7

What was the overall quality of the instruction as provided by:

2. Carl Lubold:

1      2      3      4      5      6      7

3. Pat Powers:

1      2      3      4      5      6      7

4. Perry Schram:\*

1      2      3      4      5      6      7

5. Other (fill in name)\* \_\_\_\_\_

1      2      3      4      5      6      7

6. What was the overall quality of the visual aids used during the course?

1      2      3      4      5      6      7

7. What was the overall quality of the manuals and handouts used during this course?

1      2      3      4      5      6      7

8. Rate the ability of the instructors to explain concepts and problems.

1      2      3      4      5      6      7

9. How relevant was the content of the course to your responsibilities and activities on the job?

1      2      3      4      5      6      7

10. What was the overall quality of the facilities (rooms, laboratories) used during this course?

1      2      3      4      5      6      7

**PLEASE USE THE BACK OF THIS PAGE FOR SPECIFIC CRITICISM, COMMENTS, OR SUGGESTIONS.**

**\*NOTE:** Lubold and Powers were the only instructors who delivered this program, so participants were requested to leave the answer bubbles for questions 4 and 5 blank. Some participants filled in either one or both (identified with \* on the following lists), but only responses to 1-3 and 6-10 apply.

Course Evaluations for Maintenance Bituminous Technician Certification 2000  
Session 1, April 24-25 for District 3-0

<u>Form #</u>	<u>Question</u>	<u>123</u>	<u>678910</u>
10C960001	777	77777	
10C960002	777	67775	
10C960003	577	67647	
10C960004	556	56665	
10C960005	666	67765	
10C960006	666	67665	
10C960007	555	66666	
10C960008	553	45346	
10C960009	777	67766	
10C960010	556	55555	
10C960011	555	47677	
10C960012	445	76555	
10C960013	666	57657	
10C960014	666	57667	
10C960015	531	65557	
10C960016	666	66665	
10C960017	555	56757	
10C960018	766	67647	
10C960019	566	67566	
10C960020	767	67637	
10C960021	777	77766	
10C960022	777	67757	
10C960023	566	67677	
10C960024	545	46556	
10C960025	555	65777	
10C960026	555	66745	
10C960027	777	67777	
10C960028	666	66666	
10C960029	655	47526	
10C960030	656	36566	
10C960031	666	66654	
10C960032	233	27316	
10C960033	466	66666	

Course Evaluations for Maintenance Bituminous Technician Certification 2000  
 Session 2, May 1-2, 2000 at District 8-0

<u>Form #</u>	<u>Question</u>	<u>123</u>	<u>678910</u>
10C960001	777	67776	
10C960002	666	67666	
10C960003	555	65447	
10C960004	752	67577	
10C960005	777	77777	
10C960006	777	54775	
10C960007	666	56676	
10C960008	565	67767	
10C960009	777	77777	
10C960010	666	45566	
10C960011	666	77647	
10C960012	6766	57675*	
10C960013	577	56457	
10C960014	6746	36356*	
10C960015	455	56766	
10C960016	777	77777	
10C960017	766	77777	
10C960018	666	57767	
10C960019	343	15436	
10C960020	444	34455	
10C960021	555	55555	
10C960022	555	46546	
10C960023	7677	57747*	
10C960024	666	67776	
10C960025	777	67777	
10C960026	666	56666	
10C960027	555	45657	
10C960028	4766	56767*	
10C960029	566	57737	
10C960030	677	56667	
10C960031	455	57767	
10C960032	777	77777	
10C960033	766	67667	
10C960034	7771177737*		
10C960035	666	56776	
10C960036	666	66577	
10C960037	677	57667	
10C960038	677	56666	
10C960039	777	67777	
10C960040	777	77777	
10C960041	777	67757	
10C960042	566	37766	

Course Evaluations for Maintenance Bituminous Technician Certification 2000  
 Session 3, May 4-5, 2000 @ District 10-0 (Rustic Lodge, Indiana, PA)

<u>Form #</u>	<u>Question</u>	<u>123</u>	<u>678910</u>
10C960001	666	67576	
10C960002	666	66636	
10C960003	573	56456	
10C960004	443	57612	
10C960005	655	56666	
10C960006	777	67776	
10C960007	764	67736	
10C960008	554	57657	
10C960009	453	45466	
10C960010	554	56736	
10C960011	6666	56677*	
10C960012	666	46777	
10C960013	455	44444	
10C960014	656	77677	
10C960015	666	77766	
10C960016	465	67756	
10C960017	465	57655	
10C960018	665	45626	
10C960019	453	37726	
10C960020	766	67746	
10C960021	665	46665	
10C960022	555	46664	
10C960023	545	55527	
10C960024	232	42323	
10C960025	664	67445	
10C960026	4546	66346*	
10C960027	555	46616	
10C960028	351	64437	
10C960029	666	55666	
10C960030	777	57766	
10C960031	554	54554	
10C960032	676	67675	
10C960033	666	66666	
10C960034	6665	55656*	
10C960035	666	67665	
10C960036	666	66666	
10C960037	677	66776	
10C960038	656	67546	
10C960039	571	67526	
10C960040	445	45526	
10C960041	677	67656	
10C960042	666	56666	
10C960043	777	66776	

