

DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES

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June 10, 2015

10-Cal-4-R0.0/R21.1
10-0X3904
Project ID 1012000291
ACSTP-P004(148)E

Addendum No. 2

Dear Contractor:

This addendum is being issued to the contract for CONSTRUCTION ON STATE HIGHWAY IN CALAVERAS COUNTY AT AND NEAR COPPEROPOLIS FROM STANISLAUS COUNTY LINE TO ROUTE 49.

Submit bids for this work with the understanding and full consideration of this addendum. The revisions declared in this addendum are an essential part of the contract.

Bids for this work will be opened on Wednesday June 17, 2015, instead of the original date of Thursday, June 11, 2015.

This addendum is being issued to set a new bid opening date as shown herein and revise the *Notice to Bidders and Special Provisions*.

In the Special Provisions, Section 39-8, "INTELLIGENT COMPACTION FOR HOT MIX ASPHALT," is added as attached.

To *Bid* book holders:

Inquiries or questions in regard to this addendum must be communicated as a bidder inquiry and must be made as noted in the *Notice to Bidders* section of the *Notice to Bidders and Special Provisions*.

Submit the *Bid* book as described in the *Electronic Bidding Guide* at the Bidders' Exchange website.

http://www.dot.ca.gov/hq/esc/oe/electronic_bidding/electronic_bidding.html

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Inform subcontractors and suppliers as necessary.

This addendum, EBS addendum file and attachments are available for the Contractors' download on the Web site:

http://www.dot.ca.gov/hq/esc/oe/project_ads_addenda/10/10-0X3904

If you are not a *Bid* book holder, but request a book to bid on this project, you must comply with the requirements of this letter before submitting your bid.

Sincerely,



for
SHARRI BENDER EHLERT
District Director
District 6 Central Region

Attachments

Replace section 39-8 with:
39-8 INTELLIGENT COMPACTION FOR HOT MIX ASPHALT

39-8.01 GENERAL

39-8.01A Summary

Section 39-8 includes specifications for compacting HMA using intelligent compaction. The Department will not consider a VECP that substitutes the processes or equipment specified for intelligent compaction. Intelligent compaction does not waive any specifications for HMA.

Intelligent compaction uses vibratory steel drum rollers with intelligent compaction equipment and static pneumatic tire rollers equipped with automated machine guidance system that provide roller operator with real time information for quality control and produce data for standardized software Veda. For Veda, go to:

Use Veda software to analyze the data for coverage uniformity, HMA temperature, and intelligent compaction measurement values.

Use intelligent compaction rollers and automated machine guidance rollers for breakdown, and intermediate compaction.

Create project layout files for the intelligent compaction system, automated machine guidance system and Veda from the existing pavement using GPS rover calibrated for the project site.

39-8.01B Definitions

all passes data: Compaction data that contain measurements from all passes.

automated machine guidance roller: Rollers equipped with measurement devices installed by the roller manufacturer or a post manufacture retrofit system including GPS, temperature sensor, on-board documentation system, and displays.

California coordinate system of 1983 (CCS83): A set of 6 geographic zones or coordinate systems designed for specific regions of the State of California, the boundaries of which follow county lines. CCS83 is based on NAD83. When a project crosses state plane zone boundaries, a single zone will be used for the entire project.

compaction data: Data collected by intelligent compaction equipment and automated machine guidance compaction equipment.

coordinated universal time (UTC): A time measurement system commonly referred to as Greenwich Mean Time (GMT) based on a 24-hour time scale from the mean solar time at the Earth's prime meridian (zero degrees longitude) located near Greenwich, England.

coverage: Single roller pass over a given area.

final coverage: Compaction data that contain the last pass measurements for a given area.

foot: Unit of measurement equal to U.S. survey foot.

geodetic coordinates: A coordinate system to describe a position in longitude, latitude, and altitude above the imaginary ellipsoid surface based on a specific geodetic datum. The NAD83 datum is required for use with CCS83 State Plane Coordinates.

global positioning system (GPS): A space-based satellite navigation system that provides location and time information in all weather, anywhere on or near the Earth to determine the location in geodetic coordinates. GPS refers to all GPS-related signals including US GPS, and other Global Navigation Satellite Systems (GNSS). GPS satellite signals are subject to interference from canyons, buildings, trees or even fencing. Not all locations are suitable for GPS techniques, and it is your responsibility to determine if the site conditions are practical for GPS, and to notify the Engineer if they are not.

GPS base station: A single ground-based system consisting of a GPS receiver, GPS antenna, and telemetry equipment (typically radio and radio antenna or cellular phone) to provide L1/L2 differential GPS correction signals to other GPS receivers.

GPS correction service subscription: A service that can be subscribed to receive differential GPS correction signals for higher accuracy GPS positioning without the need of a GPS Base Station. Signals are normally received via cellular wireless data services. Examples of GPS correction service subscriptions are: Trimble VRS™, Leica Smart RTK™, Topcon TopNet™ or OmniSTAR™.

GPS rover: A portable L1/L2 GPS antenna, mount, and receiver with telemetry equipment for Real Time in-situ point measurements

GPS site calibration or localization: A process to establish a relationship between the observed GPS coordinates and the known grid coordinates.

grid: A Cartesian system of XY (or North-East) coordinates utilizing the California State Plane Coordinates, known as the California Coordinate System of 1983 (CCS 83).

intelligent compaction measurement value: A generic term for all intelligent compaction measurements in units specific to each roller manufacturer.

intelligent compaction equipment: Measurement devices installed by the roller manufacturer or a post manufacture retrofit system including accelerometer, GPS, temperature sensor, on-board documentation system, and displays.

intelligent compaction roller: Rollers equipped with measurement devices installed by the roller manufacturer or a post manufacture retrofit system including accelerometer, GPS, temperature sensor, on-board documentation system, and displays.

network real time kinematic (Network RTK): A system that uses multiple bases in real-time to provide high-accuracy GPS positioning within the coverage area that is generally larger than that covered by a single GPS base station.

real time kinematic global positioning system (RTK-GPS): A system based on the use of carrier phase measurements of the available GPS signals where a single GPS base station or RTK network provides the corrections in order to achieve centimeter-level accuracy in real time.

roller pass: Movement of the roller in either direction.

universal transverse mercator (UTM) coordinate system: Is a 2-dimensional Cartesian coordinates system that divides the surface of Earth between 80°S and 84°N latitude into 60 zones, each 6° of longitude in width and centered over a meridian of longitude. Zone 1 is bounded by longitude 180° to 174° W and is centered on the 177th West meridian. The UTM system uses projection techniques to transform an ellipsoidal surface to a flat map the can be printed on paper or displayed on a computer screen. Note that UTM is metric-based.

39-8.01C Submittals

39-8.01C(1) General

Not used

39-8.01C(2) Just-In-Time Training

At the time of JMF submittal, submit a list of names participating in the just-in-time training. Identify each participant's name, employer, title, and role in intelligent compaction.

At least 10 days prior to just-in-time training, submit your just-in-time training presentation and handouts for review.

39-8.01C(3) GPS Site Calibration or Localization Report and Check Testing

Submit GPS site calibration or localization report and check testing results for intelligent compaction rollers and automated machine guidance rollers within 1 business day of calibration or check testing.

39-8.01C(4) Data and Software Analysis Results

39-8.01C(4)(a) General

Within 1 business day of HMA placement submit:

1. Hardcopy and Adobe *.pdf file of the HMA compaction quality control report from data analysis performed using Veda software.
2. Post processed Veda data file type *.icp used for creating the HMA compaction quality control report

Within 3 business days of HMA placement submit electronic data from compaction rollers in file format readable by Veda.

When a test strip is required submit:

1. Test strip data including:
 - 1.1. Nuclear gage density per location
 - 1.2. GPS measured coordinates per location
 - 1.3. Nuclear gage correlation to core densities
2. All passes compaction curves from Veda
3. All passes correlation analysis report from Veda

39-8.01C(4)(b) Data

Submit compaction information and data elements using Veda. You may combine roller data for multiple rollers operating in echelon into a section file.

Name the compaction data file using:

YYYYMMDD_TTCCRRR_DB_L_B_E_X_PT_TC_T_Data

where:

YYYY = year

MM = Month, leading zero

DD = Day of month, leading zero

TT = District, leading zero

CCC = County, 2 or 3 letter abbreviation as shown in section 1-1.08

RRR = Route number, no leading zeros

DB = Traffic direction as NB, SB, WB, or EB

L = Lane number from left to right in direction of travel

B = Beginning station to the nearest foot (i.e., 10+20) or beginning post mile to the nearest hundredth (e.g., 25.06) no leading zero

E = Ending station to the nearest foot (i.e., 14+20) or ending post mile to the nearest hundredth (i.e., 28.06) maximum 6 characters with no leading zero

X = HMA layer number, 1, 2 ...etc.

PT = Pavement Type (e.g., HMA, RHMA, HMA-O, RHMA-O, RHMA-G, etc.) with maximum 6 characters

TC = Type of compaction "BC" for breakdown compaction, "IC" for intermediate compaction, "FC" for finish compaction

T = Type of roller "R" for rubber tire, "S" for steel drum

Use the following header information for each compaction data file or section:

Item No.	Description
1	Section Title
2	Machine Manufacture
3	Machine Type
4	Machine Model
5	Drum Width (inch)
6	Drum Diameter (inch)
7	Machine Weight (ton)
8	Name index of intelligent compaction measurement values
9	Unit index for intelligent compaction measurement values
10	Reporting resolution for independent for intelligent compaction measurement values 90 degrees to the roller moving direction (inch)
11	Reporting resolution for independent intelligent compaction measurement values in the roller moving direction (inch)
12	CCS83 Zone
13	Offset to UTC (hrs)
14	Number of IC data points

Use the following data field names for each compaction data point:

Item No.	Data Field Name	Example of Data
1	Date Stamp (YYYYMMDD)	20080701
2	Time Stamp (HHMMSS.SS -military format)	090504.00 (9 hr 5 min. 4.00 s.)
3	Longitude (decimal degrees or degrees minutes-seconds)	94.85920403
4	Latitude (decimal degrees or degrees-minutes-seconds)	45.22777335
5	Easting (Foot)	6,096,666.000
6	Northing (Foot)	1,524,166.650
7	Elevation (Foot)	339.9450
8	Roller pass number	2
9	Direction index	1 forward, 2 reverse
10	Roller speed (mph)	2.0
11	Vibration on	1 for yes, 2 for no
12	Frequency (vpm)	3500.0
13	Amplitude (inch)	0.0236
14	Surface temperature (°F)	270
15	Intelligent compaction measurement values	20.0

Note: Provide either items 3 and 4 or items 5 and 6.

The GPS coordinate for each compaction data point recorded in data files must be at the center of the front drum or center of the roller in front.

The size of data mesh after post processing must be less than 1.5 feet by 1.5 feet in the X and Y directions.

39-8.01C(4)(c) Software Analysis Results

Analyze the compaction data daily using Veda and include nuclear gage and temperature data point tests, target values for passes, HMA temperature, and intelligent compaction measurement values. For a fixed interval report, use interval length of 100 feet.

For daily compaction quality control reports create a boundary for the area of hot mix asphalt daily production either by preprocessing the raw roller data or post processing in Veda. Use this boundary to exclude extraneous intelligent compaction data.

For each day of production, prepare a HMA compaction quality control report that includes:

1. Final coverage histogram of number of passes for each roller and histogram of intelligent compaction measurement value of steel drum roller with vibratory on.
2. Final coverage histogram of number of passes for each roller and histogram of intelligent compaction measurement value of steel drum roller with vibratory on for a fixed interval.
3. All passes histogram for each roller
4. Color layout plots of:
 - 4.1. Roller passes for each roller
 - 4.2. HMA temperature for first coverage of breakdown compaction.
 - 4.3. HMA temperature for final coverage of intermediate compaction.
 - 4.4. Intelligent compaction measurement value for final coverage of intermediate compaction when required.

Plots must be scaled to be legible and may be 11 by 17 inches. Plots must include quality control density testing locations and results.

Name the post processed Veda data file using:

YYYYMMDD_TTCCRRR_DB_L_B_E_X_PT_TC_T_Veda

where:

YYYY = year

MM = Month, leading zero

DD = Day of month, leading zero

TT = District, leading zero

CCC = County, 2 or 3 letter abbreviation as shown in section 1-1.08

RRR = Route number, no leading zeros

DB = Traffic direction as NB, SB, WB, or EB

L = Lane number from left to right in direction of travel

B = Beginning station to the nearest foot (i.e., 10+20) or beginning post mile to the nearest hundredth (i.e., 25.06) maximum 6 characters with no leading zero.

E = Ending station to the nearest foot e.g., 14+20) or ending post mile to the nearest hundredth (i.e., 28.06) maximum 6 characters with no leading zero.

X = HMA layer number, 1, 2 ...etc.

PT = Pavement Type (e.g., HMA, RHMA, HMA-O, RHMA-O, RHMA-G, etc.) maximum 6 characters.

TC= Type of compaction "BC" for breakdown compaction, "IC" for intermediate compaction, "FC" for finish compaction

T= Type of roller "R" for rubber tire, "S" for steel drum

39-8.01D Quality Control and Assurance

39-8.01D(1) General

Not Used

39-8.01D(2) Technical Representative

A technical representative from the intelligent compaction equipments manufacturer and automated machine guidance system or post manufacture retrofit system must be on site during the initial setup, verification testing of the compaction rollers and first 2 days of production. If requested, the technical representative must assist the Engineer with data management using Veda including compaction data input and processing.

39-8.01D(3) Just-in-Time Training

Provide just-in-time training onsite or near the project site for your personnel and Department project personnel. Schedule the just-in-time training with the Engineer at a mutually agreed time and place. Provide training materials for 4 Department personnel. Provide an enclosed facility with electrical availability for visual presentations.

The just-in-time-training for intelligent compaction is divided into two sections:

1. Roller operation
2. Intelligent compaction geospatial data and analysis

Roller operation just-in-time training must be at least 2 hours in duration and include the following topics:

1. Background information for the specific intelligent compaction system and automated machine guidance system to be used.
2. Setup and checks for compaction systems including:
 - 2.1. GPS receiver
 - 2.2. GPS base station
 - 2.3. GPS rovers
 - 2.4. Rollers
3. Operation of the intelligent compaction system and automated machine guidance systems on the rollers including:
 - 3.1. Setup data collection
 - 3.2. Start/stop of data recording
 - 3.3. On-board display options

The following personnel must attend roller operation just in time training:

1. Project manager
2. Superintendent
3. Technical representative
4. Compaction quality control technicians
5. Roller operators
6. HMA foreman

Intelligent compaction geospatial data and analysis just-in-time training must be at least 2 hours in duration and include the following topics:

1. Transferring raw compaction data from the rollers using USB connections
2. Operation of vendor's software to open and view raw compaction data files and to export all-passes and proofing data files in Veda-compatible format. If using the vendor's software to create boundary for the area of hot mix asphalt daily production, demonstrate the procedure .
3. Operation of Veda software to:
 - 3.1. Import the exported all-passes and proofing data files
 - 3.2. Import project layout
 - 3.3. If using the Veda software to create boundary for the area of hot mix asphalt daily production, demonstrate the procedure for creating the boundary.
 - 3.4. Review the compaction maps
 - 3.5. Import compaction point test data
 - 3.6. Perform statistical analysis
 - 3.7. Generate specified reports

4. Method for establishing target values for:
 - 4.1 Number of passes
 - 4.2 Temperature
 - 4.3 Intelligent compaction measurement values
5. Coverage and uniformity requirements
6. Corrective actions to be taken when coverage and uniformity requirements are not met

The following personnel must attend Intelligent compaction geospatial data and analysis just in time training:

1. Technical representative
2. Compaction quality control technicians
3. HMA foreman

39-8.01D(4) Quality Control

39-8.01D(4)(a) General

For HMA placed under section 39-1.03O(2) method compaction, use intelligent compaction rollers and automated machine guidance rollers for documenting that HMA compaction complies with the method compaction requirements for the followings:

1. Number of roller passes
2. HMA temperature for first coverage of breakdown compaction
3. HMA temperature at the completion of intermediate compaction

Do not collect intelligent compaction measurement values for stiffness when the compacted HMA layer is less than 0.15 foot.

When HMA thickness is 0.15 foot or greater, intelligent compaction rollers provide additional real time quality control for HMA density based on intelligent compaction measurement value that is correlated to the specified HMA target density.

The number of roller passes, HMA temperature and intelligent compaction measurement values are report only and are not used for compaction acceptance.

39-8.01D(4)(b) Test Strip

If the HMA layer thickness is 0.15 foot or greater, on the first day of placement of each layer of HMA construct a test strip at least 600 feet long to determine the compaction curve. The compaction curve must be created by Veda and relate the number of roller passes to intelligent compaction measurement values. Nuclear gages must be correlated with density cores under Part 2 of California Test 375.

After each coverage, use a GPS rover to measure the positions of at least 3 locations randomly selected throughout the test strip. Use a nuclear gage to determine the density of the HMA. Record the density reading, the number of roller passes, and GPS coordinates for each location. Continue roller passes and collecting nuclear gage density readings until the density remains constant or decreases. When you determine that the density remains constant or is decreasing, take an additional 7 randomly selected nuclear gage readings. If the density of the 10 locations determined for the last coverage indicates an increase in density, then continue rolling and testing.

The target density must be the peak of the nuclear gage density readings within the specified compaction requirements and temperature range for the HMA mixture.

Use the Veda generated correlation analysis report to establish production target intelligent compaction measurement value based on target density (% theoretical maximum specific gravity) that meets the specified in-place compaction requirements. Correlation analysis report is the linear regression between intelligent compaction measurement value and percent of density.

The target intelligent compaction measurement value is the point when the increase in the intelligent compaction measurement value of the material between passes is less than 5 percent on the compaction curve.

39-8.01D(4)(c) Quality Control Technician

During HMA compaction provide a quality control technician to be responsible full time for:

1. GPS site calibration or localization and upload to all GPS receivers
2. GPS check testing for the compaction rollers and rovers
3. Accuracy verification of the temperature sensor by comparing to a NIST traceable standard. The equipment temperature sensor measurement must be within +/- 3 degrees F of NIST traceable standard.
4. Test section construction to establish target compaction pass counts and target values for the stiffness of the HMA using nuclear gauges, pavement cores, and intelligent compaction rollers
5. Construction operation monitoring of the compaction rollers
6. Quality control testing for pavement temperature and compaction.
7. Backing up data compaction data twice per day
8. Downloading data from rollers at the end of the work shift
9. On a daily basis analyzing the data from the compaction rollers using Veda and produce a daily compaction quality control report
10. Daily set-up, take-down, of GPS and compaction roller components

39-8.02 MATERIALS

Not Used

39-8.03 CONSTRUCTION

39-8.03A General

Before the start of production upload the project layout file into the intelligent compaction data analysis software and depending on the roller manufacture, on-board documentation system of the rollers.

39-8.03B Equipment

39-8.03B(1) General

Not Used

39-8.03B(2) Rollers

In addition to the requirements of section 39-1.03B(3), each intelligent compaction roller must:

1. Be double-drum vibratory rollers equipped with accelerometers mounted in or about the drum to measure the interactions between the rollers and compacted materials in order to evaluate the applied compaction effort
2. Be equipped with non-contact temperature sensors for measuring pavement surface temperatures.
3. With vibratory on, produce output that represents the stiffness of the material based on the vibration of the roller drums and the measured response from the underlying materials
4. Have mounted GPS receiver, antenna, and telemetry equipment to monitor the drum locations and track the number of passes
5. Include an integrated on-board documentation system that is capable of displaying real-time color-coded maps, including the stiffness response values, vibration frequencies, roller drum amplitude, roller location, number of roller passes, roller speeds and capable of transferring data from a USB port

In addition to the requirements in section 39-1.03B(3), automated machine guidance pneumatic tire rollers must meet the following:

1. Be equipped with non-contact temperature sensors for measuring pavement surface temperatures.
2. Have GPS radio and receiver units mounted on each automated machine guidance roller to monitor the roller locations and track the number of passes of the rollers.
3. Include an integrated on-board documentation system that is capable of displaying real-time color-coded maps of roller location, number of roller passes, roller speeds and capable of transferring data from a USB port.

39-8.03B(3) Global Positioning System

39-8.03B(3)(a) General

GPS must be real time kinematic using one of the following:

1. GPS base station
2. Network real time kinematic (RTK)
3. Satellite based augmentation station system capable of providing position accuracy within 0.25 foot

You may use other high precision positioning systems in lieu of GPS. The positioning system must meet or exceed the precision specified for GPS.

GPS devices for this project must be set to the same consistent datum, coordinate system, CCS83 zone, and site calibration or localization. The CCS83 zone must be set to zone no [3](#).

Prior to July 2016, you may use UTM coordinate system if your roller on-board documentation system and display are not compatible with CCS83. Notify the engineer if you will use UTM coordinate system.

39-8.03B(3)(b) Correction Signal Source

Provide either a GPS base station correction signal or a GPS correction service subscription. The GPS correction signal must be received by the GPS receivers on the compaction roller and the rovers during operations with a survey tolerance of not greater than 0.25 foot in both X and Y horizontal directions.

39-8.03B(3)(c) Survey Control Points

Request survey control points at least 15 days prior to GPS site calibration or localization. Survey control points will be provided at least every mile.

39-8.03B(3)(d) GPS Site Calibration or Localization and Check Testing

At least 2 business days before start of production, perform a GPS site calibration or localization to the survey control points. Perform a GPS site calibration or localization whenever the GPS base station is moved to a new location.

At least 2 business days before start of production, perform roller verification testing by conducting roller check testing.

Before the start of daily production and using the same datum, conduct check testing for the proper setup of the GPS, the GPS on the rollers, and the GPS rover:

1. On a location nearby or within the project limits, the GPS base station, if required by the GPS, must be established and the compaction roller and the GPS rover must be tied into the same base station
2. Verify that the roller and rover are working properly and that there is a connection with the base station
3. Verify the roller GPS coordinates by:
 - 3.1. Stopping the roller at a location
 - 3.2. Marking the location of both ends of the roller drum or the outside of the front tires on the surface with a tee
 - 3.3. Recording the GPS measurements from the roller ensuring the distance offsets are applied so that the GPS coordinate is at the center of the front drum
 - 3.3. Moving the roller from the marked location
 - 3.4. Finding the mid-point of the two marked ends of the roller and mark this location on the surface. This marked location is the theoretical center of the front drum or center of front axle.
 - 3.5. Using the GPS rover to measure GPS coordinates of the marked location and record the GPS measurements.
 - 3.6. Computing the difference between recorded compaction roller GPS coordinates and GPS rover recorded GPS measured coordinates. The differences of the coordinates in grid must be within 0.5 foot in both the horizontal axes X and Y.

39-8.03C HMA Compaction

39-8.03C(1) General

During HMA compaction, monitor each roller's compaction graphical user interface display for roller passes, and HMA temperature. When HMA layer thickness is 0.15 foot or greater, monitor each roller's compaction graphical user interface display for intelligent compaction measurement value.

For every 4 hours of HMA placement, measure the temperature of the HMA at 3 random locations on first pass of breakdown and first pass of intermediate compaction. Use GPS rover to measure and record coordinates of each temperature test point reading.

When HMA thickness is 0.15 foot or greater, use GPS rover to measure and record coordinates of each quality control nuclear gage reading.

For each day of HMA placement establish the boundaries of the area for HMA placed using the rover.

39-8.03C(2) Roller Coverage, HMA Temperature, and Intelligent Compaction Measurement Values

At least 90 percent coverage of the construction area must meet or exceed the number of roller passes specified. When the daily HMA compaction quality control report shows the specified roller passes are not met, take corrective action and notify the Engineer of action taken.

When the roller HMA temperature sensor indicates compaction temperatures are below specified temperatures take immediate corrective action.

At least 95 percent of the construction area must comply with the specified temperatures. When the daily HMA compaction quality control report indicates less than 95 percent of the construction area is completed after HMA is below the minimum specified temperature, implement corrective action before the next HMA placement day and notify the Engineer.

For HMA 0.15 foot or greater in layer thickness, monitor the intelligent compaction measurement value against the target value established in the test strip. If intelligent compaction measurement value is 10 percent or more below the target value, verify that HMA compaction complies with density specified requirements with a nuclear gage.

If the daily average intelligent compaction measurement value is 20 percent or more below the target measurement value, reestablish an intelligent compaction measurement value using a test strip.

For HMA 0.15 foot or greater in layer thickness, when the daily average intelligent compaction measurement meets or exceeds the target value and density is verified, then the corrective action for number of passes and temperature is not required.

39-8.04 PAYMENT

Not Used