

Analysis of National Vertical Datum Using Tidal Gauge Bench Mark in KOREA

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What's TBM?

- TBM(Tidal Bench Mark) means a national control point based on **tidal observation** to use the standard of leveling when the **hydrographical surveying**.

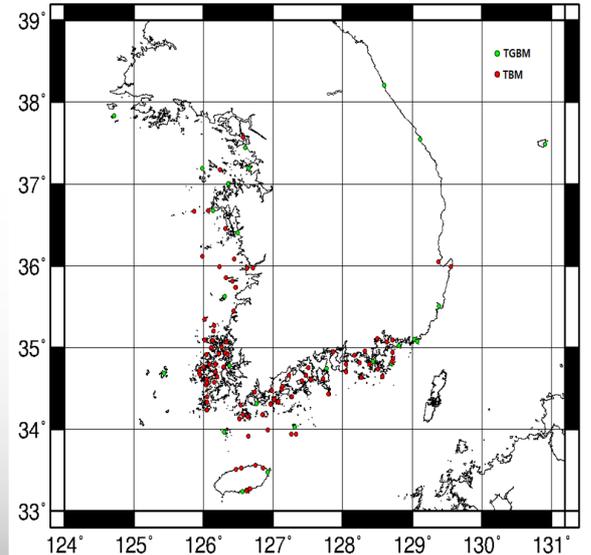


Image Source : Korea Hydrographic and Oceanographic Administration

The status of TBM

At present, totally 842 points of TBM are installed in 263 stations.

- TBM installed where the main harbor or large fluctuation in tidal movement
- 1 station has 3~5 TBM
- 445 points of TBM in 141 stations, the West Sea
- 313 points of TBM in 98 stations, the South sea
- 84 points of TBM in 24 stations, the East Sea



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TBM application

TBM can be utilized in various fields

- Provide the information of tidal observation
- Provide the height for safety of ships
- Standard of bathymetric survey
- Standard of coast disaster prevention
- Construction works of coast

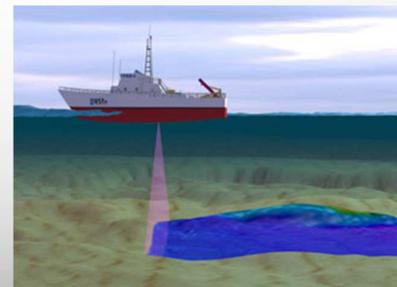
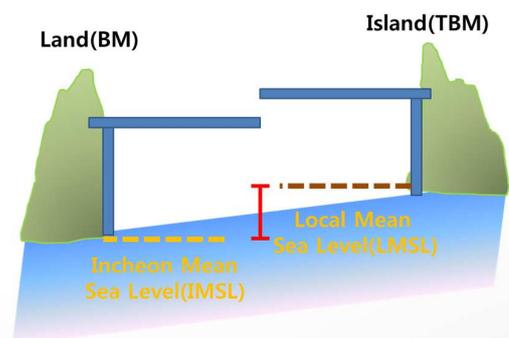
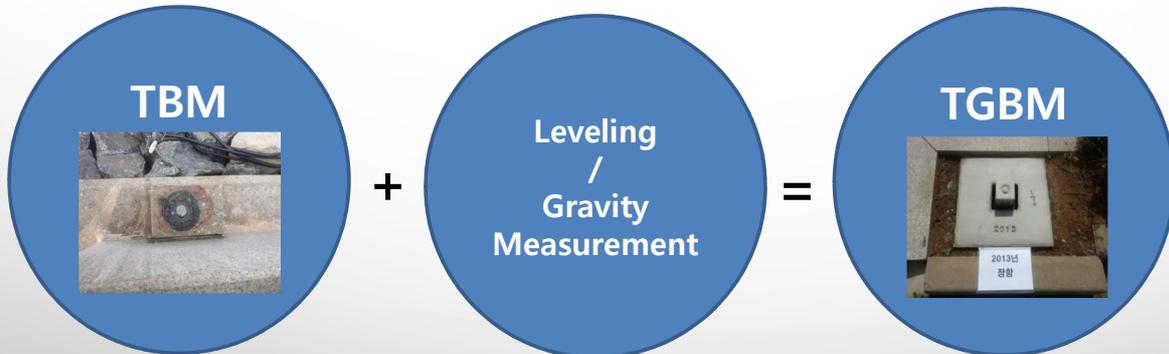


Image Source : <http://blog.naver.com/PostView.nhn?blogId=bg7728&logNo=60020439763> of Surveyor

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What's TGBM?

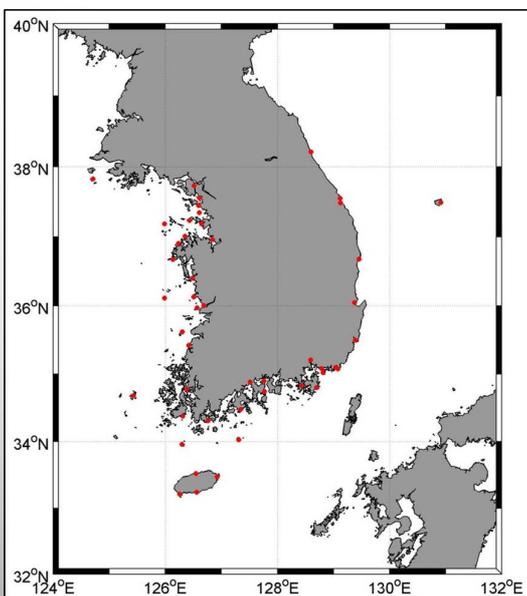
- TGBM means vertical datum point with **leveling** and **gravity** measurement based on TBM



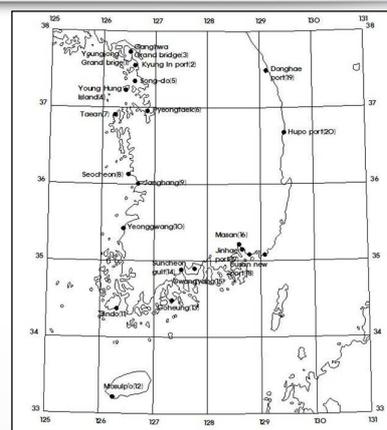
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The status of TGBM

- At present, **48** points are installed
※ (2012 : 28 points, 2013 : 20 points)



TGBM Installation Area(2012,2013)



TGBM Installation Area(2013)

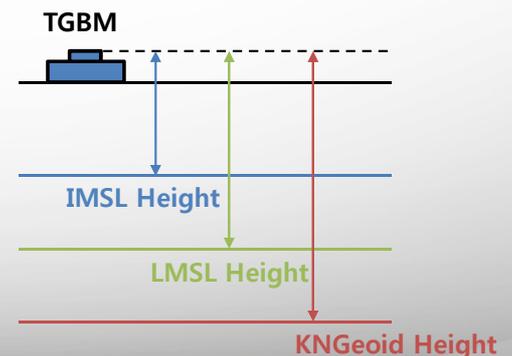
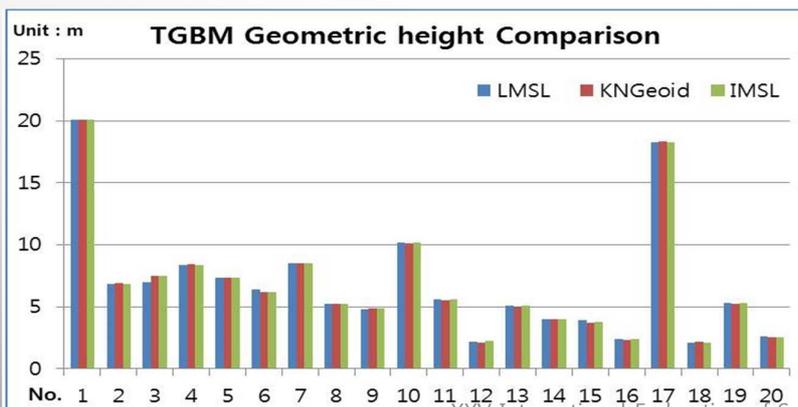
No	Designation	No	Designation	No	Designation	No	Designation
1	Youngjong Grand bridge	6	Pyeongtaek	11	Jin-do	16	Masan
2	Kyung In port	7	Taeon	12	Mosulp'o	17	Jinhae port
3	Ganghwa Grand bridge	8	Seocheon	13	Goheung	18	Busan new port
4	YoungHung Island	9	Janghang	14	Suncheon gulf	19	Donghae port
5	Song-do	10	Yeonggwang	15	Gwangyang	20	Hupo port

TGBM installation process



TGBM Data Processing

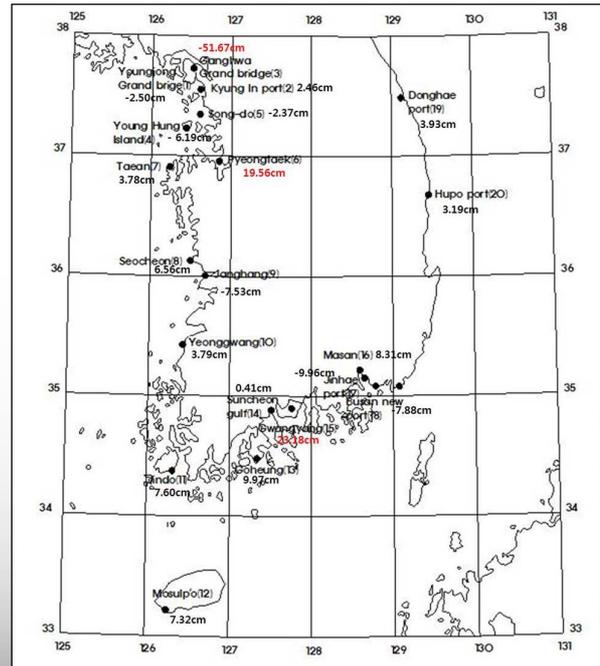
- Local Mean Sea Leveling(LMSL) Height : Short-term tidal observation
- Incheon Mean Sea Leveling(IMSL) Height : BM-TGBM Leveling
- Geoid Height : KN(Korean National) Geoid
- GPS Processing software : Bernese 5.0



TGBM Result (1)

Geometric Height Comparison Result

- Geometric height of 2013 TGBM has equal trend
- In case of Ganghwa bridge, has -51.67cm difference between IMSL and LMSL
- Gwangyang has 23.18cm, Pyeongtaek has 19.56cm difference between IMSL and LMSL
- These result occurred by influence of ocean construction work or inflow of the river
- The average gap in 20 points TGBM of KNgeoid between LMSL was 0.35cm, and standard deviation was 14.93cm

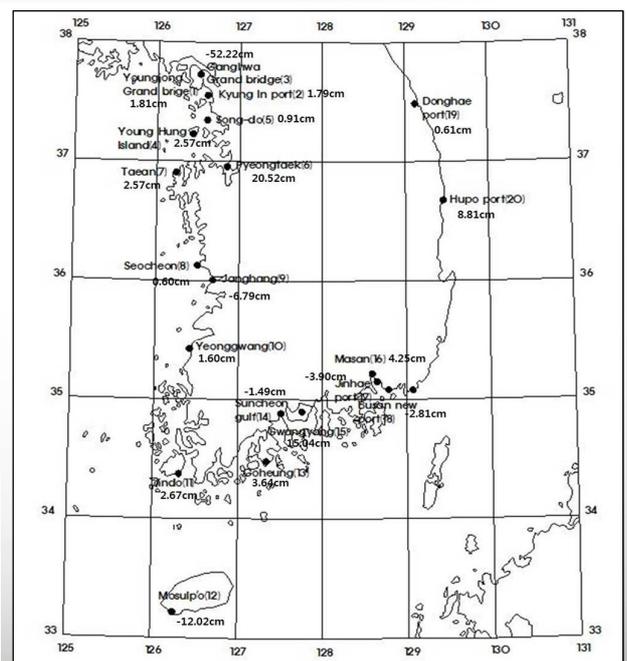


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TGBM Result (2)

Sea Level Slope of Korean coast

- Sea Level Slope is difference between Mean Sea Level (MSL) and Local Mean Sea Level (LMSL)
- Sea Level Slope has important part of Oceanographic research and set the geodetic datum network
- In case of Korea, checked the more higher from West Sea to South Sea and East Sea



Sea Level Slope	West Sea	South Sea	East Sea
Mean(cm)	-0.34	5.01	12.58
Standard Deviation(cm)	13.64	6.46	7.55

Sea Level Slope of Korea coast by TGBM(2012~2013)

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Concluding Remarks

- There are 3 points that the residual is over 10cm in 2013
 - Cause of tidal variation by influence of the ocean construct work or inflow of the river
 - Influence of relocate the tidal station
- Sea Level Slope could be checked the more higher from West Sea to South Sea and East Sea by using the TGBM
- Need continuous management and observation of TGBM
 - Providing the data to connection with spatial information of the ocean and the land
 - Observation part of sea level change(increase) and crustal movement
 - Providing the data to development accurate national geoid through gravity data of the coast
 - Providing basement data to development of the ocean and connection construction work of island area

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Thank you.

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